

# TOWARDS A GENERALISED THEORY OF ORCHESTRATION PRACTICE: A GROUNDED THEORY APPROACH

Philip Antoni Schonken

SU student number: 14775573-2006

Dissertation presented for the degree of Doctor of  
Philosophy in the Faculty of Arts and Social Sciences at  
Stellenbosch University



Supervisor: Professor Hans Roosenschoon (Department of Music)

For graduation: December 2015

## DECLARATION

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: December 2015

**ABSTRACT**

A number of authors have attempted to devise a set of principles according to which symphonic orchestration practice takes place. However, these authors have routinely failed to acknowledge the differences between a personal outlook on orchestration and a generalised study of orchestration practice. In this dissertation, Grounded Theory methodology was adopted and adapted in order to study a large number of text fragments from the most commonly used and respected orchestration textbooks of the twentieth and twenty-first century. Analysis of 6672 text fragments in open coding led to the discovery of eight core principles, or perspectives, of symphonic orchestration practice. These eight perspectives do not describe the techniques of orchestration, but rather reveal the underlying mechanics that inform and shape contemporary orchestration practice. A number of South African orchestral scores by Van Wyk, Fagan, Klatzow, Zaidel-Rudolph, Roosenschoon, Temmingh, Grové and Hofmeyr were consulted to provide musical substantiation of a number of findings and to serve as referenced examples throughout the dissertation. Personal correspondence with a number of South African composers aided in further development and corroboration of findings. Three addenda that document A) the collective instrument ranges from a number of textbooks, B) a compiled list of music examples from eight textbooks, and C) a comparative chart of instrumental saliency in low, middle and high registers, aided in providing further description of a number of important concepts throughout the thesis. The findings provide a generalised view of orchestration practice that includes historical, aesthetic, pedagogical and music-theoretical perspectives, within a Grounded Theory framework of methodology.

**Keywords:** Grounded Theory; Symphonic orchestration practice; South African orchestration practice; Orchestration theory; Orchestration principles

## OPSOMMING

ʼn Aantal outeurs het reeds al gepoog om ʼn stel kernprinsiepe saam te stel wat die onderliggende werking van simfoniese orkestrasie beskryf. Hierdie outeurs het egter nagelaat om in ag te neem die verskille tussen ʼn persoonlike uitkyk oor orkestrasie en ʼn veralgemeende studie van orkestrasiepraktyk. In hierdie tesis is ʼn Gegronde Teoretiese benadering aangeneem en aangepas om ʼn groot aantal teksfragmente uit ʼn versameling belangrike en gerespekteerde orkestrasiehandboeke van die twintigste en een-en-twintigste eeu te analiseer. Analise van 6672 teksfragmente in oop-kodering het gelei tot die ontdekking van agt kernprinsiepe, oftewel perspektiewe, wat simfoniese orkestrasiepraktyk beskryf. Hierdie agt perspektiewe beskryf nie die tegnieke van orkestrasie nie, maar ontbloot eerder die onderliggende meganismes wat die vak vorm gee en verskeie aspekte daarvan beïnvloed. ʼn Aantal Suid-Afrikaanse orkeswerke van Van Wyk, Fagan, Klatzow, Zaidel-Rudolph, Roosenschoon, Temmingh, Grové en Hofmeyr is geraadpleeg om verdere substansiëring te ontwikkel oor die bevindinge wat gemaak is, en korrespondensie met ʼn aantal Suid-Afrikaanse komponiste het bydraes gelewer in terme van verdere konseptuele ontwikkeling en staving van kernkonsepte in die tesis. Drie addenda wat bevat A) ʼn samevatting van instrumentomvang van verskeie handboeke, B) ʼn saamgestelde lys van musiekvoorbeelde uit agt handboeke, en C) ʼn vergelykende tabel van instrumentele hoorbaarheid in lae, middel en hoë registers, het deurlopend gehelp om verdere verduideliking van konsepte moontlik te maak. In geheel dra die bevindinge by tot ʼn meer veralgemeende verstaan van orkestrasiepraktyk vanuit historiese, estetiese, pedagogiese en musiekteoretiese oogpunte, binne die metodologiese raamwerk wat verskaf is deur Gegronde Teorie.

**Sleutelwoorde:** Gegronde Teorie; Simfoniese orkestrasiepraktyk; Suid-Afrikaanse orkestrasiepraktyk; Orkestrasieteorie; Orkestrasieprinsiepe.

## **ACKNOWLEDGEMENTS**

Professor Hans Roosenschoon- for nearly a decade of excellent teaching, supervision and academic leadership.

Professor Stephanus Muller- For teaching me how to perform and love research in many forms.

Harry Crossley Foundation- for generous financial support of both my masters and doctoral studies at Stellenbosch University.

SAMRO Foundation- for continuous financial support of my tertiary studies.

Flip and Tonia Schonken- to whom this dissertation is dedicated.

Arthur Feder- for conceptual advice and many, many hours of technical assistance.

## Table of contents

List of figures .....	ix
List of tables .....	xvii
List of graphs .....	xix
List of diagrams.....	xix
List of instrumental abbreviations.....	xxi
Background, design and methodology.....	1
i. Introduction.....	1
ii. Grounded Theory.....	7
iii. Perspectives.....	9
iv. Methods.....	10
iv. a) Preparation .....	10
iv. b) Data Collection.....	11
iv. c) Analysis.....	12
iv. d) Memoing.....	12
iv. e) Concept Sorting .....	12
v. Key defining features.....	13
vi. Grounded Theory in Music Research.....	15
vii. Material and presentation of material .....	16
Perspective one: The mystification of orchestration (also an introduction) .....	23
1.1 Introduction.....	23
1.2 Some notes about extra-musical references.....	24
1.3 An orchestrational view of orchestral performance as a human endeavour .....	29
1.4 An orchestrational view of thinking for orchestra .....	39
1.5 Indeterminate nature of the orchestra and orchestration .....	45
1.6 Concluding remarks.....	51
Perspective two: An instrumental-hierarchical view of the orchestra.....	54

2.1 Introduction.....	54
2.2 Instrument families of the orchestra.....	55
2.3 The foundational role of strings in the orchestra.....	56
2.4 The shifting importance and function of the percussion section.....	68
2.5 The development of heterogeneous voices in the woodwinds section.....	84
2.6 The slow and gradual incorporation of the brass section.....	97
2.7 Concluding remarks.....	119
Perspective three: Changing and interchanging of material in orchestration.....	122
3.1 Introduction.....	122
3.2 Some notes on changing and interchanging of material.....	123
3.3 Concluding remarks.....	138
Perspective four: An orchestrator’s view on hearing and sound perception in orchestration and the orchestra.....	141
4.1 Introduction.....	141
4.2 The effect of human hearing and of aural fatigue.....	141
4.3 Echoic memory and remembering sound.....	153
4.4 Some last notes about the perception of sound.....	157
4.5 Concluding remarks.....	162
Perspective five: Instrumental constraints and orchestrational creativity.....	165
5.1 Introduction.....	165
5.2 The guiding force of physical constraints in orchestration and the orchestra.....	165
5.3 The effect of musical constraints on orchestration and the use of the orchestra.....	181
5.4 Concluding remarks.....	191
Perspective six: Inherited practices and orchestrational traditions.....	194
6.1 Introduction.....	194
6.2 Reinforcement of tradition.....	196
6.3 Changing traditions.....	214
6.4 A statistical view of tradition in orchestration.....	218

6.5 Concluding remarks .....	225
Perspective seven: The meaning of effective orchestration .....	227
7.1 Introduction .....	227
7.2 Effectiveness in orchestration .....	228
7.3 Clarity of effective orchestration .....	243
7.4 Other factors that contribute to effective orchestration .....	249
7.4.1 The contribution of tone colour .....	249
7.4.2 Doing the right thing at the right time .....	251
7.4.3 Avoiding that which is not effective .....	254
7.5 Concluding remarks .....	258
Perspective eight: Knowledge and orchestration .....	261
8.1 Introduction .....	261
8.2 Explicit knowledge .....	264
8.3 Implicit knowledge .....	273
8.4 Concluding remarks .....	279
Reference list and bibliography .....	283
Addendum A: instrument ranges .....	293
Piccolo .....	294
Flute .....	295
Oboe .....	296
English horn .....	297
Piccolo clarinet .....	298
Soprano clarinet .....	299
Bass clarinet .....	300
Bassoon .....	301
Contrabassoon .....	302
Saxophones .....	303
French horn .....	304



Trumpet/Cornet .....	305
Tenor trombone .....	306
Bass trombone.....	307
Tuba .....	308
Violin.....	309
Viola.....	310
Violoncello .....	311
Double bass .....	312
Pianoforte .....	313
Harp .....	314
Xylophone.....	315
Roto-toms.....	316
Timpani.....	317
Marimba .....	318
Vibraphone .....	319
Glockenspiel .....	320
Tubular bells .....	321
Celesta .....	322
Addendum B: orchestral references .....	323
Addendum C: relative instrumental saliency .....	384

## List of figures

Figure 1:	Use of trumpet, percussion and strings in Hofmeyr's <i>Sinfonia Africana</i> (2003) .....	26
Figure 2:	In a singing style, then calm – for violins I+II in Van Wyk's <i>Primavera</i> (1960).....	28
Figure 3:	Sweet and expressively – for the oboe in Fagan's <i>Karoosimfonie</i> (1976). .....	28
Figure 4:	Dry - for the brass section in Roosenschoon's <i>The Magic Marimba</i> (1991).....	28
Figure 5:	Use of non-standard bowing in order to exert control of the resultant phrasing of the strings in the second movement of Fagan's <i>Karoosimfonie</i> (1976). .....	31
Figure 6:	Precise dynamic and articulation control exerted by Grové in the second movement of <i>Raka</i> (1996) .....	32
Figure 7:	Use of graphic and text instructions to ensure that the correct inter-instrumental balance and relationships are adhered to in Klatzow's <i>Incantations</i> (1984) .....	33
Figure 8:	Detailed balancing of voice parts to differentiate musical layers in Hofmeyr's <i>Sinfonia Africana</i> (2003). .....	34
Figure 9:	Use of indeterminate figuration and gestural writing to aid performers in realising a passage with greater ease in Klatzow's <i>Incantations</i> (1984). .....	37
Figure 10:	Complex layering of musical and textural elements in Van Wyk's <i>Primavera</i> (1960).....	43
Figure 11:	Complex layering of rhythmic and pitch material to form a single timbral unit in the first movement of Roosenschoon's <i>The Magic Marimba</i> (1991).....	44
Figure 12:	A demonstration of finely nuanced dynamic shifts required of the strings in Van Wyk's <i>Primavera</i> (1960). .....	59
Figure 13:	An extended passage for full strings displaying the stamina of their sustained sound in the first movement of Fagan's <i>Karoosimfonie</i> (1976). .....	60
Figure 14:	An example of the unparalleled sustaining ability of the string choir, as well as the use of solo orchestral violin in Klatzow's <i>Incantations</i> (1984) .....	61
Figure 15:	Use of strings to provide a foundation of sound for other orchestral sections in Zaidel-Rudolph's <i>Tempus Fugit</i> (1986) .....	63

Figure 16:	<i>Divisi</i> capabilities of strings, woodwinds and brass as demonstrated by Roosenschoon in the first movement of <i>The Magic Marimba</i> (1991) .....	64
Figure 17:	Use of the string section to accompany a solo cellist in Temmingh's concerto for cello and orchestra (1992). .....	65
Figure 18:	Exploitation of timbral homogeneity and visual choreography in the string section of Grové's <i>Raka</i> (1996). .....	66
Figure 19:	The exploitation of the string section's ability to perform with dexterous agility for sustained periods of time at a low dynamic level in the first movement of Hofmeyr's <i>Sinfonia Africana</i> (2003) .....	67
Figure 20:	The first 61 measures of percussion in Van Wyk's <i>Primavera</i> (1960), showing the timpani as well as the bass drum and tambourine .....	76
Figure 21:	Use of percussion in the opening of Fagan's <i>Karoosimfonie</i> (1976) .....	76
Figure 22:	Use of percussion in Klatzow's <i>Incantations</i> (1984) as a colouristic orchestration device. ....	77
Figure 23:	Use of percussion in Klatzow's <i>Incantations</i> (1984) to add punctuation to material in strings and winds .....	78
Figure 24:	Percussion offset with other instruments in order to create a sense of dialogue in Klatzow's <i>Incantations</i> (1984) .....	79
Figure 25:	A representative example of solo percussion in Klatzow's <i>Incantations</i> (1984) .....	80
Figure 26:	Opening measures of Zaidel-Rudolph's <i>Tempus Fugit</i> (1986), showing the use of percussion and in particular the use of solo marimba.....	81
Figure 27:	The use of percussion in the first movement of Roosenschoon's <i>The Magic Marimba</i> (1991) .....	82
Figure 28:	Use of percussion with supporting piano and clarinets in Hofmeyr's <i>Sinfonia Africana</i> (2003) .....	83
Figure 29:	Approximate registral comparison of orchestral woodwinds to strings, showing overlaps .....	87

Figure 30:	Exchange of melodic material between piccolo and flute in Van Wyk's <i>Primavera</i> (1960).....	89
Figure 31:	Interchanging of piccolo and flute to counteract reduced saliency of the piccolo's lowest octave in Grové's <i>Raka</i> (1996) .....	90
Figure 32:	Exploitation of registral saliency in the woodwind section of Hofmeyr's <i>Sinfonia Africana</i> (2003).....	90
Figure 33:	Woodwinds performing a supportive role for the string section in Zaidel-Rudolph's <i>Tempus Fugit</i> (1986) .....	91
Figure 34:	Spacing of chord tones between instruments of the woodwind section in the second movement of Roosenschoon's <i>The Magic Marimba</i> (1991).....	92
Figure 35:	Application of woodwinds both as a unified voice and in support of another instrument group in the sixth movement of Grové's <i>Raka</i> (1996).....	94
Figure 36:	Use of woodwinds as heterogeneous voices within the orchestra in Klatzow's <i>Incantations</i> (1984).....	95
Figure 37:	Use of woodwinds to increase the brilliance of the orchestral sound at the conclusion of Temmingh's concerto for cello and orchestra (1992) .....	96
Figure 38:	The use of brass in a forceful orchestral <i>tutti</i> in Van Wyk's <i>Primavera</i> (1960) .....	98
Figure 39:	Use of brass in a forceful <i>tutti</i> in the fourth movement ("Storm") of Fagan's <i>Karoosimfonie</i> (1976).....	100
Figure 40:	Use of brass in the second movement of Hofmeyr's <i>Sinfonia Africana</i> (2003) to reinforce other sections of the orchestra in a dramatic <i>crescendo</i> .....	102
Figure 41:	Thinning out of the instrumental groups during an orchestral decrescendo in the second movement of Roosenschoon's <i>The Magic Marimba</i> (1991).....	104
Figure 42:	Use of horns as supporting mechanism for woodwinds in Van Wyk's <i>Primavera</i> (1960).....	107
Figure 43:	Use of horns as an extension of the woodwinds in Klatzow's <i>Incantations</i> (1984) .....	109

Figure 44:	Use of horns as a complement to the woodwind section in Temmingh's <i>tjellokonsert</i> (1992).....	110
Figure 45:	Use of horns to double bassoons in a robust forte passage for woodwinds in Grové's <i>Raka</i> (1996) .....	112
Figure 46:	Approximate registral comparison of orchestral woodwinds to strings, showing overlaps .....	115
Figure 47:	Fanfare-like trumpet followed by the brass choir in Hofmeyr's <i>Sinfonia Africana</i> (2003). .....	116
Figure 48:	Trumpet fanfares and horn padding in the opening first movement of Grové's <i>Raka</i> (1996).....	117
Figure 49:	Stabbing trumpets and drum, eroica-horns, and trombone triads in Temmingh's <i>tjellokonsert</i> (1992) .....	117
Figure 50:	Polyrhythmic brass stabs in Roosenschoon's <i>The Magic Marimba</i> (1991) .....	118
Figure 51:	The start of the final climactic phrase of Mussorgsky's <i>Pictures at an Exhibition</i> (1874), here shows in its original form for piano.....	125
Figure 52:	The start of the final climactic phrase of Mussorgsky's <i>Pictures at an Exhibition</i> (1874), as transcribed for solo piano by Horowitz (1946) .....	126
Figure 53:	The start of the final climactic phrase of Mussorgsky's <i>Pictures at an Exhibition</i> (1874), as transcribed for symphony orchestra by Tushmalov (1886) .....	127
Figure 54:	The start of the final climactic phrase of Mussorgsky's <i>Pictures at an Exhibition</i> (1874), as transcribed for symphony orchestra by Ravel (1922).....	128
Figure 55:	Measures 21-26 of <i>Bydlo</i> from Mussorgsky's <i>Pictures at an Exhibition</i> (1974), showing the original piano score and Ravel's orchestration (1922).....	130
Figure 56:	The opening four measures of the last movement of Mussorgsky's <i>Pictures at an Exhibition</i> (1874), showing the original piano version and Ravel's orchestration (1922).....	133

Figure 57:	The final four measures of the opening promenade of Mussorgsky's <i>Pictures at an Exhibition</i> , showing the original piano version and Ravel's orchestration .....	135
Figure 58:	One of a set of Robinson-Dadson curves (ISO 226: 2003) showing the equal-loudness contour of the human ear .....	144
Figure 59:	Use of colouristic repetition and then variation to aid the listener with auditory scene analysis in Klatzow's <i>Incantations</i> (1984) .....	150
Figure 60:	Exploitation of the cocktail lounge effect to differentiate foreground from background material in Temmingh's <i>tjellokonsert</i> (1992) .....	151
Figure 61:	Use of silence and a new timbral entry to maintain and renew listener interest in Grové's <i>Raka</i> (1996) .....	152
Figure 62:	Carefully planned and executed utilisation of the most salient instruments of Temmingh's orchestra at a point of climax in <i>tjellokonsert</i> (1992) .....	153
Figure 63:	Use of timbral repetition to support structural repetition in Fagan's <i>Karoosimfonie</i> (1976).....	156
Figure 64:	Use of timbral repetition to support structural repetition in Klatzow's <i>Incantations</i> (1984).....	157
Figure 65:	Timbral repetition in the marimba in order to provide structural unity between two contrasting sections of Zaidel-Rudolph's <i>Tempus Fugit</i> (1986) .....	157
Figure 66:	Registral spacing of chord tones in Temmingh's <i>tjellokonsert</i> (1992).....	161
Figure 67:	Registral spacing of chord tones in Grové's <i>Raka</i> (1996) .....	162
Figure 68:	Registral spacing of chord tones in Hofmeyr's <i>Sinfonia Africana</i> (2003).....	162
Figure 69:	Doubling of musical lines in various instrument groups to improve performance versatility in Zaidel-Rudolph's <i>Tempus Fugit</i> (1986).....	169
Figure 70:	Complex layering of instruments in the second movement of Roosenschoon's <i>The Magic Marimba</i> (1991) .....	171

Figure 71:	A potentially unsuccessful layering of instruments to produce the sounds of a thunderstorm in the fourth movement of Fagan's <i>Karoosimfonie</i> (1976).....	174
Figure 72:	Use of harp to fortify a robust texture for strings, woodwinds, brass and piano in the first movement of Van Wyk's <i>Primavera</i> (1960) .....	176
Figure 73:	Use of harp, piano and celesta to add colouristic accentuation to the brass in the second movement of Fagan's <i>Karoosimfonie</i> (1976).....	177
Figure 74:	Use of piccolo in its lowest tessitura by Van Wyk in the opening measures of <i>Primavera</i> (1960) .....	178
Figure 75:	Use of piccolo in its lowest octave in the final movement of Roosenschoon's <i>The Magic Marimba</i> (1991).....	178
Figure 76:	Strings <i>pizzicato alla chitarra</i> , percussion and solo trumpet in the opening of Hofmeyr's <i>Sinfonia Africana</i> (2003).....	182
Figure 77:	Rhythmic and harmonic differentiation of musical layers leading up to a recapitulation of the opening material in Klatzow's <i>Incantations</i> (1984) .....	187
Figure 78:	Use of polyphonic techniques to differentiate musical layers in Zaidel-Rudolph's <i>Tempus Fugit</i> (1986). .....	188
Figure 79:	Correct use of enharmonic spelling to support voice leading in Hofmeyr's <i>Sinfonia Africana</i> (2003) .....	190
Figure 80:	A representative example of Van Wyk's use of clarinets in the final movement of <i>Primavera</i> (1960) .....	198
Figure 81:	A representative example of Fagan's use of clarinets in the first movement of <i>Karoosimfonie</i> (1976) .....	198
Figure 82:	A representative example of Klatzow's use of clarinets in <i>Incantations</i> (1984).....	199
Figure 83:	A representative example of Zaidel-Rudolph's use of clarinets in <i>Tempus Fugit</i> (1986) .....	199
Figure 84:	A representative example of Roosenschoon's use of clarinets in the second movement of <i>The Magic Marimba</i> (1991).....	199

Figure 85:	A representative example of Temmingh's use of clarinets in <i>tjellokonsert</i> (1992).....	199
Figure 86:	A representative example of Grové's use of clarinets in <i>Raka</i> (1996).....	199
Figure 87:	A representative example of Hofmeyr's use of clarinets in <i>Sinfonia Africana</i> (2003) .....	199
Figure 88:	Representative example of Van Wyk's use of harp in the first movement of <i>Primavera</i> (1960) .....	202
Figure 89:	Representative example of Fagan's use of harp in the second movement of <i>Karoosimfonie</i> (1976).....	202
Figure 90:	Representative example of Klatzow's use of harp in <i>Incantations</i> (1984) .....	202
Figure 91:	Representative example of Grové's use of harp in the first movement of <i>Raka</i> (1996) .....	203
Figure 92:	Representative example of Hofmeyr's use of harp in the third movement of <i>Sinfonia Africana</i> (2003) .....	203
Figure 93:	The final measures of Temmingh's <i>tjellokonsert</i> (1992), showing the solo cello at the top, timpani below that and followed by the full orchestra .....	209
Figure 94:	The final measures of Grové's <i>Raka</i> (1996), showing solo piano at the top and full orchestra below .....	209
Figure 95:	The first entry of the solo soprano in the second movement of Hofmeyr's <i>Sinfonia Africana</i> (2003) .....	209
Figure 96:	Colouristic separation of static and dynamic textures in the first movement of Van Wyk's <i>Primavera</i> (1960) .....	211
Figure 97:	Colouristic separation of static and dynamic textures in the first movement of Fagan's <i>Karoosimfonie</i> (1976).....	211
Figure 98:	Colouristic separation of static and dynamic textures in Klatzow's <i>Incantations</i> (1984).....	211



Figure 99:	Colouristic separation of static and dynamic textures in Zaidel-Rudolph's <i>Tempus Fugit</i> (1986) .....	212
Figure 100:	Colouristic separation of static and dynamic textures in the first movement of Roosenschoon's <i>The Magic Marimba</i> (1991) .....	212
Figure 101:	Colouristic separation of static and dynamic textures in Temmingh's <i>tjellokonsert</i> (1992).....	212
Figure 102:	Colouristic separation of static and dynamic textures in the opening of Grové's <i>Raka</i> (1996).....	213
Figure 103:	Colouristic separation of static and dynamic textures in the first movement of Hofmeyr's <i>Sinfonia Africana</i> (2003) .....	213
Figure 104:	Repetition of a colour effect in Hofmeyr's <i>Sinfonia Africana</i> (2003), which is at first effective, but becomes ineffective later .....	232
Figure 105:	Four basic patterns of chord tone distribution.....	234
Figure 106:	Spacing of vertical elements in the first movement of Fagan's <i>Karoosimfonie</i> (1976).....	235
Figure 107:	Spacing of vertical elements in the fourth movement of Grové's <i>Raka</i> (1996) .....	235
Figure 108:	Spacing of vertical elements in Temmingh's <i>tjellokonsert</i> (1992).....	236
Figure 109:	A score excerpt from the first movement of Fagan's <i>Karoosimfonie</i> (1976), showing poor technical workmanship.....	239
Figure 110:	A score excerpt from the second movement of Roosenschoon's <i>The Magic Marimba</i> (1991), showing a high level of technical workmanship .....	240
Figure 111:	Use of dynamic markings to differentiate foreground, middleground and background material in Zaidel-Rudolph's <i>Tempus Fugit</i> (1986) .....	246
Figure 112:	Use of rhythm, timbre and dynamics to differentiate musical textures in Klatzow's <i>Incantations</i> (1984).....	247
Figure 113:	Separation of musical elements by rhythmic, timbre and registral contrast in the first movement of Grové's <i>Raka</i> (1996) .....	248

Figure 114:	Overpowering of the solo voice by the orchestra in the last movement of Hofmeyr's <i>Sinfonia Africana</i> (2003).....	249
Figure 115:	Expedient use of standard techniques and registers to create effective textural layers in Temmingh's <i>tjellokonsert</i> (1992) .....	253

## List of tables

Table 1:	The total number of fragments identified for analysis in eight suitable orchestration textbooks .....	17
Table 2:	A number of time signature changes occurring in close succession in the first movement of Roosenschoon's <i>The Magic Marimba</i> (1991).....	38
Table 3:	Average orchestral forces of various time periods, following the designations of Blatter (1997), Kennan & Grantham (2002) and Adler (2002). The average orchestral forces used in eight South African works is included for reference and comparison .....	47
Table 4:	A visual representation of the different number of instruments that is used in each of the orchestral sections in eight South African works .....	48
Table 5:	Percussion layout in eight South African orchestral scores, highlighting some major differences between scores. Line breaks separate different players .....	72
Table 6:	Comparison of percussion instruments and players in eight South African orchestral works .....	74
Table 7:	Juxtaposition of instrument groups in Roosenschoon's <i>The Magic Marimba</i> (1991) .....	93
Table 8:	Development of instrumental colours throughout Ravel's <i>Boléro</i> (1928) .....	137
Table 9:	Use of different octaves in the orchestra per measure in the last movement of Roosenschoon's <i>The Magic Marimba</i> (1991) .....	149
Table 10:	Two possible performance ensembles for Zaidel-Rudolph's <i>Tempus Fugit</i> (1986).....	168

Table 11:	Basic instrument order in eight South African orchestral works in order to show a high level of systematisation.....	207
Table 12:	Total number of examples counted, per nationality, in eight orchestration textbooks .....	220
Table 13:	A table showing the ten musical works that are cited most often in eight orchestration textbooks .....	221
Table 14:	The ten most cited works in eight orchestration textbooks of the twentieth century .....	221
Table 15:	The number of examples per decade cited in Addendum B across all nationalities.....	222
Table 16:	Four categories of effective and ineffective orchestration displayed in a table for comparison.....	255
Addendum B Table 17:	Examples regarding brass instruments referenced in various orchestration textbooks .....	325
Addendum B Table 18:	Examples regarding woodwind instruments referenced in various orchestration textbooks .....	337
Addendum B Table 19:	Examples regarding stringed instruments referenced in various orchestration textbooks .....	351
Addendum B Table 20:	Examples regarding percussion instruments referenced in various orchestration textbooks .....	368
Addendum B Table 21:	Examples regarding keyboard and plucked string instruments referenced in various orchestration textbooks.....	373
Addendum B Table 22:	Examples regarding orchestral tutti referenced in various orchestration textbooks .....	377
Addendum C Table 23:	Colour intensity and saliency per woodwind instrument per register compared to other instruments .....	384
Addendum C Table 24:	<i>(Continued)</i> Colour intensity and saliency per woodwind instrument per register compared to other instruments .....	385

Addendum C Table 25: Colour intensity and saliency per orchestral brass instrument per register compared to other instruments .....	386
Addendum C Table 26: Colour intensity and saliency per string group per register compared to other instruments.....	387

## List of graphs

Graph 1: Music examples referenced in eight orchestration textbooks (total per nationality).....	20
Graph 2: Music examples referenced in eight orchestration textbooks (percentage per nationality) .....	20
Graph 3: Total number of examples per decade (all nationalities) from eight orchestration textbooks .....	223
Graph 4: Number of examples per decade in four old-world music centres from eight orchestration textbooks.....	223
Graph 5: Number of examples per decade in secondary and in new-world music centres from eight orchestration textbooks .....	224
Graph 6: An approximation of the number of codes per category that refer either directly or by implication to implicit or explicit types of knowledge .....	281

## List of diagrams

Diagram 1: Concept web showing interrelatedness of concepts in Perspective 1 with other Perspectives. ....	53
Diagram 2: Concept web showing interrelatedness of concepts in Perspective 2 with other Perspectives.....	121

Diagram 3:	Concept web showing interrelatedness of concepts in Perspective 3 with other Perspectives. ....	140
Diagram 4:	Concept web showing interrelatedness of concepts in Perspective 4 with other Perspectives. ....	164
Diagram 5:	Concept web showing interrelatedness of concepts in Perspective 5 with other Perspectives. ....	193
Diagram 6:	A visual conceptual representation of inherited practices as a category of orchestration practice. ....	196
Diagram 7:	Concept web showing interrelatedness of concepts in Perspective 6 with other Perspectives. ....	226
Diagram 8:	Concept web showing interrelatedness of concepts in Perspective 7 with other Perspectives. ....	260
Diagram 9:	The cyclical process of knowledge transfer between explicit and implicit spheres in orchestration. ....	263
Diagram 10:	Concept web showing interrelatedness of concepts in Perspective 8 with other Perspectives. ....	282

## List of instrumental abbreviations

<b>Instrument</b>	<b>Abbreviations</b>	<b>Instrument</b>	<b>Abbreviations</b>
Piccolo	Picc.	Tambourine	Tamb.
Flutes	Fls; Flts; Flt.; Fl.	Triangle	Tri.;
Oboes	Obs; Ob.	Glockenspiel	Glock.
English horn	Eng.hn; Eng.hrn; Eng.horn	Marimba	Mba
Piccolo clarinet	Picc.Cl.	Vibraphone	Vibes
Clarinets	Cls; Cl.	Xylophone	Xylo.
Bass clarinet	B.clarinet; B.cl.; Bass.clar.	Cymbals	Cymb.; Cymb.
Bassoons	Bsn; Bsns	Suspended cymbal	Sus.cymb.
Contrabassoon	C.bsn; Contra.bsn.	Finger cymbal	F.cymb.; Fing.cymb.
French horns	Horns; Hrn; Hrns	Tubular bells	T.bells; Bell
Trumpets	Tpts; Trpts; Tpt; Trump.	Piano	Pno
Trombones	Tbn.; Tbns; Trbn.; Trbs; Tromb.	Harp	Hrp
Bass trombone	B.tbn.	Pipe organ	Organ
Tuba	Tba	Violins	Vlns; Vlns I; Vlns II; Vlns I+II
Timpani	Timps.; Timp.	Violas	Vlas
Bass drum	B.drums	Violoncellos	Vcls
Snare drum	S.drums; snare	Double basses	Basses; D.basses; DBs

## Background, design and methodology

### i. Introduction

In *The Technique of Orchestration* by Kennan & Grantham (2002), the authors explain to the student orchestrator how the unison orchestral tutti should be constructed and applied in an orchestral composition. Here, they mean the use of the majority or whole of the symphony orchestra to play a single melodic line. They quote well-known examples of such passages from Johannes Brahms's fourth symphony, Stravinsky's *Pulcinella* suite and Bernstein's *Symphonic Dances* from *West Side Story* as exemplary of the orchestral tutti and list some eight other examples as well. Other orchestration texts, including Adler (2002), Wagner (1959), Brinkman (2009), Jacob (1956) and Rimsky-Korsakov (1964) also emphasise the importance of the ability to utilise the orchestral tutti as an orchestrator, and collectively present some 56 examples demonstrating its mechanics. What Kennan & Grantham and their peers do not note, however, is that all of their examples refer to passages where the aim of the tutti is to emphasise the main thematic material of the composition<sup>1</sup>.

One can deduce that there is an uncommunicated aspect of orchestration shared by these texts, namely that the orchestral tutti is of structural significance. The student orchestrator who uses the orchestral tutti improperly will inadvertently accentuate an aspect of the composition's structure in a way that might not be beneficial to the structural aims of the work. It is also, therefore, implied by the texts that an adequate working knowledge of the orchestral tutti is required in order to become an effective orchestrator. Conversely, it is an underlying or uncommunicated principle of orchestration that the use of the orchestral tutti as a technique has structural ramifications. The current study explores these uncommunicated aspects of orchestration that are common to a number of text sources, and how they can a) be better understood and b) be more unambiguously documented. The results could lead to an increased understanding of the practices and traditions that define contemporary orchestration.

---

<sup>1</sup> A number of such examples is shown in Addendum B, which lists musical references from eight orchestration text books.

**What does *orchestration* refer to in this study?**

Piston (1961) pragmatically defines orchestration as the process of writing music for orchestra. It is a definition that unifies composition, instrumentation and musical aesthetic into a single process. However, as orchestration is described by other authors, it presents a number of difficulties. One such difficulty lies in the notion of orchestration both as an art and as a technique, touched on by Kreitner (2013) in his definition of orchestration as “the art of combining sounds of a complex of instruments” to form a satisfactory tone and balance. By using “art” instead of “technique”, one could infer that Kreitner implies that effective orchestration requires a kind of insight that transcends textbook knowledge about various methods that underscore the subject. A number of sources refer to orchestration interchangeably as an art and as a technique, but in others orchestration is described as an art while instrumentation is described as technique. These differences of opinion about orchestration appear to revolve around a perceived dichotomy between technical knowledge (instrumentation) and artistic insight (orchestration). There is, therefore, some epistemological ambiguity in authors’ views of orchestration that centres on a view of orchestration as being dependent on explicit and/or implicit kinds of knowledge. This dualism of knowledge and insight could be what Read (1979: 9) refers to when he writes that

“the term Orchestration should be used in contradistinction to the term Instrumentation, the literalism of which would make the latter more concerned with the study of technical manipulation, compass, tone quality, limitations and adaptability of instruments treated singly rather than in combination. Accordingly, Instrumentation is a Science; Orchestration is an Art”.

In Perone’s bibliography (1996), the majority of German sources negate the use of the term Orchestration in favour of Instrumentation, although they deal with orchestration in the sense implied by Read above. A number of authors, like Kreitner (2013), Kennan & Grantham (2002), Adler (2002), Wagner (1959) and Piston (1961), however, encourage a distinction between the two. Adler (2002) thinks of instrumentation as the rudiments of orchestration, a view supported in a way by Kennan & Grantham (2002) when they state that a student who sets out to learn orchestration must, in the process, learn much



about instrumentation. In Sevsay (2013), three subsets of orchestration are identified: firstly there is organology (the study of instruments) that is necessary for instrumentation to take place effectively; secondly there is instrumentation, which applies the knowledge gained in organology to combine instruments in the most effective and telling manner; lastly there is orchestration, which ties together knowledge about organology and instrumentation with other musical ideas about form and structure, harmonic rhythm, consonance and dissonance, character, intention and style, so that orchestration deals with aesthetics while instrumentation deals with technicalities. Belkin (2008) states that although many composers achieve a mastery of orchestration, it remains difficult to teach; the author infers that there is more to teach about orchestration than can be known by its technique alone.

The same dichotomy between instrumentation and orchestration also seems to be synonymous with the dichotomy between arrangement and composition for orchestra. Brinkman (2009) argues that on a basic level, arranging music for orchestra requires only of a person to choose the best instruments to play the various melodies and accompanimental figures of a work (in other words, only instrumentation is required). Piston (1961: vii) somewhat refutes this simplified view of arrangement by stating that the act of orchestral arrangement can be a “fine though difficult art, provided the orchestrator is able to put himself momentarily in the composer’s place, and...to think the composer’s thoughts”. In other words, if orchestral arrangement becomes an extension of the compositional process, it can exceed the limits of instrumentation and enter the realm of orchestration. Failing this, Piston writes, the result will come to nothing more than a display of craft of a superficial nature, a sentiment that is echoed in McKay (1969), in Meyer (2012) and in personal correspondence with Hofmeyr (2015) and Feder (2015). Read (1979) argues along the same lines that the true act of orchestration is inseparable from the creative act of composing music, because the sounds produced by the orchestra are actually an external manifestation of musical ideas produced in the mind of the composer. An idea related to this is found in Carse (1964), who links the historical development of orchestration to advances made in musical art, composition and instrumental technique.

Inversely, in the writing of some authors, a description of orchestration as an art is applied with a reduced awareness of its delineation from its description as a technique. For example, in *Style and Idea* (2008), Schoenberg writes about the popularisation of the art of orchestration, without providing meaningful explanation of his reasons for using “art” as a delimiter of orchestration. In his case the impression is created that “art” could be omitted entirely without changing the meaning of the idea. Other authors, however, do expand on their understanding of orchestrational artistry. Brinkman (2009) describes it as the ability to imagine sounds and to make them come alive. Adler (2002: x) describes it in much the same sense as “the ability to hear instrumental sounds individually and collectively and to transfer these sounds into written notation”. The difference then between an orchestrational technician and an orchestration artist is that the latter “does not have to go through such mental gymnastics, ...but hears the specific instrument at the moment of creation and so there is no agonising choice to be made” (Read, 2004: xi). The mental gymnastics and agonising choices refer to instrumental balance, timbre and a conceptualisation of the final aural result that the orchestrator aims to achieve.

Kennan (in Kennan & Grantham, 2002: 2) contradicts the statements above, however, by arguing that orchestration “is not a nebulous sort of business conditioned sheerly by artistic inspiration, but to a large extent an intensely real and down-to-earth technique”. In Read (1979) one also finds the statement that orchestration is a highly practical science. Piston (1961) provides us, perhaps, with the best mitigation between the two extremes (art vs technique) in arguing that like with any art, orchestration cannot be effective without a thorough knowledge of its constituent components and an excellent technique. Wagner (1959) also argues that orchestration is impossible until and unless the purely technical elements of instrumentation “have been properly recognised, assimilated and evaluated”.

The orchestra, in the symphonic sense, is generally thought of not as a group of instruments, but as a single complex instrument, as text evidence shows. As early as the nineteenth century, Berlioz described the orchestra as a large instrument that is capable of producing a multitude of sounds of different kinds

(Berlioz & Strauss, 1991<sup>2</sup>). Furthermore, Adler (2002) describes the orchestra as a composite instrument of which its components are not the individual instruments, but the ranges and limitations of those instruments. Piston (1961) and Carse (1964) describe it as a single, individual and gigantic instrument. In Read (1979) we see how Joseph Schillinger, composer and music theorist, complained about the durability of the “heterogeneous aggregation of antiquated tools, wooden boxes and bars, wooden pipes, dried sheep’s guts, horse hair and the like” that constitute the symphony orchestra. Seventy years later, Griffiths writes in the same line in Kreitner, et al. (2013), that composers working within the symphonic tradition are of conservative inclination and have been less prone to question the conventional norms of the orchestral format and balance. Composers such as Berio, Boulez and Knussen have, similarly, not fundamentally changed the orchestral instrument, having found the standard orchestra to be “a continuing source of new sonorities and an abiding vehicle for creative virtuosity” (Griffiths in Kreitner, et al., 2013). Even Stravinsky and Schoenberg, who Read (1979: 86) claims have changed the “very face of harmony,” have not “materially altered the basic concepts of orchestral writing”. As Carse (1964) shows us, however, the orchestra as we know it today only became relatively stabilised towards the middle of the nineteenth century; Schillinger’s criticism of the complex instrument seems unduly harsh when one considers how young it actually is in comparison with, for example, members of the modern violin family.

As stated earlier, this thesis is a study of orchestrational practice and that it aims towards formulating the rudiments of a grounded, generalised theory of orchestration that describes orchestration on a more general level than individual knowledge experts have been able to, by looking at a number of sources to discover commonalities and core principles. Meyer (2012) notes that orchestration literature shows a lack of theory formulation about the principles of orchestration, because authors focus largely on “rules of thumb” that represent individual views instead of general principles. Even McKay (1969), who attempted to construct a general theory of orchestration principles, failed to transcend this limitation of self-devised rules of thumb so that his principles are actually personal viewpoints; this observation is also

---

<sup>2</sup> It has been noted by some scholars that there are problems in the 1991 translation, but other scholars have given this edition by Dover very positive reviews.

made by Meyer (2012). Following this, South African born composer Arthur Feder wrote that orchestration textbooks often over-emphasise the personal tastes of their authors and portrays them as the best ways in which to orchestrate (Feder, 2015, personal correspondence). The relatively young age of the orchestra, which is still undergoing subtle developments of structure and internal balance (Brinkman, 2009), can serve to explain the fact that such a theory has not yet been constructed. Piston (1961: viii) very accurately describes other reasons for the absence of such a theory:

“A multitude of obstacles and unsolved problems has prevented the establishment of a science of orchestration. The imperfection and vagueness of our musical notation make it impossible to indicate with accuracy dynamic and rhythmic quantities as well as pitch, to say nothing of shades of tone colour, warmth and intensity. One consequence of this is the preponderance of the role played by the performers and the conductor in the translation of written notes into sound.”

The idea that a general theory of symphonic orchestration can be explicitly coded is refuted to a certain extent by some authors. In a reading of various of the aforementioned text sources, this refutation is linked to a defence of the artistic merits of orchestration. The negation centres on the dichotomy of orchestration both as an art and a science discussed earlier in this section. Berlioz (in Berlioz & Strauss, 1991), in his treatise on instrumentation and orchestration writes that although the ranges, timbre, peculiar character or even the expressive potential of any instrument can be described, to try and go beyond it would be to “trespass on the territory of inspiration, where only genius is capable of making discoveries”. Rimsky-Korsakov (1964) also writes that no treatise on orchestration will ever be able to teach the art of poetic orchestration. Read (2004) quotes the Italian composer Gian Francesco Malipiero as once relating how “the theories of combination cannot be set up according to empiric criterions, because they represent the inimitable expressions of all the composers by whom they were invented”. The general notion then is that certain aspects of orchestration simply cannot be documented. Yet, in the numerous textbooks on orchestration published over the last century, certain fundamental ideas about orchestration feature in all of them. Sometimes, those ideas are communicated as if they were common knowledge, good advice or

something that any orchestrator should already be aware of; these ways of referencing are reminiscent of Meyer's (2012) use of the term "rules-of-thumb". An example of such a statement relates to the string section, which is described by Piston (1961), Carse (1964), Kennan & Grantham (2002), Jacob (1956), Wagner (1959), Adler (2002) and many more as the essential foundation of the orchestra. Such a statement not only has a profound impact on a student orchestrator's understanding of and writing for the orchestra but brings into question some of the aspects of orchestral writing and practices that this study aims to describe. What becomes clear is that the "poetic art of orchestration" described by Berlioz and Piston is already deemed more practically attainable by the student who would heed the common advice of all these authors, and the explicit coding of this idea, common to so many authors, does not seem impossible anymore. The methods chosen to aid an undertaking of such a task are described in the following section.

## ii. Grounded Theory

Creswell (2009: 13) possibly provides us with the most systematic definition of Grounded Theory, describing it as "a qualitative strategy of inquiry in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants in a study" (2009: 13). These participants can be interviewees, authors, practitioners, or observers. According to Charmaz (2006) and Strauss & Corbin (2008), a Grounded Theory research process normally involves multiple stages of data collection in order to refine the interrelationships of categories of information presented by the data analysed.

Grounded Theory is both a methodology and representative of a research paradigm (Babbie, 2001; Charmaz, 2006). Methodologically, Grounded Theory is a theory discovery process that allows the researcher to build a theoretical account of the general features of a topic, whilst simultaneously grounding the account in empirical observations or data (Glaser & Strauss, 1967). It, therefore, places a strong emphasis on research procedures when developing theories (Martin & Turner, 1986). Paradigmatically,

grounded theory combines traditions of positivism<sup>3</sup>, interactionism<sup>4</sup> and inductivism<sup>5</sup> in order to be supported by real data and retain a connection to the substantive area.

The inductivist nature of grounded theory is in contrast with theory derived deductively from grand theory, which could normally take place without the help of data and could eventually fit no data at all (Borgatti, 1996). In contrast to this, Grounded Theory values an involvement with and a connection to the substantive area. The value of a Grounded Theory, according to Strauss and Corbin (2008), can be evaluated by the process by which the theory is constructed. In contrast, deductive theory tends sometimes to value a theory's ability to explain data irrelevant from the process of its discovery.

Grounded Theory is suitable when the study of social processes, experiences or interactions aims to explain a process, not to test or verify an existing theory (Lingard, 2008). Historically, the methodology is designed to mitigate, at least to some extent, the background assumptions and sensitising concepts brought to the study by a researcher. Rather, the theory emerges through a close and meticulous analysis of data (Strauss & Corbin, 1997). Recently, Charmaz & Bryant (2008) have advocated a constructivist approach to Grounded Theory that brings into sharper focus the involvement of the researcher as a generator of codes and data in the construction of a grounded theory.

The methodology of grounded theory was first developed in 1967 by the American sociologists Barney Glaser and Anselm Strauss to describe a new method of qualitative research that aimed to combine

---

<sup>3</sup> In this context, positivism is aligned with Auguste Comte's postulation that it is possible to observe social life and establish reliable, valid knowledge about the way in which it functions, and also that theory should be constructed with methodical rigour. It is, however, not aligned with the belief that sensory observation should be the only concern of the researcher. For more about this, see Glaser & Strauss (1967), Charmaz (2006) and Creswell (2009).

<sup>4</sup> Interactionism, as described by Bryant (2003) and Creswell (2009), maintains that society is a product of the everyday social interactions among many people. Social life is largely a complex fabric woven of many, many interactions. Interactionism examines how different social agents or actors interpret their own behaviour and that of others, in order to discover more general truths about society.

<sup>5</sup> This study adopts a core definition of inductivism as scientific knowledge derived inductively from observation, in other words that general truths and probabilities can be formulated from observation of particular instances (Glaser & Strauss, 1967; Glaser, 1992; Babbie, 2001; Charmaz, 2006; Charmaz & Bryant, 2008).

positivist and interactionist paradigms. Before this, in 1965, they published a study called *The Awareness of Dying*, in which they adopted investigative research methods with no preconceived hypotheses, rendered inductively reflexive by a continuous comparative analysis of collected data, to result in a theory that could be described as “grounded” because it was so strongly rooted in its substantive area (Glaser & Strauss, 1967).

### iii. Perspectives

At present, three mainstream variations of Grounded Theory exist (Charmaz & Bryant, 2008). The first and oldest methodology is documented in Glaser and Strauss’s *The Discovery of Grounded Theory* (1967) and later expounded by Glaser in *Theoretical Sensitivity* (1978). The first variation was published by Strauss and Corbin in 1990 and is documented in *Basics of Qualitative Research*. Whereas Glaser (1992) advocates a flexible approach to coding and the emergence of concepts, Strauss & Corbin (1998) emphasise verification and the adherence to technical procedure. Axial coding, introduced by Strauss and Corbin, aims to delineate the boundaries of categories and draw relationships between categories according to conditional matrixes (Charmaz & Bryant, 2008). The current study, although drawing on conceptual and methodological contributions by Strauss & Corbin (1998), is paradigmatically more in line with the open and flexible approach of Glaser (1992) due to its flexible and organic engagement with data sources.

Constructivist Grounded Theory, developed by Bryant (2002, 2003) and Charmaz (2000, 2005, 2006), retains the flexible approach of Glaser, but emphasises the presence and contribution of the researcher in the research as an active participant who is able to develop dialogue between researcher and data (Charmaz, 2006). Charmaz & Bryant (2008) adopt the view that codes and categories, as well as the eventual theory, are a result of the researcher’s direct intervention within the substantive area. In their methodology, concepts surrounding research context, prior knowledge, existing literature and reflexivity are studied to greater depth than in other approaches to Grounded Theory. The current study also adopts

this awareness of the researcher in the research and attempts through such an awareness to mitigate the effect of researcher on research outcomes.

#### iv. Methods

Grounded Theory studies generally focus on social processes and participant experience and, therefore, draw the bulk of their findings from analysis of participant research (Glaser, 1992). Dick (2014), Charmaz (2006) and Creswell (2009) promote the idea, however, that valuable findings can be discovered in any data source. Examples include autobiographies, interviews, focus groups, personal accounts and correspondence, artworks, recordings and scores. For that reason, Grounded Theory can be especially productive in theorising about creative arts. Glaser's Grounded Theory methods, as described by Simmons (2014) and Scott (2009) and taken from Glaser (1992) include 5 common stages: preparation, data collection, analysis, memoing, and concept sorting. The current research project is aligned with these 5 research stages.

##### iv. a) Preparation

As it was mentioned earlier, the majority of theory building methodologies function deductively, usually drawing on insights from grand theories<sup>6</sup> and combining them with empirical research to produce middle-range theories<sup>7</sup> similar to grounded theories (Babbie, 2001; Corbin & Strauss, 2008; Creswell, 2009). Deductive theory building processes generally rely on the formulation of some sort of hypothesis before data is analysed, and is therefore in contrast to the Grounded Theory design by promoting a divide between data collection and analysis (Glaser & Strauss, 1967; Charmaz & Bryant, 2008). Grounded Theory

---

<sup>6</sup> Grand Theory is understood in this study as the theoretical classification invented by Charles W. Mills (1959) that refers to highly abstract theorising in which formal organisation of concepts takes precedence over understanding the substantive area.

<sup>7</sup> Middle-range Theory is an approach to sociological theory construction, developed by Robert K. Merton (1968), which is aimed at integrating theory and empirical research. Merton's approach came into public view almost the same time as Glaser and Strauss's Grounded Theory approach.



aims to obviate such a disunion by merging data collection and analysis into a continuous developing research trajectory.

For a successful Grounded Theory study, Simmons (2014) advocates omitting a literature review, working with a general research topic, and avoiding a predetermined research problem. Scott (2009), in his description of grounded theory methodology, only precedes data collection and analysis by the identification of a substantive area, or an area of interest. For Charmaz (2006), data collection and analysis occur simultaneously as the first steps towards developing a theory, as soon as the area of interest has been identified. Many authors refer to the identification of a study area in terms of inspiration or intuition (Borgatti, 1996; Charmaz, 2006; Creswell, 2009). This is an ideal that is unachievable in an academic process that requires the submission of a research proposal, but the negative effects thereof can be mitigated by knowledge of the views of Charmaz about the presence of the researcher in the research (described earlier).

#### iv. b) Data Collection

All is data (Glaser & Strauss, 1967). This implies that any data source which presents the researcher with an opportunity to generate meaningful findings for a grounded theory can be included in a study (Glaser, 1992). Some authors even advocate the technique of self-interviewing in order to generate data for a study (Glaser, 1992; Corbin & Strauss, 2008). Quantitative, qualitative and mixed data may be used (Scott, 2009), including but not restricted to:

- Collecting observations of the substantive area, and activities occurring within it;
- Accessing public or private records irrespective of form;
- Conversing with individuals or groups of individuals, either directly or remotely.

Data collection in Grounded Theory only ceases when the researcher is certain of the desired level of saturation in the various theoretical categories is attained or until the practical boundaries of the research project has been reached; data collection, therefore, constitutes a continuous process within the Grounded Theory methodology (Scott, 2009; Charmaz, 2006).

#### iv. c) Analysis

Various modes of data analysis may occur within a grounded theory study, the most common of which are substantive, open, selective and theoretical (Simmons, 2014). Open coding is the most functional though, because it can generate useful findings from any form of data, and is flexible enough to accommodate many different study topics. Open coding differs from most types of qualitative coding, which rely on pre-established static topics and characteristics (Charmaz & Bryant, 2008).

Generally, open coding is led by three principle foci (Martin & Turner, 1986; Charmaz, 2006; Corbin & Strauss, 2008; Hsiung, 2010):

1. What is really being explained in the data? (This approach also challenges the researcher to explore what is *not* being explained)
2. How is it being explained/presented?
3. What does it mean/imply?

The abstract data produced by these questions aid the researcher in creating the necessary conceptual links and categories that are needed to construct a grounded theory.

#### iv. d) Memoing

Memoing is the process by which the researcher continuously documents findings and ideas produced by coding. According to Charmaz & Bryant (2008), grounded theorists write memos to elaborate on their codes, by identifying their properties and the conditions under which they arise. Theorists can compare memos with other memos and codes to produce new, more analytic memos that raise the theoretical level of their work (Charmaz, 2006). The eventual grounded theory is not only constructed from codes, but from memos as well.

#### iv. e) Concept Sorting

Memos form data points that the theorist can sort in order to identify categories. A category is a common theme or idea that occurs in many codes and memos and can be exploited as an anchoring point for further purposive sampling and coding. As categories become more populated, the researcher can begin

to assess their positions and weight within the framework of the study, and begin to formulate one or more core categories. The identification of categories, therefore, provides the theorist with a) more opportunities to collect and analyse data in order to strengthen the validity of the theory, and with b) a framework by which to order and document the final theoretical findings (Charmaz & Bryant, 2008).

Saturation (also described earlier) is a state whereby a researcher can find very little or no new data or findings to add to a theoretical category (Glaser & Strauss, 1967). Generally, researchers aim for the highest level of saturation attainable within the boundaries of the study (Charmaz, 2006). Saturation is an important characteristic of a theoretical category, because it is a reliable way for the researcher to verify the significance of the category within the context of the theory (Scott, 2009; Charmaz & Bryant, 2008; Simmons, 2014).

## v. Key defining features

Arguably, the central drive in data analysis during grounded theory research is constant comparison. As key points of interest are discovered in the data, they are compared with other examples for similarities and differences. Through this process of constant comparison, emerging theoretical constructs are continually being refined through comparisons with “fresh” examples from ongoing data collection, which produces the richness that is typical of grounded theory analysis (Martin & Turner, 1986; Dick, 2014).

These concepts – iterative study design, theoretical sampling, and system of analysis – are closely linked. As Lingard (2008) states, an iterative study design requires theoretical sampling for iterations to be meaningful, and constant comparative analysis allows the integration of new and existing data in this iterative cycle, towards a well-grounded theory. Therefore, a study must use all three of these features to allow the emergence of new conceptual models.

Note that in Grounded Theory the data is continuously analysed with what Charmaz (2006) and others describe as naïveté – that is, *as if* nothing about the context of the data is already known (Glaser &

Strauss, 1967). This ideal albeit impossible approach stems from one of the core ideals of Grounded Theory (and one that is likely also near to impossible): that the researcher must enter the research process without preconceived notions or frameworks in mind (Glaser & Strauss, 1967). Evidently, what advocates of Grounded Theory are attempting to obviate here is the possibility of these preconceptions skewing the eventual formulation or outcomes of the resulting theory in the direction of one or more unformulated proto-hypotheses. In literature about grounded theory, this ideal surfaces as the greatest weakness of the methodology (Babbie, 2001; Charmaz, 2006; Strauss & Corbin, 1997; Martin & Turner, 1986; Dick, 2014), because an individual entering into a study cannot do so without some preconceived ideas about the research subject, content or process. This is sublimated only in part by the constant comparison of and reflection on as divergent a collection of data as possible in a Grounded Theory study (Creswell, 2009).<sup>8</sup> A constructivist view of the methodology, as is described earlier under *iii. Perspectives*, page 9, becomes an important consideration in Grounded Theory, because it promotes a reflexive awareness of researcher-intervention in the study area and provides mechanisms for mitigation.

At this point, five defining features of grounded theory are posited, namely that

1. data and emerging categories are under constant comparison;
2. data should originate from divergent sources to maximise similarities and differences of information;
3. a multiplicitous approach to the reading and analysing of data is an essential step towards the mitigation of theory-altering factors brought to the study by the researcher;
4. explanation takes precedence over description, by drawing on conceptual abstraction produced by the study; and
5. the context of the researcher and the study is demoted to the level of other data sources, to be analysed in the same way.

---

<sup>8</sup> Judith A. Holton (2009) expands on this notion in her methodological critique of Glaser's Grounded Theory, titled *A Review of Study: Qualitative Tussles in Undertaking a Grounded Theory Study*.

See also *Problematics of grounded theory: innovations for developing an increasingly rigorous qualitative method* (Wasserman, Clair, & Wilson, 2009).

Finally, in order to validate a grounded theory, Strauss & Corbin (1998) in Ke & Wenglensky (2014) state four primary requirements:

1. It should fit the phenomenon that is being studied<sup>9</sup>;
2. it should provide understanding of the phenomenon and be itself understandable;
3. it should provide generality; and
4. it should provide control, that is to say that the conditions under which the theory applies should be clearly laid out.

## vi. Grounded Theory in Music Research

In the large body of music research that is accessible through online and written enquiry, both locally and abroad, Grounded Theory methodology is noticeably absent. The few cases of its application in music research is limited mostly to three main subject areas: education (Roberts, 1991; Lesch, 2013), behaviour regulation (Saarikallio & Erkkilä, 2014; Bishop, Karageorghis, & Loizou, 2007; Mornhinweg, 1999), and music therapy (Daveson, O'Callaghan, & Grocke, 2008; O'Callaghan, 2001; O'Callaghan & Magill, 2009). Most notable, however, is Tobert's *Music and meaning: an evolutionary story* (2001), which sets out to frame the development of music in a way that is both evolutionary plausible and socially grounded. It is the only grounded theory research dealing with a general theoretical aspect of music that the current author has been able to locate.

In a South African sphere there exists an important recent study by Felicia Lesch of Stellenbosch University's music department, titled *The certificate programme in music: a means of broadening access to higher education music studies at the University of Stellenbosch* (2010). In her study, Lesch utilises the axial Grounded Theory procedures set forth in Strauss & Corbin (1990). As was noted under *iii*. Perspectives on page 9, the methodology proposed by Strauss & Corbin constitute a delineation from the original methods

---

<sup>9</sup> In Strauss & Corbin (1998) and in Ke & Wenglensky (2014), this requirement is immediately followed by the provision that the theory has been derived from diverse data.

proposed by Glaser & Strauss (1967), and which was contested by Glaser (1992) thereafter. In her study, Lesch aimed to develop a longevity-ensuring strategy based on change theories. Categories in her study included motivation, self-regulation, service learning and development of emotional intelligence.

## vii. Material and presentation of material

In this study, four main bodies of material were analysed or consulted, including orchestration textbooks, supplementary sources, correspondence, and a collection of orchestral works. Orchestration textbooks by Jacob (1956), Parrott (1957), Piston (1961), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004) and Sevsay (2013) were the main sources used in the initial analysis according to grounded theory methods (level 1/open coding), but a number of other orchestration textbooks were also consulted to provide additional substantiation for certain concepts and practices. These additional textbooks, as well as supplementary sources (most notably Carse, 1964; Del Mar, 1983; Baines, 1991; and Herbert, 1997), were consulted to provide deeper understanding of terminology, instrumental practice, or historical orchestral practice in focused/level 2 coding. Correspondence with a number of South African orchestrators of various ages aided in developing contextual understanding of the findings from level 1 and 2 coding. Lastly, eight South African orchestral works were consulted as musical references to complement the textual sources referenced in this study.

Initial grounded theory analysis of textbooks took place in four stages --

1. Selection of textbooks according to a list of criteria: eight textbooks were chosen for the initial coding process because they a) were published after 1950, b) were written specifically for teaching purposes, c) contain a profundity of information not only about instruments, but also about various methods of instrumentation in the symphony orchestra, and d) make regular reference to a variety of orchestrators of varying nationalities and style periods. Three notable sources that were therefore not included in the initial coding are Berlioz (1991), Forsyth (1914), and Rimsky-Korsakov (1964).

2. Identification and sorting of fragments: textbooks were first divided into short text fragments in order to separate individual ideas from each other. In keeping with a Grounded Theory paradigm, which aims to gain insight about how individuals perceive, experience or deal with a process, text fragments were chosen for analysis when they communicated more than only factual knowledge about an instrument or a technique. In other words, fragments were chosen because they display an author's individual outlook on or experience of orchestration or the use of instruments in the orchestra. The use of qualitative jargon such as "best", "better", "ineffective", "idiomatic", "best-avoided", "normal" or "unusual" was a key mechanism for identifying useful fragments<sup>10</sup>.
3. Analysis and coding of fragments: in this phase, the general processes or phenomena that were described in the fragments were discovered by asking the questions shown previously in this chapter (see *Analysis* under *Methods*). In the following fragment for example, "the second common usage of percussion instruments is to emphasize general rhythmic activity or for sharp accents" (Adler, 2002: 506), I found that the author was describing instrumental tradition, and subdividing the orchestra.
4. Sorting of codes: in the last phase of this initial process, the text fragments were sorted into separate groups according to the codes that were assigned to each. In this study, eight major groups or categories were identified.

Table 1 -- The total number of fragments identified for analysis in eight suitable orchestration textbooks:

Source	No. of fragments	Source	No. of fragments
Jacob (1956)	536	Kennan & Grantham (2002)	1881
Parrott (1957)	380	Adler (2002)	1555
Piston (1961)	702	Casella & Mortari (2014)	318
Blatter (1997)	602	Sevsay (2013)	698

<sup>10</sup> An example of a fragment that was included, because it presents a qualitative judgement of the function of orchestral percussion: "The second common usage of percussion instruments is to emphasize general rhythmic activity or for sharp accents" (Adler, 2002: 506). An example of a fragment that was not included, because it describes the physical appearance of an instrument and therefore does not make a personal qualitative judgement: "Temple blocks are a graduated series of five clam-shaped wooden blocks mounted on a stand" (Adler, 2002: 458).

The table above gives a breakdown of the total number of text fragments that were identified for use in coding, with a general total of 6672 fragments. It should be understood now already that no source can be considered more significant than another based on the number of fragments identified for coding. The different approaches of authors, which can be either more technical (objective), or more idiosyncratic (subjective), or a combination of both, determined mostly the number of fragments from them that were chosen in the selection process. It should also be noted that because of the very large number of coded fragments used in the study, text references in this thesis generally refer to concepts that are present throughout a source and not only in one location; therefore, in-text citations generally do not indicate page numbers except where a passage is quoted directly or when a concept occurs only in one specific place in a source. This is consistent with the APA style of referencing, which this thesis adopted in accordance with guidelines set forth by Stellenbosch University.

Correspondence with active South African composers was an important tool in discovering a more contemporary and a more locally relevant understanding of the concepts that presented themselves in textbooks and other sources. Correspondence took place in the form of simple, open-ended questionnaires that were then followed up with personal correspondence when necessary or appropriate. These composers included Hans Roosenschoon, Jeanne Zaidel-Rudolph, Martin Watt, Peter Klatzow, Arthur Feder, Jaco Meyer, Hendrik Hofmeyr and Kevin Volans, and they were chosen to contribute to the study because they a) have produced a number of significant orchestral works, b) have studied or worked abroad, c) have significant experience in teaching orchestration, and/or d) have formally studied the practices of orchestration as part of a formal research degree at a tertiary institution<sup>11</sup>.

The final body of information that is referenced in this study is a collection of eight South African orchestral scores composed between 1960 and 2003. These works include:

1. Arnold van Wyk: *Primavera* (1960),
2. Gideon Fagan: *Karoosimfonie* (1976),

---

<sup>11</sup> See Feder (2015) and Meyer (2012).



3. Peter Klatzow: *Incantations* (1984),
4. Jeanne Zaidel-Rudolph: *Tempus Fugit* (1986),
5. Hans Roosenschoon: *The Magic Marimba* (1991),
6. Roelof Temmingh: *tjellokonsert* (1992)<sup>12</sup>,
7. Stefans Grové: *Raka* (1996), and
8. Hendrik Hofmeyr: *Sinfonia Africana* (2003).

These works did not form part of the Grounded Theory analysis, but they are rather referred to throughout the thesis in the form of music examples that aim to demonstrate visually some of the concepts that are explained in the text. They, therefore, perform a supplementary function in this thesis as a visual complement to the text<sup>13</sup>. These eight works were chosen from the South African oeuvre because they a) are considered significant in the history of South African composition, b) are available in score form either published or from an archive, c) are composed for symphony orchestra, d) have been performed and recorded, and e) exist in the form of an audio recording. South African works were chosen specifically for two reasons, firstly because South African orchestral music is underrepresented in orchestration literature, and secondly because it follows the tradition of orchestration authors to use examples of music originating from their respective institutions. That is not to say, however, that the theory is orientated specifically to a South African context, but rather that the South African works which are included in this study as a reference are equally able to contribute to an international body of orchestral literature than works from other countries and continents are.

In the following two tables, the number of examples referred to in eight textbooks are compared according to the number of examples per author per nationality as net total and then as a percentage. Casella & Mortari (Rome and Paris), Blatter (Philadelphia), Sevsay (Vienna) and Widor (Paris) show a

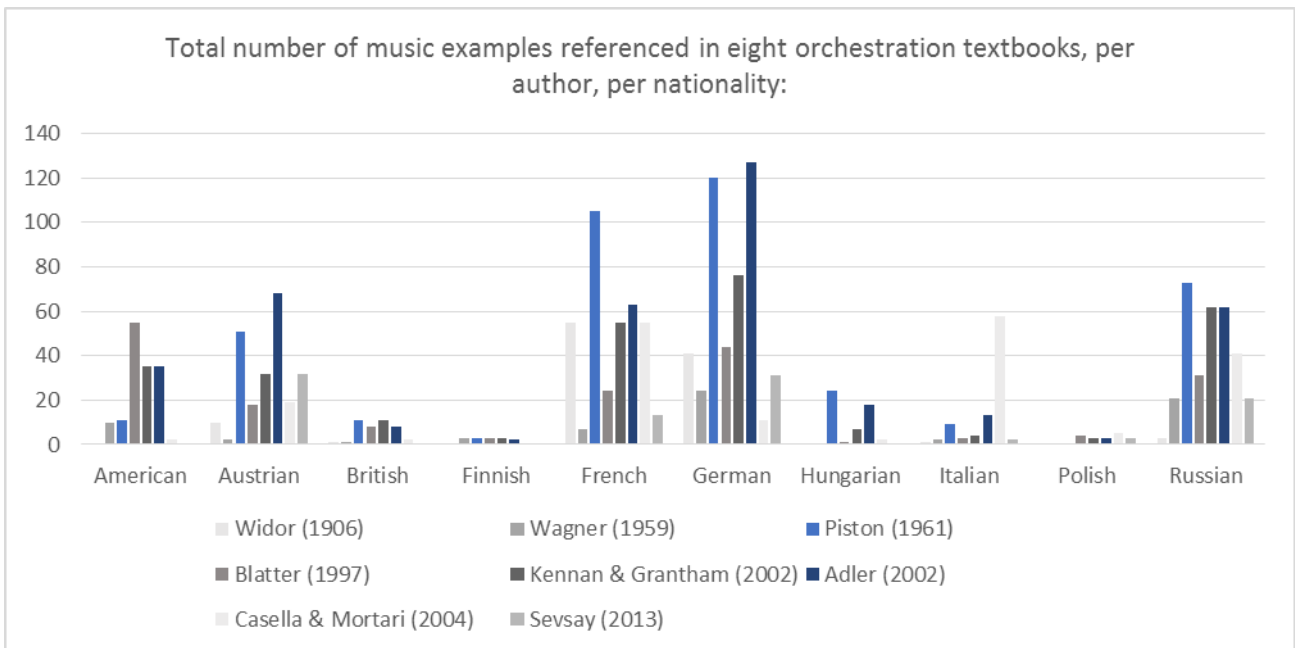
---

<sup>12</sup> See footnote 38, p.48.

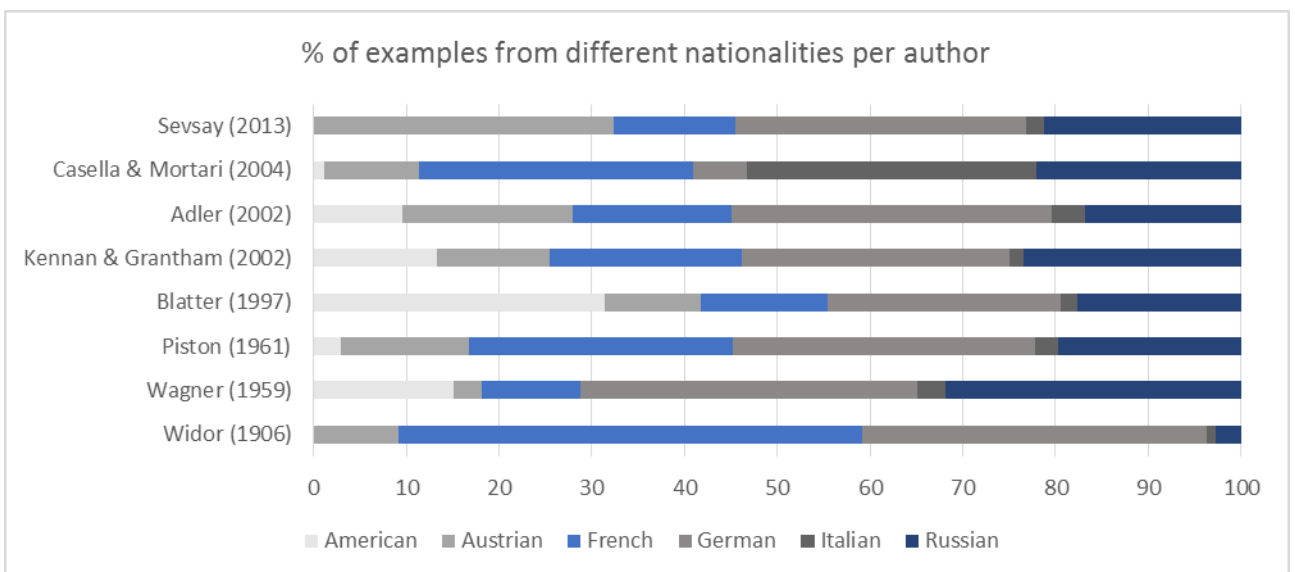
<sup>13</sup> Wherever possible, examples are quoted as they appear in the reference scores, although they are regularly reduced to save space. Some small technical problems/mistakes have been carried over from the manuscripts. In reducing the examples, some minor detail regarding phrasing or articulation is sometimes omitted in order to maintain a focus on the subject of discussion.

predilection towards favouring composers from their own institutional affiliations, so that there is a pedagogical and a historical precedent for referencing South African works in this thesis. The findings that are displayed below are a partial list compiled from eight textbooks; a full exposition of music examples can be found in Addendum B, and are more fully discussed in a later chapter (Category 6, page 194).

Graph 1 -- Music examples referenced in eight orchestration textbooks (total per nationality):



Graph 2 -- Music examples referenced in eight orchestration textbooks (percentage per nationality):



Together, these four main bodies of data constitute the foundation of the study, the results of which are documented in the following eight theoretical categories as short and separate chapters. In this thesis, the categories are referred to as Perspectives, because they describe a single occurrence (symphonic orchestration) from different vantages. The first Perspective, which deals with the mystification of orchestration, is presented as an introduction to the theoretical structure, while the last Perspective that deals with knowledge in orchestration is presented as a conclusion. The presentation of the eight categories does not follow a linear narrative, but each of the chapters represents a different facet of the overall theoretical structure of the study. In an attempt to capture with some accuracy the jargon and colloquialisms of the authors whose texts were studied, there is a tendency throughout the thesis to describe some concepts almost to the point of tautology. I am of the opinion that small nuances of meaning between the different adjectives that orchestrators use to describe their experience of the subject is an important aspect of understanding the theoretical content of this thesis. For the same reason, some passages in this document could seem too florid for an academic study, but again this is an attempt to capture the descriptive vocabulary of the sources that were analysed. Lastly, the use of a first-person style of writing is employed in a small number of cases in order to differentiate more clearly between ideas that are born of the text and reactions that stem purely from my reading of the material.

The nature of Grounded Theory methods means that the eight categories of the theoretical structure are intertwined to some extent; in order to aid the reader, a number of cross-references are also included throughout the thesis in order to show explicit links between different categories. The chapters also vary to some degree in length and content; this is a reflection of how much the ideas contained in each chapter are discussed in the various textbooks, as well as the complexity of those ideas. Three addendums are also frequently referenced in the thesis, which deal with instrumental ranges (Addendum A), instrument examples (Addendum B) and a comparison of registral strength and saliency between different orchestral instruments in different registers (Addendum C). These eight categories, as well as the addenda, constitute the body of this grounded theoretical discussion of orchestration practice. At the end of each chapter, a

short summary is given of its content, as well as an overview of the position of the category within the greater context of the Grounded Theory study.

## Perspective one: The mystification of orchestration (also an introduction)

### 1.1 Introduction

From analysis of orchestration textbooks, orchestration appears to be equal parts elucidation and mystification. Almost all attempts to systematise orchestration in texts by Piston (1961), Jacob (1956), Parrott (1957), Kennan & Grantham (2002), Adler (2002) and Sevsay (2013) are countered at the same time with the opposite tendency, namely the assertion that aspects of orchestration cannot be defined, cannot be controlled, or cannot be known. It is for this reason that the term “mystification” is used in this instance, because it describes a process by which systematisable aspects of orchestration are shrouded by a sense of the unknowable. That being said, orchestration appears to be successful when it balances these known and unknown elements in a bid to a) predict and control the outcome of a specific notation idea, and b) exploit the indeterminacies inherent to orchestration<sup>14</sup>. In the following sections, some ideas surrounding this dichotomy and its exploitation will be described as closely as possible to how they appear in the various orchestration textbooks.

Some indeterminacies in orchestration are related to our understanding of the physical properties of sound and articulate a schism between what we perceive audibly and how we are able to express that perception<sup>15</sup>, an example being that the quality of tone colour cannot be described adequately in words (Kennan & Grantham, 2002). Other indeterminacies are related to inaccuracies inherent in notation and score preparation, for instance that there is no fixed rule for grouping of percussion instruments in an orchestral score, or the distribution of instruments between players (Adler, 2002)<sup>16</sup>. The last kind of indeterminacy is related to the indeterminacy of notation, and is a resisting force against the development of predictable systems in orchestration that would entail determining and defining empiric processes in writing for orchestra. This same problem (as was shown in the previous chapter) is seen by Piston (1961) as

---

<sup>14</sup> See the chapter titled *Perspective seven: The meaning of effective orchestration*, p.226.

<sup>15</sup> See the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception*, p.141.

<sup>16</sup> See the section titled *2.4 The shifting importance and function of the percussion section* on p.68, in the chapter titled *Perspective two: An instrumental-hierarchical view of the orchestra*.

a general systemic factor in prohibiting the establishment of a more scientific method of music documentation. Jacob (1956), Rimsky-Korsakov (1964) and Piston (1961) emphasise this idea that it is not possible to compile formulas by which all the contingencies of writing for orchestra can be contained throughout their writing. As was stated earlier, in the analysis of literature this emerging counterpart to a systematised technique of orchestration presents itself in all major sources, and is seen in terms of a grounded approach to orchestration as a core category because of its strong interrelatedness to other categories. Codes in this category describe ideas and processes surrounding the lack of control, the impossible, the indescribable, imprecision, the role of instinct, inspiration, and relativity. They have been grouped together here into four sections that discuss extra-musical references, orchestral performance as a human endeavour, different ways of “knowing” orchestration, and the indeterminate nature of the orchestra and orchestration.

While the concerns and thoughts of the authors have been outlined here and have been linked by way of their use of keywords and conceptual frames, the text is in no way an exhaustive or conclusive extrapolation of these ideas. This chapter does however lay down a number of general ideas about orchestration from the viewpoints of the most important orchestration authors, and provides a useful springboard to other chapters of this thesis that discuss these ideas in greater detail. For that reason, this Perspective serves as an introduction to the theoretical findings of this thesis. It is interesting that a mechanism of romanticising and mystifying the practice of orchestration has imbued every aspect of its undertaking so that nearly every category of the analytical findings is referenced in this chapter. Where it has seemed prudent to provide a cross reference, another chapter with a more detailed discussion of a topic has been cited to lead the reader to the correct section.

## 1.2 Some notes about extra-musical references

The idea that sounds produced by instruments of the orchestra can conjure meanings outside of the specific music that they are realising, is a popular notion in orchestration literature. The castanets, for

example, being heard most often in music of a Spanish dance style (Kennan & Grantham, 2002), could be understood to bring that same quality to an orchestral work in which they are written for. Furthermore, this Spanish connotation can conceivably only be brought to the performance by a listener who has a pre-existing knowledge or memory of Spanish music in which the castanets feature prominently, or by a person who understands in some other way that the castanets are representative of Spanish styles of music. Then it is also necessary for the listener to forge the conceptual link between the heard castanets and the perceived Spanish influence, whether it was intended by the composer or not. The quality of that knowledge or memory is, therefore, dependent on the perceptions and experiences of the listener. In this way, something is brought to the orchestral performance that cannot be controlled by the composer – it is an indeterminacy that directly counters the idea of control and structure in orchestration. Although a composer can attempt to circumvent these engendered contexts by reinventing the techniques or applications of an instrument, it is not possible to control how the listener will interpret the sounds presented by the orchestra. A number of composers attempted to do so during the last one hundred years. In the following figure, for example, Hofmeyr's specific application of string pizzicato, percussion and trumpet is reminiscent of some Spanish dance forms due to the accentuation of the second and fourth beats, guitar-like accompaniment and decorative trumpet melody in a Phrygian mode. It is unlikely, however, that this reference was the exact intention of the composer, because the music is composed about Africa:

The image shows a musical score for the first movement of Hofmeyr's *Sinfonia Africana*, measures 58-63. The score is in 4/4 time and features a solo trumpet part starting at measure 14. The trumpet part is marked 'f' and includes a triplet. The percussion part includes timpani (mp), suspended cymbal, and bass drum (mp). The string parts (Vlns+Vlas and Vcls+basses) are marked 'mf pizz. sul pont. alla chitarra'.

Figure 1: Use of trumpet, percussion and strings in the first movement (Quasi Marcia funebre  $\text{♩} = c.$  58-63) of Hofmeyr's *Sinfonia Africana* (2003).

The kind of extra-musical imagination involved here can find its way into our more general conceptualization of instrumental character. Parrott (1957) in *Method of Orchestration* describes the use of bassoons in Dukas's *L'Apprenti Sorcier* as suggestive of senile mockery, going on to say that that bassoons are often considered the jokers of the orchestral pack. Sir Edward Downes, opera conductor with the Royal Opera House and Opera Australia, echoes this sentiment when labelling the bassoons as the "traditional jokers of the orchestra" (Downes, 1963). However, in a number of works after 1900 where the bassoon takes a solo function, the instrument performs remarkably stoic passages; Stravinsky's *Le Sacre du Printemps* and Shostakovich's ninth symphony are good examples of works containing *serioso* bassoon solos. Percussion instruments, having joined the orchestral forces in their full gamut relatively recently, are especially prone to such descriptions: the sound of an extended roll on the snare drum is likened to a tightrope act in the way it can engender a sense of tension or expectancy (Kennan & Grantham, 2002), while the xylophone is described by Adler (2002) as adding a gypsy sound quality to certain works. Jacob (1956) even describes the sound of the celesta as suggesting of the taste of a ripe plum. Many of the percussion instruments, which found a place in the orchestra due to their ability to bring local sounds to an orchestration, are described according to their exotic qualities. As a more recent example, the use of an alarm siren in some orchestral works brings with it the sound of impending danger, war or catastrophe,



whether from real experience of its characteristic warning signal or from pop-culture exposure to it; in Varèse's *Ionisation* (a work for 13 percussionists) even the highly tempered and decontextualized use of an alarm siren still suggests that specific extra-musical connotation.

Expanding on these similes, the current author would like to propose that extra-musical descriptions draw on senses and common social experiences that fall outside of the realm exclusively of hearing to help carry meaning from orchestrator to performer, performer to audience, author to reader, or teacher to student, especially when a lack of knowledge about the use and customs of a specific instrument might place the receiver of that knowledge at a disadvantage<sup>17</sup>. Kennan & Grantham (2002) propose that a designation of intensity like dark, bright or ominous could be applied to an instrumental effect such a suspended cymbal roll in order to aid a player in choosing the best attack, mallet and instrument for its execution<sup>18</sup>. Such a designation would only be effective because of a common understanding shared between the two parties of the ideas of darkness, brightness or ominousness, which have no bearing on the description of sound except in a metaphorical or psychological sense. This also holds bearing on Piston's (1961) statement that the orchestrator who is anxious to understand the sound outcome of what has been written on paper, will have to acknowledge the unknown quantity of the performer's understanding.

Below are a small number of examples from eight South African orchestral works that show how extra-musical descriptors can aid the performer in realising the sound imagined by the orchestrator. There is a noticeable development in these works in terms of the use of such descriptors: Whereas Van Wyk

---

<sup>17</sup> The important roles that different forms of knowledge play in orchestration is discussed in a later chapter titled *Perspective eight: Knowledge and orchestration*, p.260.

<sup>18</sup> Although not strictly related to the aspects of extra-musical referencing referred to in this section, the complex web of musical terminology that has evolved over centuries of western art music development is worth mentioning shortly. Much of the terminology indicating tempo, character, articulation or dynamics are not in the native language of the musician interpreting it. Musicians become so accustomed to reading and interpreting Italian, French or German terms in their performance practice, that they are able to extrapolate extremely nuanced meaning from them. Through centuries of use and transference into new styles of music and new generations of composers, the terms become abstract symbols of meaning and the language in which the term was originally embedded becomes of insignificant value.

(1960) and Fagan (1976) lean more towards describing the quality of sound that is required from the performers, later works lean towards the technical requirements of sound production. In Klatzow (1984) for example, the only two character descriptions used are *leggiero* (It.: lightly) and *espressivo* (It.: expressively), and these terms are ambivalent in that they could be said to describe the approach to sound production as much as the sounds themselves. In Zaidel-Rudolph (1986) and later works, descriptors focus almost exclusively on playing techniques. Both approaches have benefits and disadvantages: the former gives the player an approximation of the ideal sound result so that the player can choose the best mode of sound production to achieve that goal at the expense of the orchestrator's technical control over the sound; the latter gives the performer clear instructions about the utensils and methods that are required to produce the sounds, but do not give a very good idea of what the expressive characteristics of that sound should be.

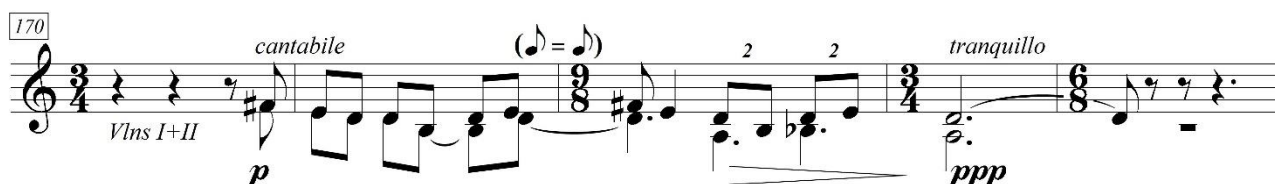


Figure 2: In a singing style, then calm – for violins I+II in the first movement (Meno mosso ♩ = c.96) of Van Wyk's *Primavera* (1960).



Figure 3: Sweet and expressively – for the oboe in the first movement (Pochissimo meno mosso ♩ = 96) of Fagan's *Karoosimfonie* (1976).

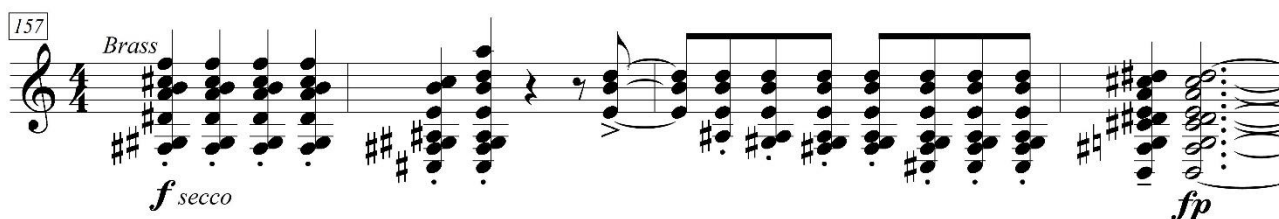


Figure 4: Dry - for the brass section in the second movement (♩ = 168) of Roosenschoon's *The Magic Marimba* (1991).

In the figures above, the sounds required by the composers/orchestrators are described in terms that are impossible: sound cannot be tranquil, nor can it be sweet, nor can it be dry. These are characteristics one would associate with an emotional state, or the sensation of taste, or of touch. Rather, these terms are meant to conjure a certain frame of mind in the performer, so that a complex set of performance parameters can be called upon to produce the sound in the required way without the orchestrator having to describe the exact articulation, sustain, vibrato and overtone composition of the sound. The terms *tranquillo*, *dolce* and *secco* all have a rich history of application and context, so that when the orchestrators call on them, they also call on the performance history surrounding those terms – the performers can refer to these contexts in order to develop a finely nuanced approach to the interpretation of these passages.

### 1.3 An orchestrational view of orchestral performance as a human endeavour

In Jacob (1956), Parrott (1957) Piston (1961), Rimsky-Korsakov (1964), Del Mar (1983), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Sevsay (2013) and in others, there is an awareness of a kind of complexity introduced to orchestral performance at the moment when instrumentalists or performers become a part of the music production process. Zaidel-Rudolph (2015, personal correspondence) wrote for example that the success of an orchestration is highly dependent on the cohesiveness of an orchestra, as well as the players' well-intentioned approach to the music. This awareness stretches beyond the limits of pure instrumental technique to touch on ideas of physicality, interpretation, and even suggests the idea of ethical orchestration. What these authors infer to some extent is that the practice of orchestration might be able to strive towards a compensation for the presence and possible impact that these unknown factors might have on the orchestral performance, if and when the orchestrator writes for instrumentalists of the orchestra with the correct kind of technical insight and empathy.

On a very basic level, such an awareness translates into the notion that when a performer has better control over an instrument, the result is that more complex musical possibilities become available to the orchestrator. In this regard, Jacob (1956) makes the comment that a good player has remarkable control over the instrument, by which he reveals something of the inexplicable wonder that one experiences at witnessing the dexterous feats of professional musicians when they successfully perform challenging music. At the opposing side of the spectrum, however, music can gain an awkward quality of being perceived as unconvincing if the musicians are unable to gain technical mastery of a passage. Kennan & Grantham (2002) warns against subdividing the string sections of an inexperienced orchestra, because the instrumentalists may “suffer” as a result and may not be able to perform the music successfully<sup>19</sup>. It is conceivable therefore that the material produced by the orchestrator is always in a state of tension between these limits, and that the outcome of every performance is in some way determined by the amount of instrumental control that the performer can exert within the ensemble.

In orchestration, instrumental control is perceived to be closely tied to the interpretation of the orchestration and the expression of the musical ideas of the orchestrator; these are processes that have the potential to disrupt the orchestrator’s control over his score and therefore change the exact sound outcome of each performance. Adler (2002) cites Ravel as an example of a composer who maintains very accurate expressive control in his music, and is known to have produced orchestral scores of remarkable detail in terms of articulation, colour and pitch duration. Furthermore, Adler propagates the notion that changes in dynamics (e.g. *crescendo* and *diminuendo*) and tempi (e.g. *ritardando* and *rubato*) are made clearer when written into the texture of the score. If it could be possible that Adler is as such not trusting of his performers, one could deduce that he rather wishes to control as many of the musical components of a score as is possible, in order to reduce the possibility of ambiguity. However, even with such measures

---

<sup>19</sup> String choirs in the orchestra are generally successfully able to handle material that is above the technical proficiency of the average player of that group, because the stronger players will be able to carry the more difficult sections of the music (Del Mar, 1983). In amateur orchestras where the difference in technical ability between the first and last players of each section is substantial, it is often possible to see and hear how some players struggle with the material.

present, it is still possible for the conductor to disrupt the orchestrator's controlling measures: In Piston (1961) one finds examples of two commonplace occurrences in performance: firstly, that however well the timbral, dynamic and registral relationships between accompaniment and melody are constructed by the orchestrator, they could still be destroyed if performed without the necessary understanding of the performance relationship between the two functions of material (for instance, melody and accompaniment); secondly, that a conductor who attempts to highlight secondary material in a score can damage the balancing measures implemented by the composer by altering dynamic instructions. The latter is often witnessed in contemporary performances of well-established work from the canon, where the music is already so well-known to most listeners that conductors and orchestras strive to produce new interpretations of them and bring to the foreground previously unheard textures in a bid to produce an original and relevant performance.

The image displays a musical score for strings, specifically measures 98 through 102. It consists of four staves: two treble clefs (Violins I and II) and two bass clefs (Violas and Cellos/Double Basses). The music is written in a key with one sharp (F#) and a 3/4 time signature. The score is marked with a dynamic of *p* (piano) and includes numerous triplets and slurs. Above many notes, there are 'V' symbols with arrows indicating bowing directions. Some of these 'V' symbols are placed above notes that are part of triplets or slurs, indicating non-standard bowing directions for phrasing control. The bottom staff (Cello/Double Bass) features a prominent triplet pattern in the lower register.

Figure 5: Use of non-standard bowing in order to exert control of the resultant phrasing of the strings in the second movement (Allegro ma non troppo a quasi misterioso  $\downarrow = 100$ ) of Fagan's *Karoosimfonie* (1976).

In Figure 5, as in many sections of Fagan's *Karoosimfonie* (1976), the bowing direction of the majority of notes for the strings has been supplied by the orchestrator. It is commonly known that bowing is a basic method by which string players can express phrasic structure in music (in a manner reminiscent of how singers utilise breath in order to control phrasic structure in song). Composers rarely exert substantial control over bowing in orchestral scoring, because it is such fundamental part of idiomatic string technique that it is difficult for an orchestrator to stipulate idiomatic bowing without having substantial experience in

string playing (Kennan & Grantham, 2002; Adler, 2002; Casella & Mortari, 2004). This is not meant to imply that composers are inconsiderate of bowing procedures, however, and many examples exist in orchestral scores to show how composers have made use of non-standard bowing to produce interesting and expressive colour effects. Fagan stipulates bowing in many sections throughout his work, making use of non-standard bowing sequences to control the flow or articulation of phrasing within melodic patterns. In bar 99, for example, the use of double downbows and upbows creates a lilt in the music, as well as creating more defined articulation. Although it is not uncommon for section leaders in the orchestra to make changes to the bowing provided by an orchestrator (usually to facilitate the ease of playing, or to cancel out impractical instructions by the orchestrator), the orchestrator does make it less likely for misinterpretations to occur when detail of such a fine level is included in the score, as even if bowing changes are made in the orchestra the section leaders have a better understanding of the expressive aims of the orchestrator.

Figure 6: Precise dynamic and articulation control exerted by Grové in the second movement (Agitato ♩ = 108) of Raka (1996).

In the example above, Grové's successful control of different layers of material in the orchestral texture is demonstrated through his use of dynamics and articulation. In the first measure, two textural ideas are pitted against each other: the violas and horns double on the primary material, which has been accented on every pitch, while the cellos, basses and trombone are doubled by violins in a lighter

*staccatissimo* passage. Grové's differentiated use of articulation makes it clear to the literate musician which line constitutes foreground material and which one accompanies, and therefore makes it unlikely that the interpretation and performance will reflect something else. The four last bars of the example show how Grové introduces mechanisms into his orchestration to ensure that his exact dynamic indications are noticeable in performance: although the entire brass ensemble could have performed the *forte-piano-subito* passage with a similar effect, Grové has chosen to sustain the trumpets and trombones while taking out the horns in order to make the change in dynamic level more pronounced. The exact number of beats for which each dynamic level is sustained is also shown by Grové, so that no confusion may occur.

Figure 7: (Lightly ♩ = 72) Use of graphic and text instructions to ensure that the correct inter-instrumental balance and relationships are adhered to in Klatzow's *Incantations* (1984). Other orchestrational elements have been omitted from this example.

Klatzow makes use of written instructions in his orchestral text to ensure that the correct instrumental balances and relationships are maintained. Klatzow indicates explicitly the inter-instrumental relationships by use of dotted lines – a practice that is common in contemporary choral writing when a linear line is divided between voice groups. Furthermore, he gives written instructions on the score that the oboe balances with violins II, while the harp balances with vibraphone. Arguably, Klatzow had to give these instructions to clarify any possible ambiguity in the score, which presents the listener with a multitude of different voices performing at dynamic levels ranging from *pianississimo* to *fortissimo*; within that complex web of sound textures, the interweaving of musical lines is difficult to maintain or even recognise in the score. Any possible ambiguity is dispelled however by the addition of graphic and written instructions, so

that the incorrect interpretation and performance of the score becomes less likely under the baton of a conscientious conductor.

201

Laat uit die oe - wer - lo - se ons ver

oer - krag van die le - we self ver - rys, laat uit die oe - wer - lo - se ons ver

oer - krag van die le - we self ver - rys, uit die oe - wer - lo - se laat ons ver

le - de ver - rys, laat uit die oe - wer - lo - se ons ver

van die le - we self ver - rys, laat uit die oe - wer - lo - se ons ver

rys, met oer - krag ver - rys, laat uit die oe - wer - lo - se ons ver

Figure 8: Detailed balancing of voice parts to differentiate musical layers in the third movement (Tranquillo ♩ = c.42-46) of Hofmeyr's *Sinfonia Africana* (2003).

The example above shows solo voice and choir, with each voice doubled by woodwinds, brass and strings. In order to be absolutely sure that the importance of the different lines are understood and respected, the primary vocal lines are marked forte, while the secondary and accompanimental lines are marked down to *mezzo piano* and *piano*. Customarily, primary material only needs to be marked one dynamic level higher than secondary material, but here Hofmeyr marks the soloist and basses two dynamic levels above the rest of the choir. A possible reason for this is that, because there is much material in the middle registers of the orchestra and choir, the outer registers are marked louder in order to balance the sound mass. This is in accordance with the findings of a later chapter (*Perspective four: An orchestrator's view on hearing and sound perception*, p.141), where it is established that because human hearing becomes less sensitive in outer registers, orchestrators might have to mark those passages louder in order



to compensate. Hofmeyr also doubles the soloist in a higher octave and the basses in a lower octave to increase the breadth of their sonority and ensure that they are discernible within the orchestral mass.

Orchestrator and orchestra/conductor are to a large extent not in the state of conflict or tension that might have been implicated earlier, however. Kennan & Grantham (2002) articulates the relationship between orchestrator and performer as a symbiotic one. Primarily, the conductor and performers have the responsibility to ensure that the instructions provided by an orchestrator are followed, while the composer/orchestrator ensures that the music is suitable for and usable by the musicians. As Klatzow stated in an interview with Veronica Franke (2015): “But in the making of this new work the composer must also take into account the role that the performer has to play. A work which fails to integrate the performers’ contribution will never find its mark with receptive audiences”. In the past, for example, the orchestrator would not generally indicate such detail as the use of mallets by the timpanist, leaving it to the performer to choose the best utensils. Musically speaking, furthermore, there are precedents for the performers overriding the notation of the orchestrator in concert, intervening in the musical text to produce what they believe is a more appropriate or effective musical product. Kennan & Grantham (2002) explain that, for example, there are cases in which it would not be appropriate to carry the roll over into the next beat, and skilled players are able to cope with such spots. Such an approach where the performer is allowed to contribute to the orchestration brings into play the considerable knowledge and skill of an orchestral musician in the performance of the material, leading to greater opportunities for collaboration. However, because the performance product will likely differ from the written score in such examples, and because the orchestrator cannot determine when such intervention occurs, an indeterminacy is introduced that serves to make less controlled and more unpredictable the act of orchestration.

Lastly, instrumental technique and musical interpretation are taxing physical and psychological endeavours that can be limiting factors in orchestration<sup>20</sup>. Even on a very fundamental level, the

---

<sup>20</sup> Earlier in the chapter, it was also mentioned that the technical skills of orchestral players could become a limiting factor in orchestration. These constraints, as they might be called, are discussed to greater length in *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.

performance of an orchestral work requires accurate intonation before any attempt can be made at realising musical detail and personal interpretations; this is why Piston (1961) states that proper intonation is a constant preoccupation with all instrumentalists, because it is a relative and not an absolute value<sup>21</sup>. Jacob (1956) introduces the audience again (as previously in the chapter) as another component of this constant equation, because the use of extreme registers (which are technically challenging to control) can be risky in the hands of an insufficiently capable player, and can cause physical discomfort both to the player and the audience<sup>22</sup>. For this reason, Sevsey (2013) states as an important aspect of orchestration that one acknowledges the limitations of the players – however skilled they are, they should not be forced to the point of exhaustion. The harpist, as an example, is especially sensitive in this regard; although harpists are accustomed to changing pedals often, it is only reasonable to avoid unnecessary pedal changes by applying intelligent notation and scoring (Kennan & Grantham, 2002). Jacob (1956) expresses the same sentiment when emphasising the human aspect of performance, and that players require sufficient breathing and resting spaces. Although not expressed directly, there appears to be a subtext of ethics involved in orchestration. The idea of ethical orchestration was expressed previously as well. What is expected of the instrumentalist in an orchestration develops into a complex relationship of responsibility between the performer and the orchestrator, and the orchestrator becomes as much responsible for the realisation of a written technique as the performer. How this is expressed in orchestration textbooks is that the orchestrator cannot write anything imaginable and expect the instrumentalist to make it possible, at least not without careful planning and deliberation (Jacob, 1956; Parrott, 1957; Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002).

---

<sup>21</sup> See Matei (2009).

<sup>22</sup> This is discussed to greater length in the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception*, p.141.

Figure 9: (Tempo primo ♩ = 72) Use of indeterminate figuration and gestural writing to aid performers in realising a passage with greater ease in Klatzow's *Incantations* (1984).

In Figure 9, Klatzow has composed a passage for flutes, oboes and clarinets that is difficult for a number of reasons. Chromatic fingerings, some leaps that are problematic, as well as registral crossings are challenging considering the short note values; mixed rhythms, either double-tongued or slurred, leading up to a synchronised climax point, will be difficult to achieve. Klatzow aids the players in a number of important ways: firstly, instead of writing out the exact performance effect of the rapid figuration in bars 197 and 198, Klatzow gives the first flute and oboe freedom to repeat the figuration in their own preferred manner and out of time with the orchestra so that the performers can adjust the tempo and repetitions to suit their own technical abilities; secondly, towards the final point of synchronisation, the Piccolo is brought in on the last quaver in a rising flourish in order to aid and drive the players towards the final note; thirdly, after the challenging moment, the woodwinds are allowed to rest for a full bar; and lastly, the clarinets and second oboe are given passages that will help to reinforce the main beats and aid the other woodwinds with synchronicity. By introducing these notational features, Klatzow has considered the stamina and technical limitations of the performers, and has aided them in realising a challenging passage with a greater chance of achieving efficacy<sup>23</sup>.

<sup>23</sup> This manner of writing, which takes into consideration the ensemble coordination between different instruments or sections as well as the technical requirements and limitations of each player, could be considered to constitute a kind of idiomatic orchestration. More about this in the sections titled *Perspective five: Instrumental constraints and orchestrational creativity*, p.165, and *Perspective six: Inherited practices*, p. 193.

Table 2 -- A number of time signature changes occurring in close succession in the first movement of Roosenschoon's *The Magic Marimba* (1991):

Location	Tempo	Tempo change (conducted)	Beats per bar	Time per bar (in seconds)	Length per bar: ♩ = 66 ( <i>tempo primo</i> )	Beats per bar: ♩ = 66 ( <i>tempo primo</i> )
mm.1 ( <i>tempo primo</i> )	♩ = 66	n/a	3 = $\frac{3}{4}$	2.76	100%	n/a
mm.61	♩ = 152	+ $\frac{4}{7}$	7	2.76	100%	7 ♩ : 6 ♩ (septuplet)
mm.62	♩ = 88	- $\frac{4}{9}$	4	2.72	100%	4 ♩ : 3 ♩ (quadruplet)
mm.65	♩ = 66	- $\frac{1}{4}$	3	2.72	100%	No change
mm.67	♩ = 132	+ $\frac{2}{1}$	4	1.82	66.67% (2:3)	Change to $\frac{3}{4}$
mm.68	♩ = 88	- $\frac{1}{3}$	4	2.72	100%	4 ♩ : 3 ♩ (quadruplet)
mm.72 (71) <sup>24</sup>	♩ = 132	+ $\frac{2}{3}$	4	1.82	66.67% (2:3)	Change to $\frac{3}{4}$
mm.75 (74)	♩ = 152	+ $\frac{5}{38}$	7	2.76	100%	4 ♩ : 3 ♩ (quadruplet)

In his orchestration of *The Magic Marimba*, Roosenschoon takes a novel and conceivably performance-unfriendly approach to rhythm and tempo control. In the performance notes to the score, Roosenschoon states that some tempo changes have been introduced in the place of measure-long quadruplets, quintuplets or septuplets, in order to avoid the perceivable rhythmic syncopations that these groupings often result in. In other words, the tempo and/or metre is changed so that the resultant groupings will have a legitimate rhythmic flow with structured impetus and meter. In the table above, some of these changes are indicated, showing as a reference in the last column the standard notational equivalent of what he has orchestrated. The third column, which shows the relational tempo changes required from the orchestra and conductor in these moments, is evidence of the vastly increased technical difficulty introduced by the replacement of tuplets with new time signatures and tempi. Changes which occur in simple mathematical proportions are less involved, so that a change of a third, a quarter or a half is

<sup>24</sup> Due to a printing error, measures 70-75 are displayed as 71-76. The format applied here: printed number(real number).

not necessarily difficult to perform accurately<sup>25</sup>; changes involving mathematically irrational or very complex relationships (such as four ninths or five thirty-eighths) are nearly impossible to achieve with accuracy, and place a strain on the synchronicity of the ensemble. In such instances, where the writing is not sensitive to the performers, it will likely require extra rehearsal time to gain technical mastery of those passages<sup>26</sup>. As in Mahler's first symphony, which is well known for its multiple tempo and character changes, these tempo changes invariably contribute to the generally perceived character of the work. Roosenschoon (2015, personal correspondence) views the presence of a conductor as one of the orchestra's major functional advantages, and in this section the conductor plays a vital role in determining the outcome of his orchestrational decisions.

#### 1.4 An orchestrational view of thinking for orchestra

"Scoring for orchestra is thinking for orchestra" (Adler, 2002:547). Adler summarises an idea commonly found in orchestration textbooks, namely that writing for orchestra as a compound instrument is as a mental function fundamentally different from writing for the collection of instruments that make up the orchestra. There are a number of reasons why the orchestra would warrant a unique way of thinking, the chief of which is a strong conception of the traditions that surround the development of the orchestra and the application of orchestral form since the eighteenth century<sup>27</sup>. Conceptualising the orchestra as a

---

<sup>25</sup> Tempo changes in simple mathematical proportions have been employed throughout the history of western music, and especially in music before 1600. This well-established practice is proof of its ease and viability in performance situations. See DeFord (1995) and Planchart (1990) for more.

<sup>26</sup> Writing with an awareness of the performers is an essential aspect not only of effective orchestration (*Perspective seven: The meaning of effective orchestration*, p.226), but also of orchestration in general (*Perspective five: Instrumental constraints and orchestrational creativity*, p.165). The development of orchestrational practices over hundreds of years contribute to a central body of techniques and procedures (such as the use of tuplets) that are more easily mastered in rehearsal than novel approaches. It is very likely that new approaches and procedures will, however, become absorbed into the central body of idiomatic scoring over following decades, as they are allowed to be assimilated by performers and conductors (*Perspective six: Inherited practices*, p.193).

<sup>27</sup> Instrumental traditions and the development of orchestrational traditions is discussed in a later chapter of the thesis: *Perspective six: Inherited practices*, p.193.

compound instrument by itself can act as a gateway towards considering more abstract musical ideas like colour and rhythm in a uniquely orchestral manner. Furthermore, when instruments are viewed as mechanisms or components of a greater musical structure, they are stripped to some degree of their own historical, stylistic and aural baggage and the composer can utilise them in new and uniquely orchestral ways. Following this chain of logic, one can reason that the stronger one's awareness is of the orchestra and its history, use and change, the greater one's ability will be to engage with these ideas in meaningful and effective ways. As Piston (1961) puts it, the sounds made by the orchestra are the final manifestation of the musical ideas which were formed in the mind of the composer. In order to be able to determine the exact outcome of that manifestation, it is not enough to have only a technical understanding of the procedures of orchestration<sup>28</sup>.

Adler (2002) goes on further to say that in order to make a very satisfactory version of any work for orchestra, one must respect and love the piece<sup>29</sup>. Both respect and love point to deeper seated ways of knowing the orchestra than can be afforded by textbook knowledge about instruments and how they function together. Perhaps this more abstract knowledge of the orchestra is what Piston (1961:356) refers to when he urges students to study orchestral works of master composers in order to discover not the perfections, but the imperfections in their work. Here, he believes, is where the student will engage with what he calls the "unaccountable stroke of genius". In these deviations, the student can come closer to understanding the composer's intentions, as Adler (2002), Jacob (1956) and Sevsay (2013) describe it. If one is to orchestrate with only the aim of being technically correct, it could be possible to exclude these ideas of love and respect, genius and intention from the music altogether, but then as Hofmeyr (2015, personal correspondence) wrote, the result "would likely be bland and uninteresting".

---

<sup>28</sup> There are different kinds of knowledge at work in the practice of orchestration, which are discussed in the chapter titled *Perspective eight: Knowledge and orchestration*, p.260.

<sup>29</sup> These notions of respect and love of a work are listed as requirements for effective orchestration in a later chapter titled *Perspective seven: The meaning of effective orchestration*, p.226.

Experience, which in these texts seems to act as a linking device between knowledge, creative thought and intention, is another criterion for good orchestration<sup>30</sup>. Intention, mentioned earlier, is according to Jacob (1956) a fundamental driving force of orchestration, and any action taken should always take place with definite intention and should not mechanically be added to the ensemble without consciously imagining its effect. Experience allows for better communication of creative intention because technical knowledge has already been transferred to the subconscious and the orchestrator can work with increased clarity. Following this, Piston (1961) states that to one experienced in orchestral writing, the material will suggest certain instruments, or one particular instrument that is most suited for its performance. In order to gain experience rooted in the subconscious, Parrott (1957) advocates self-study of instrument ranges and instrumental techniques rather than simply consulting a table; Piston (1961) describes this experience as an instinctive feeling for the orchestra as instrument. Lastly, as the student assimilates the principles of orchestration, a growing variety of possibilities and combinations will emerge during the orchestration process (Jacob, 1956)<sup>31</sup>.

---

<sup>30</sup> Experience is one of the major forms of implicit knowledge gained by regular practice of orchestration. For more on implicit knowledge and its contributions to orchestration, see the chapter titled *Perspective eight: Knowledge and orchestration*, p.260. Here, reference is also made to a central aspect of orchestration, namely the ideals of effective orchestration (discussed further in the chapter titled *Perspective seven: The meaning of effective orchestration*, p.226).

<sup>31</sup> No better example exists to prove this point than to look at the numerous orchestral transcriptions of Mussorgsky's *Pictures at an Exhibition*, of which over 25 exist to date. Each of these versions takes a unique approach to the same pitch, rhythm and harmonic material to produce interesting and meaningful orchestral sound combinations. Although likely not an exhaustive list, versions for various symphonic forces have been produced by Mikhail Tushmalov (1886), Henry Wood (1915), Leo Funtek (1922), Maurice Ravel (1922), Giuseppe Becce (1922), Leonidas Leonardi (1924), Lucien Cailliet (1937), Leopold Stokowski (1939), Walter Goehr (1942), Sergei Gorchakov (1954), Nikolai Golovanov (an arrangement of the Ravel version), Lawrence Leonard (1977), Vladimir Ashkenazy (1982), Thomas Wilbrandt (1992), Emile Naoumoff (1994), Mekong Delta (1997), Carl Simpson (1997), Chao Ching-Wen (2002), Jason Wright Wingate (2003), Václav Smetáček (ca.2003), Clarice Assad (2008), Jukka-Pekka Saraste (an amalgamation of versions by Funtek and Gorchakov with some amendments), Aurélian Bello (2011), One picture each by Alastair King, Roger May, Tolib Shakhidi, David Betterworth, Philip Mackenzie, Simon Whiteside, Daryl Griffiths, Natalia Villanueva, James McWilliam, Julian Kershaw (2012), Peter Breiner (2012). There are also at least fifty arrangements for other chamber instrumental ensembles, including big band and various combinations of string and woodwind instruments.

The following example from Van Wyk's *Primavera* (1960) shows the complex layering of musical textures and instrumental colours that is only possible in a compound instrument such as the orchestra. Thinking for orchestra in this example appears to imply thinking: firstly in terms of writing for each instrument in an idiomatic manner, secondly in terms of constructing different musical layers in the same and in different octaves, and thirdly in terms of differentiating those layers through intelligent division of material amongst instrument families, as is seen in the figure below:





In the following excerpt from Roosenschoon's *The Magic Marimba* (1991), thinking for orchestra translates to a complexity of rhythm and tone combinations that could not be achieved on any single instrument, but which can only be realised by a large group of instruments performed on by numerous instrumentalists and conducted by a central figure<sup>32</sup>. In the figure below, rhythms are combined in the complex mathematical proportion of 8:9:10:12:18:24:30:36 notes per every 2 measures. Against this, a sustained chord spread over 7 octaves is structured throughout the orchestra so that the rhythmic figurations are absorbed into a greater textural unit, creating a single complex timbre:

The image displays a musical score excerpt for the first movement of *The Magic Marimba* (1991) by Roosenschoon. The score is written for a large orchestra and includes the following parts:

- Cl. (Clarinets):** Two staves, both marked *ff*. The upper staff features sixteenth-note patterns with sixteenth-note rests, grouped in sixes (6). The lower staff features eighth-note patterns with eighth-note rests, grouped in fives (5).
- Ob. (Oboes):** Two staves, both marked *ff*. The upper staff features eighth-note patterns with eighth-note rests, grouped in sixes (6). The lower staff features eighth-note patterns with eighth-note rests, grouped in threes (3).
- Hrn (Horns):** Four staves, all marked *ff*. The upper two staves feature eighth-note patterns with eighth-note rests. The lower two staves feature eighth-note patterns with eighth-note rests, grouped in fives (5) and threes (3).
- Strings, organ, woodwinds, brass:** A large section at the bottom of the score, marked *ff*. It consists of multiple staves for each instrument family, all playing a sustained chord spread over 7 octaves.

The score is in 2/4 time and begins at measure 8. The key signature has two flats (B-flat and E-flat). The tempo is marked with a quarter note equal to 66 (♩ = 66).

Figure 11: Complex layering of rhythmic and pitch material to form a single timbral unit in the first movement (♩ = 66) of Roosenschoon's *The Magic Marimba* (1991).

<sup>32</sup> It was noted earlier in the chapter that Roosenschoon (2015, personal correspondence) views the conductor as a crucial asset when composing material for orchestra.

## 1.5 Indeterminate nature of the orchestra and orchestration

Studying text fragments from Piston (1961), Jacob (1956), Kennan & Grantham (2002) and Adler (2002), revealed a common line of thought in that as much as the orchestra is defined and delineated as an institution of known and understood musical traditions and compositions, it is at the same time equally unknown and unknowable. Kennan & Grantham (2002) poses this indeterminism in ontological terms, stating that the designation of “orchestra” or “symphony orchestra” is lacking in precision, because many different combinations of instruments have constituted orchestras in the past<sup>33</sup>. Even in contemporary practice, there is no fully standardised orchestra, to such an extent that it is feasible to imagine an orchestra partially or completely missing one of its sections<sup>34</sup>. Piston expands on the idea to touch on the many indeterminacies that exist within orchestral writing that have limited the development of a more scientific approach to orchestration; western musical notation as an example, although having developed tremendously in the past century towards accurately describing the various characteristics of the desired sound product, is still a relative and not an exact system. It was mentioned previously that Piston uses “imperfection” and “vagueness” to delineate the qualities of western notation, noting that it is impossible to describe accurately the required rhythmic and dynamic values of a pitch, or exactly the required tone colour, warmth and intensity required from a performer. Many composers of the twentieth century devised systems to improve the accuracy of notated musical ideas and cancel out ambiguities; however, one could argue to the contrary, as Jacob (1956) and Adler (2002) do, that these indeterminacies contribute to a multiplicity of possibilities in every aspect of orchestration and in every performance of an orchestral work.

---

<sup>33</sup> Klatzow (2015, personal correspondence) views the orchestra simply as a collection of strings, woodwinds, brass and percussion, and states that without any of those groups, the designation of orchestra does not apply anymore. Hofmeyr (2015, personal correspondence) views any collection of large groups of strings, woodwinds and brass as an orchestra, so that the percussion family fulfils an auxiliary function (see *Perspective 2*).

<sup>34</sup> Although such a statement is not in agreement with Klatzow’s comment from the previous footnote, there are orchestral works that omit one or more of the orchestral sections to achieve a specific effect. Traditionally, any large group of instruments with strings is considered an orchestra, whereas any large group of instruments without strings is considered a band (Carse, 1964; Del Mar, 1987). More about this can be found in the following three chapters: *Perspective five: Instrumental constraints and orchestrational creativity*, p.165; *Perspective six: Inherited practices*, p.193; *Perspective seven: The meaning of effective orchestration* p.226.

These indeterminisms and multiplicities are the driving forces that allow for a work like Mussorgsky's *Pictures at an Exhibition* to be transcribed many times over and still yield interesting and meaningful results (see Footnote 31, p.41).

Working from Del Mar (1983), Carse (1964), Blatter (1997), Kennan & Grantham (2002) and Adler (2002), it is possible to arrive at an accurate approximation of various orchestral sizes and compositions throughout history as they are documented by these authors. The following table displays the historic growth of the orchestra from modest forces in the Baroque to gargantuan proportions in the late Romantic, while the contemporary orchestra displays a predilection for variability with moderate to large forces. Once greater distance is attained from the twentieth century, it will likely be more possible to discern standard and experimental practices to a greater degree, so that the standard twentieth century orchestra can be displayed with increased accuracy. In every time period, some composers display a penchant for experimenting with orchestral forces, so that the average or standard orchestra of a time period does not reflect the practices of all composers (A good example is *Symphonie Fantastique* by Hector Berlioz, which in 1830 was composed for an uncommonly large orchestra of over 90 players).

Table 3 -- Average orchestral forces of various time periods, following the designations of Blatter (1997), Kennan & Grantham (2002) and Adler (2002). The average orchestral forces used in eight South African works is included for reference and comparison:

Baroque orchestra	Classical orchestra	Early Romantic Orchestra	Late Romantic Orchestra	Modern Orchestra	Eight South African Orchestra works
2 Flutes	2 Flutes	2 Flutes Piccolo	1-2 Piccolo(s) 3-4 Flutes	2-4 Flutes *Piccolo <sup>35</sup> *Alto Flute	2 Flutes Piccolo
2 Oboes	2 Oboes	2 Oboes English Horn	3-4 Oboes English Horn	2-4 Oboes *English Horn	2 Oboes English Horn
	2 Clarinets	2 Clarinets Bass Clarinet	3-4 Clarinets Piccolo Clarinet Bass Clarinet	2-4 Clarinets [*Picc. Clarinet] <sup>36</sup> *Bass Clarinet	2 Clarinets [Picc. Clarinet] Bass clarinet
2 Bassoons	2 Bassoons	2 Bassoons Contrabassoon	3-4 Bassoons Contrabassoon	2-4 Bassoons *Contrabassoon 1+ Saxophones	2 Bassoons Contrabassoons [1 Saxophone]
2 Horns	2 Horns	4 Horns	4-10 Horns	4-8 Horns	4 Horns
2 Trumpets	2 Trumpets	2 Trumpets	3-8 Trumpets	3-6 Trumpets	3 Trumpets
		3 Trombones	3-5 Trombones Bass Trombone	2-4 Trombones 1-2 Bass Trombones	2 Trombones 1 Bass Trombone
		Tuba	1-2 Tubas [0-4 Wagner Tubas] <sup>37</sup>	1-2 Tubas [Euphonium]	1 Tuba
Timpani	Timpani	Timpani + 1 Percussionist	Timpani +2-3 Percussionists	Timpani +2-4 Percussionists	Timpani +2-4 Percussionists
Harpsichord			Piano Celesta	Piano Celesta [Pipe Organ]	Piano [Celesta] [Pipe Organ]
		1 Harp	2 Harps	1-2 Harps	1 Harp
6 Violins I	12 Violins I	14 Violins I	16 Violins I	16 Violins I	12-16 Violins I
5 Violins II	10 Violins II	12 Violins II	14 Violins II	14 Violins II	10-14 Violins II
4 Violas	8 Violas	10 Violas	12 Violas	12 Violas	8-12 Violas
4 Violoncellos	8 Violoncellos	8 Violoncellos	10 Violoncellos	10 Violoncellos	6-10 Violoncellos
3 Double Basses	6 Double Basses	6 Double Basses	8 Double Basses	8 Double Basses	6-8 Double Basses

The following table shows more specifically the orchestral numbers and composition of each of the eight South African works studied in this project. In some regards, the South African orchestral works are more in line with forces of the early romantic, but in others they display fully modern proportions. These differences are likely due to an increased awareness of economic constraints and the financial implications of employing a large orchestra. This point also arose in personal correspondence with Klatzow (2015), Hofmeyr (2015) and Zaidel-Rudolph (2015).

<sup>35</sup> An asterisk denotes an instrument that is doubled by another player of the section.

<sup>36</sup> The piccolo clarinet is less often used in contemporary orchestration than in Late Romantic works.

<sup>37</sup> Square brackets refer to the optional use of an instrument.

Table 4 -- A visual representation of the different number of instruments that is used in each of the orchestral sections in eight South African works:

Van Wyk <i>Primavera</i> (1960)	Fagan <i>Karoosimfonie</i> (1976)	Klatzow <i>Incantations</i> (1984)	Zaidel- Rudolph <i>Tempus Fugit</i> (1986)	Roosenschoon <i>Magic Marimba</i> (1991)	Temmingh <i>tjellokonsert</i> <sup>38</sup> (1992)	Grové <i>Raka</i> (1996)	Hofmeyr <i>Sinfonia Africana</i> (2003)
2 Flutes 1 Piccolo	2 Flutes 1 Piccolo	3 Flutes: (1 Piccolo) <sup>39</sup>	3 Flutes: (1 Piccolo) <sup>40</sup> (1 Alto flute)	2 Flutes 1 Piccolo	2 Flutes	2 Flutes 1 Piccolo	2 Flutes: (1 Piccolo) <sup>39</sup>
2 Oboes 1 English Horn	2 Oboes 1 English Horn	2 Oboes 1 English Horn	3 Oboes: (1 Eng. horn) <sup>39</sup>	2 Oboes 1 English Horn	2 Oboes	2 Oboes 1 English Horn	2 Oboes: (1 Eng. Horn) <sup>39</sup>
2 Clarinets 1 Bass clarinet	2 Clarinets 1 Bass clarinet	3 Clarinets	2 Clarinets 1 Bass clarinet	Picc. clarinet 2 Clarinets 1 Bass clarinet 1 A. saxophone	2 Clarinets	2 Clarinets 1 Bass clarinet	2 Clarinets: (1 Bass clar.) <sup>39</sup>
2 Bassoons 1 Contra bsn	2 Bassoons 1 Contra bsn	2 Bassoons 1 Contra bsn	3 Bassoons	2 Bassoons 1 Contra bsn	2 Bassoons: (1 C. bsn) <sup>39</sup>	2 Bassoons 1 Contra bsn	2 Bassoons: (1 C. bsn) <sup>39</sup>
4 Horns	4 Horns	4 Horns	4 Horns	4 Horns	4 Horns	4 Horns	2 Horns
3 Trumpets	3 Trumpets	3 Trumpets	3 Trumpets	3 Trumpets	3 Trumpets	3 Trumpets	1 Trumpet
3 Trombones	3 Trombones	3 Trombones	3 Trombones	2 Trombones 1 Bass tbn	3 Trombones	2 Trombones 1 Bass tbn <sup>41</sup>	1 Trombone
1 Tuba	1 Tuba	1 Tuba	1 Tuba	1 Tuba	1 Tuba	1 Tuba	1 Tuba
Timpani +1 pitched <sup>42</sup> +7 unpitched	Timpani +3 pitched +7 unpitched	Timpani +3 pitched +9 unpitched	Timpani +6 pitched +14 unpitched	Timpani +6 pitched +13 unpitched	Timpani +2 pitched +4 unpitched	Timpani +2 pitched +6 unpitched	Timpani +5 pitched +11 unpitched
	(celesta) <sup>43</sup>		(celesta) <sup>44</sup>				
1 Piano 1 Harp	1 Piano 1 Harp	1 Piano 1 Harp		1 Piano: 4 hands Pipe organ		1 Harp	1 Piano 1 Harp
							Choir: SSATTB
					Solo cello	Solo Piano	Solo voice
Violins I <sup>45</sup>	Violins I	Violins I	Violins I	16 Violins I	Violins I	Violins I	12 Violins I
Violins II	Violins II	Violins II	Violins II	14 Violins II	Violins II	Violins II	10 Violins II
Violas	Violas	Violas	Violas	12 Violas	Violas	Violas	8 Violas
Violoncellos	Violoncellos	Violoncellos	Violoncellos	10 Violoncellos	Violoncellos	Violoncellos	6 Vln.cellos
Double Basses	Double Basses	Double Basses	Double Basses	8 Dbl. basses	Dbl. Basses	Double Basses	6 Dbl. basses

<sup>38</sup> With respect for the composer's tendency to print the titles of his compositions in the minuscular, *tjellokonsert* appears lowercased throughout the thesis.

<sup>39</sup> The second or third player doubles on the instrument in brackets.

<sup>40</sup> 3<sup>rd</sup> Flute doubles on piccolo, while 1<sup>st</sup> flute doubles on alto flute.

<sup>41</sup> Grové takes for granted the E-attachment required by his bass trombonist, which should be indicated by the orchestrator.

<sup>42</sup> Percussion instruments have been divided between those of definite pitch, and those of indefinite pitch.

<sup>43</sup> Although some composers include the celesta with the percussion section, although it is a keyboard instrument that will normally be played by a keyboardist. In such cases, celesta has been counted under the percussionists, but also placed in brackets under a separate designation.

<sup>44</sup> See footnote 43.

<sup>45</sup> The number of each string group is only displayed in cases where composers have stipulated a preferred number.

The tables above show that six different sections can be identified in the symphony orchestra: woodwinds, brass, percussion, strings, solo instruments, and specialised instruments. Orchestration textbooks focus mostly on the first four sections, while the last two are described to a lesser extent and with a focus on the ways in which they impact the use of the first four. Generally speaking, the orchestras of these eight works are relatively standardised: in each of the four main groups, at least one of each of the core instruments is used, while a number of auxiliary instruments is used or omitted. The proportions of the eight orchestras display only minor variation, but in Temmingh (1992), Grové (1996) and Hofmeyr (2003) the general proportions are reduced to compensate for the presence of solo instruments. Furthermore, the scores show that whereas composers are very specific about the number of players assigned to each of the woodwind, brass or percussion parts (also in the use of specialised instruments), the number of string players required in each section is only indicated in some instances. The most interesting deviation from the standard setup occurs in Hofmeyr (2003), because he makes use of relatively small orchestral forces (and an additional choir) in his symphony in comparison to the standards set by Van Wyk (1960), Fagan (1976), Klatzow (1984), Zaidel-Rudolph (1986) and Roosenchoon (1991).

Related to this indeterminacy of the orchestra's construction and its notation practices is an aspect of performance over which a composer cannot exert control: the acoustic properties of the instruments of the orchestra, as well as the environment in which a work is performed, has a perceivable impact on the sound outcome of a work<sup>46</sup>. Piston (1961) is the earliest orchestration author to describe the subject of acoustics and orchestration, noting the wide differences in acoustic properties of various auditoriums and the fact that one work can sound very different in different performance spaces. Mechanical differences in instrument construction within the same family, coupled with varying subtle techniques of sound

---

<sup>46</sup> Acoustics and its impact on sound is discussed from different angles in the following chapters: *Perspective four: An orchestrator's view on hearing and sound perception*, p.141, and *Perspective seven: The meaning of effective orchestration* p.226.

production by different players lead to a decreased measure of control of exact tone colour<sup>47</sup>. When combining instruments, as Piston (1961) describes it, the problem becomes exponentially more complex, because of the addition of more variables in the process. An orchestrator is compelled to find and explore different ways with which to circumvent these indeterminacies in order to achieve a desired sound idea.

However, orchestration has a rich tradition of admiring indeterminacies in tone production, the strings chief among them, for bringing vibrancy to the orchestral sound. This vibrancy is a choir effect<sup>48</sup> caused by minute differences in tone quality between different instruments of the section, or the interplay of their constantly shifting overtones. These small differences help to average out incorrect intonation and timbral anomalies. The presence of audible overtone reinforcement is especially difficult to predict, because it is largely dependent on a combination of production, projection, acoustics and sympathetic resonance. As Piston (1961) writes, however, soft chords in the woodwinds are often unpredictably enhanced by the sounds of overtones in open spacing; this unpredictability is praised by orchestrators for bringing an attractive element of the unexpected to a performance. The science behind overtones has only made a small and insubstantial impact on orchestration texts of the previous century, although it is a fundamental part of writing for any group of instruments in a physical space. Casella & Mortari (2004) is the only textbook on orchestration to dedicate an entire section of the book to sound propagation and perception.

In closing of this chapter, Piston's defence of orchestration's ability to represent both the systematic and the mystical is an important contribution to understanding its practice. As he states it, there are some questions in orchestration that can never be answered, and this is a core principle of orchestration.

---

<sup>47</sup> Mechanical development and differences between instruments have been some of the greatest contributing factors to the development of the orchestral sections as we know it today. This is discussed to greater length in the next chapter, titled *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

<sup>48</sup> When a group of strings play together, minute variations in the pitch and overtone construction of each player's tone contributes to a collective sound that is undergoing constant minute change. These constant fluxes help to mitigate the aural fatigue brought about by constant exposure to a sound, and some would argue that the sound becomes more organic and less mechanic in quality. See the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception*, p.141.



## 1.6 Concluding remarks

In this chapter, it was shown how orchestrators call on a number of mechanisms to imbue the process of orchestration with a sense of mysticism. These mechanisms derive from the point of view that some aspects of orchestration cannot be fully known, or that even if the orchestrator endeavoured to know these aspects it would not be possible, or lastly even that these aspects should not necessarily be known because their unknown quantities contribute positively to orchestration. These unique contributions were shown to be admired by orchestration authors for enriching the depth of meaning, sound possibilities and nuances of an orchestration. Unknowable aspects of orchestration include the contributions of performers and conductors through the act of interpretation, as well as unknown quantity of the listener's perception and understanding of the music. Even the acoustic effects of the instruments themselves or the performance environment become of concern to the orchestrator, who must account for various unknown possibilities in an orchestration.

A successful orchestration would exploit these unknowable qualities together with other systematised orchestrational mechanisms in order to balance both paradigms in an effective manner. These mechanisms include the use of descriptors and references from outside of the realm of sound in order to draw on other collective sensory perceptions (e.g. light or dark, or ominous) in a manner that could help different parties to understand a sound in the same way. It was also shown that orchestrators are concerned with the imprecise nature of music notation, and that these extra-sonic descriptors help to reduce ambiguities in notational outcomes as well. In order to exploit these mechanism, however, the orchestrator would need to find unique ways by which to conceptualise not only the material written for the orchestra, but also the orchestra itself. This would require developing a sense of the orchestra as a single, compound instrument, and studying a large number of orchestral scores in order to develop a sense of standard orchestration practices. Then, the orchestrator would be able to engage with implicit forms of knowledge that are often described in terms such as intention, genius, inspiration, or understanding, together with explicit forms of knowledge gained from textbooks.

As the reader progresses through this thesis, it will become evident that concepts discussed in this Perspective are strongly interrelated to the focus of all other Perspectives (sometimes cross-references were used in this chapter to refer the reader to the correct location). It is useful to relate some of these conceptual correlations by way of a graphic representation in the form of a concept web, which follows below. Inter-correlation between Categories or Perspectives is one of the key defining features of a grounded theory; it is therefore important to display the conceptual relationships and correlations that are shared between different chapters in this thesis.

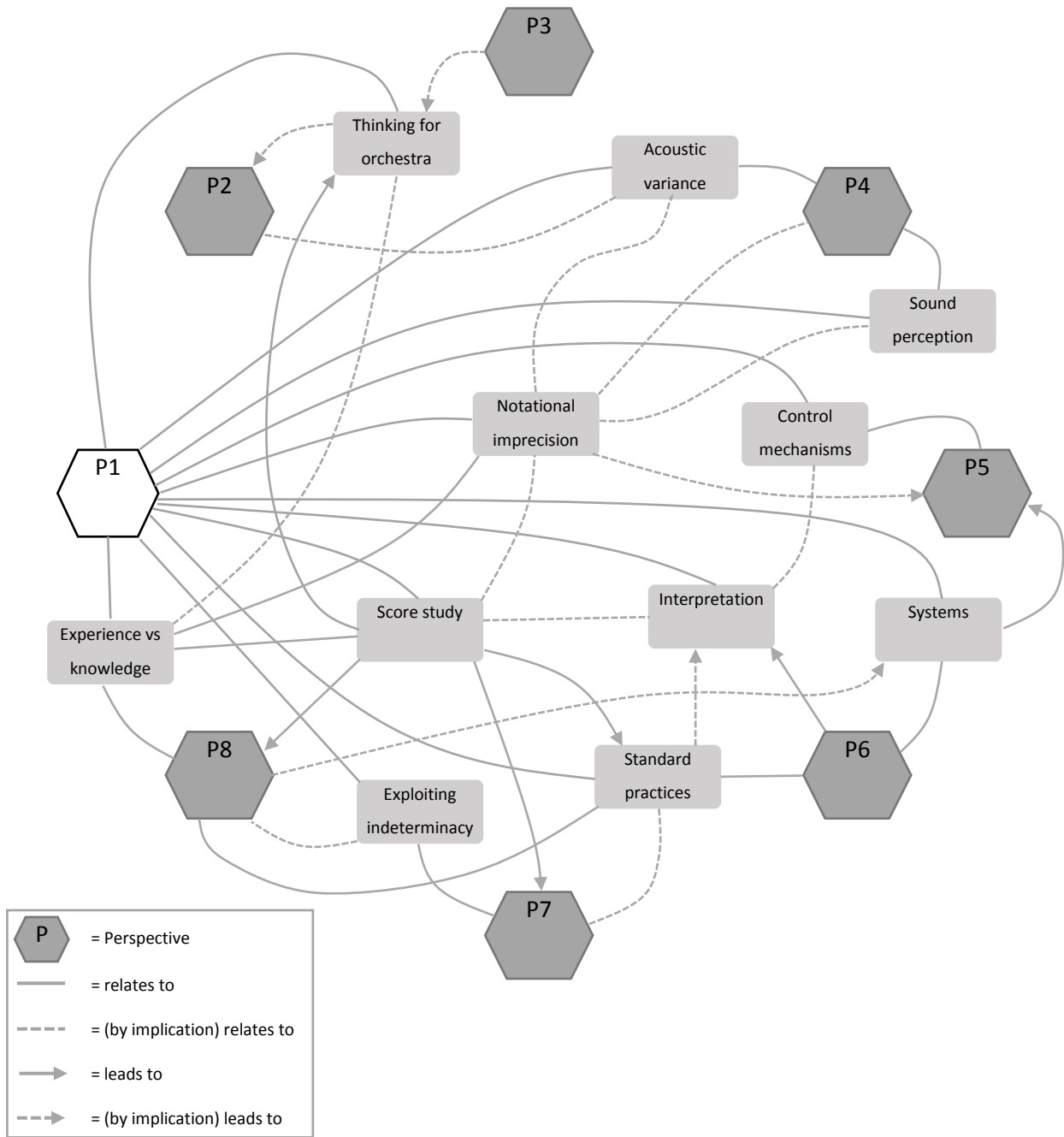


Diagram 1: Concept web showing interrelatedness of concepts in Perspective 1 with other Perspectives.

## Perspective two: An instrumental-hierarchical view of the orchestra

### 2.1 Introduction

The orchestra, which was previously described as a collection of instruments as well as a single, compound instrument, can be perceived as a complex structure of internal functional hierarchies. Orchestration texts studied in this project, together with other sources, have provided a body of evidence pointing to a number of such hierarchies being present between and within the instrument families of the symphonic orchestra; these hierarchies exist because of differences in sound quality of these instruments, as well as their technical abilities and their ability to be utilised in combination with other instruments. The relative position of the instruments within the trajectory of their technical development is another factor to consider. The strings serve as the gauge for these comparisons in nearly all texts, including Berlioz & Strauss (1991), Rimsky-Korsakov (1964), Piston (1961), Jacob (1956), Parrott (1957), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004) and Sevsay (2013). It is interesting that in personal correspondence with Feder (2015), Roosenschoon (2015), Zaidel-Rudolph (2015) and Hofmeyr (2015), these composers were mostly in support of the idea that in a general as well as in a historic context the orchestra displays characteristics of a hierarchical division, but that they in their own music posited that these hierarchies are to the most part absent. Klatzow (2015, personal correspondence) categorically negated the existence of orchestral hierarchies both in general and in his own music. When writing about their use of the woodwinds section as part of the orchestra, however, the same composers were able to articulate the unique qualities that would necessitate a different approach to utilising woodwinds when compared to other instrument groups.

Historical and traditional use of the orchestra<sup>49</sup> are two major driving forces in the development of a contemporary perception and application of orchestration technique, and are intimately connected to the myriad of factors that influence instrumental traditions and techniques. This thesis is not an in-depth exploration of the history of orchestration, nor can it attempt to be a historical theory of orchestration –

---

<sup>49</sup> Orchestral traditions are expounded in another section of the thesis. See *Perspective six: Inherited practices*, p.193.

other such studies have already been undertaken by a number of authors<sup>50</sup> and would contradict the outcomes of a grounded theory study. Rather, this thesis draws on a large number of clues evidenced in orchestration textbooks, orchestral works and correspondence with orchestrators and probes them *vis-à-vis* the main categories (Perspectives) of this research project, drawing on the findings of historically focussed texts to provide context where needed.

## 2.2 Instrument families of the orchestra

The orchestra is, on a macroscopic level, divided into the four main departments that are well-known today as the strings<sup>51</sup>, woodwinds, brass and percussion (Jacob, 1956; Carse, 1964; Del Mar, 1983), according to the broad and general means by which they produce sound. In orchestration textbooks, these instrument groups are discussed in their own chapters according to certain generic orchestration techniques, such as balance and register, scoring (voicing) of chords and designing of textures; each of the groups can be said to function, theoretically at least, on the same level as each of the other. Additional instruments that also form part of the orchestra (such as the harp and piano) are governed by other procedures and traditions, although their means of sound production will generally place them within one of the existing four groups. These instruments are not discussed in the same detail as the four main groups, although they often have a rich and highly developed orchestral tradition of their own<sup>52</sup>. The seemingly

---

<sup>50</sup> Adam Carse, in *A History of Orchestration* (1964), gives the most comprehensive overview of the historical factors and traditions that have influenced the development of symphonic orchestration over the last 400 years.

<sup>51</sup> In this thesis, “strings” specifically refers to the bowed stringed instruments (violins, violas, cellos and double basses) of the symphonic orchestra, but in a broad sense may refer to other stringed instruments as well (like the harp or piano). French scores follow the English custom of naming the strings “les cordes”. In contrast, German scores refer to “Streichinstrumente”, i.e. bowed instruments. In contrast, “Saiteninstrumente” is a broader German term that includes stringed instruments that are bowed, hammered or plucked. See Del Mar (1983) for a more expansive discussion of naming customs in orchestral scores.

<sup>52</sup> The harp, for example, was used in the orchestra as early as Gluck’s *Orfeo ed Euridice* of 1762 and is discussed at length in Berlioz’s treatise on instrumentation and orchestration written in 1843 (see Berlioz & Strauss, 1991). Much of the harp’s technical development took place in order for it to maintain a position within the growing orchestra of

equal nature of this hierarchy is expressed musically by the fact that, technically speaking, each of the four sections can play either on its own or in combination with any of the others to carry the musical content of a composition.

In some cases, the cleanly separated orchestral sections do intermingle. The French horn is a unique case in the orchestra when viewed in terms of these instrumental subdivisions, because it has developed in such a way that it may side with either the brass or the woodwinds, placing it at a junction between mechanical and procedural traditions<sup>53</sup>. This is a tradition which was already described as early as 1843 by Berlioz in his famous treatise. In the past, but not so readily in the twentieth century anymore, the timpani and brass have customarily been coupled together in orchestral scores, so that the timpani could be seen as bridging a divide between brass and percussion. The piano, a relatively new addition to the orchestra (although some early examples of the use of piano in the orchestra exist), often seems to fill the similar role of bringing the woodwinds and strings closer to the percussion family. In the scores of Stravinsky and Prokofiev, for example, the piano gives percussive support to the lower woodwinds and strings, or resonance to the upper partials these groups. Other less literal connections exist as well, so that the different members of the four main instrument groups are conceptually interconnected in much the same way: Jacob (1956) likens the use of the contrabassoon of the woodwinds to the double basses of the strings or the tuba of the brass. In the same way, the English horn is described as fulfilling the same function as the violas in some works (Adler, 2002), while the horns are sometimes seen as the cellos of the brass, and the bassoons are sometimes seen the horns of the woodwinds (Kennan & Grantham, 2002).

## 2.3 The foundational role of strings in the orchestra

Within the orchestral hierarchies, the strings appear to take a dominant functional role. Through the entire range of instructional texts about instrumentation and orchestration, the string section is described

---

the nineteenth and twentieth centuries (Del Mar, 1983), but it remains an antiquated machine in comparison to other orchestral instruments (Carse, 1964).

<sup>53</sup> See the chapter further on titled *Perspective six: Inherited practices and orchestration traditions*, p.193.

with terms such as ‘backbone’ (Parrott, 1957; Kennan & Grantham, 2002), ‘foundation’ (Berlioz & Strauss, 1991; Jacob, 1956; Parrott, 1957), ‘most important’ (Adler, 2002; Rimsky-Korsakov, 1922; Kennan & Grantham, 2002), ‘dominant element’ (Piston, 1961), ‘mainstay’ (Parrott, 1957), ‘superiority’ (Adler, 2002; Piston, 1961) and ‘most appealing’ (Praetorius, 1619; Jacob, 1956). Del Mar (1983) describes string dominance in both physical and ontological terms: in common practice, strings occupy a visually dominant position at the front of the orchestra in sound and number, and (according to Del Mar) the designation of a group of instruments as an orchestra is often only applied because of the presence of the strings<sup>54</sup>. Some authors attempt to provide musical reasons for the collective attitude that orchestration focusses mostly on the strings; these centre on sound production, dexterity, stamina, homogeneity of sound, registral compass and versatility of technique. Kennan & Grantham (2002), apart from providing a substantial explanation for the centrality of the strings in orchestration, cites traditional usage as a main cause: in the early orchestra, strings carried the most of the material. Elsewhere in the thesis it is shown that score study is the most significant way by which orchestral practice and knowledge are carried from one generation of orchestrators to the next, so that the centrality of strings could be carried over in this manner<sup>55</sup>. Carse (1964) gives another reason, namely that the bowed family of stringed instruments were some of the first to be called upon to produce special, non-vocal, uniquely instrumental techniques, placing them in a unique position to lead the orchestra in this capacity<sup>56</sup>.

In terms of orchestrational use, the strings have a number of advantages over the rest of the orchestra that could contribute to their perceived centrality in orchestration practice. Firstly, because the strings consist of a large group of players, a chorus effect governs and somewhat neutralises differences in

---

<sup>54</sup> Historically, according to Del Mar (1983), any large group of instruments void of a standard complement of strings (violins, violas, cellos and double basses) is called a band. In Verdi’s *Rigoletto*, the use of a large wind ensemble is referred to by the composer as *Banda Interna*.

<sup>55</sup> See *Perspective six: Inherited practices*, p.193 and *Perspective eight: Knowledge and orchestration*, p.260.

<sup>56</sup> Carse (1964), Forsyth (1914) and Weiss & Taruskin (1984) note that the tremolo (a technique idiomatic to bowed string instruments) was invented by Claudio Monteverdi in the 16<sup>th</sup> century for use in *Il combattimento di Tancredi e Clorinda*. According to Carse, players refused to perform the alien technique during the first rehearsals, because it did not mimic vocal lines and phrasing.

their general intonation, timbre and balance, allowing the orchestrator to rely on these principles to make feasible more daring and challenging effects for this group (this was mentioned in the previous chapter as well). Secondly, the complex composition of fundamentals and overtones in the sounds produced by the strings group can be adapted to blend and balance more easily with other instrument groups, either by utilising a different string or a different part of the bow, or by utilising varying amounts of bow hair or pressure, or by bowing with varying speeds or on different sections of each string. These variations contribute to enormous possibilities for expressive nuance and colour differences. Lastly, the diffuse quality of the strings' sounds within an enclosed concert space, as opposed to the direct projection of trumpet or trombone sound, places them in a good position to shift more easily between foreground and background within an orchestral texture, thereby increasing their versatility. Together, these factors contribute to what Kennan & Grantham (2002) describe as a less involved or more forgiving technique when scoring for strings, in comparison to other instrument groups.

The centrality of the string section in symphonic orchestration, which has been shown to be a generally accepted notion, is clearer to discover if viewed from the opposing side, namely by discovering the position of the woodwinds, brass and percussion in relation to the strings. These positions will be explored to some extent in the following sections of this chapter. It is, however, more difficult to describe these exact qualities of centrality, dominance or foundationality only by looking at short musical extracts, because especially in contemporary orchestral works it is most often only by the use of strings throughout an entire composition that their significant contributions become clearly detectable and understandable. Nonetheless, there are some specific aspects of the use of strings that can be looked at to understand some of these applications; examples from the eight South African orchestral works studied in this project show these contributions as well.



Figure 12: A demonstration of finely nuanced dynamic shifts required of the strings in the first movement (Tempo I ♩ = c.60) of Van Wyk's *Primavera* (1960).

In the example above, and throughout most of *Primavera*, Van Wyk prefers to work with strings divided into ten parts rather than five. The homogeneous quality of string timbre, combined with their ability to divide into a multitude of voices, places them at an advantage within the orchestra. In this example, Van Wyk has divided the strings into two main functions of foreground and background: violas and violins I carry melodic material, while double basses, cellos and violins II provide quaver-rhythm accompaniment. Both textures are subdivided: melodic material is divided into two homorhythmic voices, expanding to three voices in some instances; the accompaniment is divided into a pedal tone crotchet-pattern in the double basses, with a syncopated quaver pattern overlaid in the other voices. Note in this example the heterophony in measure 56: while the violins I sustain the melody at *pianisissimo*, the subdivided violas repeat the note in crotchets to provide impetus to the musical energy. In this example, Van Wyk exploits the homogenous sound quality of the strings as a whole in order to be able to spread melodic fragments over different instrument choirs, so that the entering of violins I at key moments can provide dynamic support and subtle accentuation to the material already present in the violas, while the violins II can provide greater sonority to the cellos in moments of higher volume. Van Wyk's use of pizzicato in the upper half of the double basses adds further timbral nuance and a greater sense of rhythmic clarity to the string

section. The overall homogeneity of sound achieved in this section would be impossible in the other orchestral sections.

Figure 13: An extended passage for full strings displaying the stamina of their sustained sound in the first movement (*un pochissimo piu mosso* ♩ = 56) of Fagan's *Karoosimfonie* (1976).

The ability of the string section in its entirety to play unbroken passages for prolonged periods of time is unparalleled in other sections of the orchestra. In the example above, the full string section performs a 27-measure long sustained passage, a feature of symphonic orchestration which is extremely common in string writing and the likes of which is almost only found in the string section. Composers are able to write for the strings in this manner for two reasons: firstly, because string players are not dependent on breath but on a bow to produce sound on their instruments so that they are able to play extended passages with greater ease than either woodwinds or brass, whilst secondly, the sounds

produced by the strings are less salient<sup>57</sup> in a choir than those produced by other sections of the orchestra (such as percussion) and therefore retain a greater measure of freshness, as Jacob (1956) refers to it. In the example above, the double basses add the greatest amount of weight to the sound, which could fatigue the listener after some time; in a possible bid to counteract this effect at some moments during this section, Fagan has chosen to give the double basses plucked rather than bowed notes, or short rests, or he has changed the vertical sonority of the sound by changing the interval between the basses and cellos to a perfect fifth rather than an octave. By contrast, it seems difficult to imagine that Fagan could have been able to write such an extended passage for the entire woodwind or brass section (certainly not the percussion section) while retaining the clarity necessary to allow other instrument groups to contribute effectively to the texture.

Figure 14: (Meno mosso  $\downarrow = 54$ ) An example of the unparalleled sustaining ability of the string choir, as well as the use of solo orchestral violin in Klatzow's *Incantations* (1984).

Expanding on the previous example (Figure 13), Klatzow exploits the ability of the strings to produce a pitch of extended length at a very soft dynamic level. In the figure above, which takes place at a metronome mark of  $\downarrow = c.54$ , Klatzow expects a static chord of considerable vertical span to be balanced and held by the strings at *pianissimo* for approximately 30 seconds. Whereas it is quite possible for the strings to do so with relative ease and a homogeneous sound, it would be exceptionally strenuous for either

<sup>57</sup> Saliency is defined in the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141.

woodwinds or brass to achieve the required balance and blend. This kind of versatility witnessed in the orchestral string section allows for the composer to take greater liberties in writing for the string family, with less involved considerations for possible technical problems brought about by dynamic restrictions or physical restrictions of sound production.

Klatzow exploits another interesting ability of the string players, namely to produce drastic differences in sound quality between ensemble and solo performance. The example above could appear to be a counterintuitive combination of instrument colours in the sense that it might not seem very possible for a solo violin to project over an entire string orchestra at a dynamic of only *piano* or *pianissimo*. However, by changing bow pressure, bowing speed, bow position, intensity of vibrato and speed of vibrato, the solo violin is able to gain the same kind of projection qualities that opera singers are praised for and that are necessary to compete with a large ensemble<sup>58</sup>. In Strauss's *Ein Heldenleben* or Rimsky-Korsakov's *Scheherazade*, a solo violinist is capable of projecting over an entire orchestra by manipulating the aforementioned characteristics of sound production. By contrast, it seems less probable for an oboe, flute or clarinet to project with the same clarity over an entire woodwind section at such a low dynamic level.

---

<sup>58</sup> By changing the composition of its overtones, the human voice is able to produce the wide variety of vowel sounds that are utilised in everyday speech. The mechanisms and processes that control these overtones, especially in singing, is called the singer's formant. Whilst studying the recordings of the renowned opera singer Jussi Bjoerling, Swedish voice scientist Johann Sundberg discovered that in order for the singer to project his voice over the mass of an entire orchestra, he had developed his technique in such way that he had adapted his formant in order to produce more vocal energy in a frequency range that the orchestra was less present in (Sundberg, 1972; 1987). See also Van der Linde (2013), who expands on Sundberg within a singing ensemble context. Of the orchestral instruments, the strings are technically most able to control the overtone composition of their sound, so that it is possible that the power of projection of a solo stringed instrument occurs by the same general means as a trained human voice.

The image shows a musical score for two staves. The top staff is labeled 'Vlns I+II, Viola' and contains sustained octaves. The bottom staff is labeled 'Vcls+Basses' and contains a more active, rhythmic pattern. The score is in 4/4 time and features a dynamic marking of 'pp' (pianissimo) and a 'cresc.' (crescendo) marking. The bottom staff also includes a '3' marking, indicating a triplet.

Figure 15: ( $\downarrow = 66$ ) Use of strings to provide a foundation of sound for other orchestral sections in Zaidel-Rudolph's *Tempus Fugit* (1986).

Zaidel-Rudolph applies two different methods of orchestral sound reinforcement in the example above. The top line, performed by violins I+II and violas, provide a sustained sound platform over which the other orchestral instruments can project their sound. The kind of support provided by these sustained octaves plays an important musical role in the orchestral performance by diminishing the exposed feeling of the solo woodwinds. The strings are well-suited to perform such a function for two reasons: firstly, they perform in a group so that, psychologically speaking, they are not as exposed as their counterparts in the woodwinds, brass or percussion; secondly, they are able to produce sounds at a very low and stable dynamic level for a prolonged period of time. Another form of support is provided by cellos and double basses in the bottom staff in a more traditional manner when they double piccolo and bass clarinet at various octaves. This kind of doubling between strings and woodwinds serves a number of functions, the primary of which is to mix different tone colours into a compound colour; another important function is to mitigate the extreme contrasts of tone colour between the bass clarinet and piccolo, both of which tune more readily with the string groups than with each other.

♩ = 66  
154

+8va Picc.  
 Fls  
 Obs  
 E. Hn.  
 Cl. Eb  
 Cls Bb  
 B. Cl.  
 Alto Sax.  
 Bsns  
 C. Bsn  
 Tpt. 1-3  
 Hns 1-4  
 1  
 2  
 Tbn  
 3  
 Tubal  
 Timp.  
 Crot. Bells  
 Pnos  
 Org.  
 Vlins I  
 Vlins II  
 Vlas  
 Vcls  
 D.Bs -8va

Figure 16: Divisi capabilities of strings, woodwinds and brass as demonstrated by Roosenschoon in the first movement of The Magic Marimba (1991).

In this example, Roosenschoon pits the dividing capabilities of the strings, woodwinds and brass against each other in a compound chordal construction of impressive dimensions. The full spread of the chord is six octaves, and each of the three instrument groups contributes a different function to the construction: the woodwinds add focus and projection to the bottom octaves and a piercing brightness to the topmost octave; the brass contribute weight to the bottom end and significant weight and warmth to the top-middle octave (the brass occupy only a small range within the chord); the strings act to bind together the contrasting colours of woodwinds and brass by adding a homogeneous tone and even weight throughout the vertical span of the chord structure. It should be noted that although the strings are considerably divided, there are still multiple musicians on every pitch, and they contribute more chord tones to the structure than the other two instrument groups. By contrast, the woodwinds and brass are unable to perform with such even balance in such a broad sonority, and without the binding function of the strings, the chord would be more difficult to intone convincingly.

The musical score for Figure 17 is written in 4/4 time. It features a solo cellist line at the top, marked with *mf* and *p*. Below it are five staves for the string section: Violin I, Violin II, Viola, Cello, and Double Bass. The string section accompaniment is marked with *p* and *pp*. The score includes a *pizz.* (pizzicato) marking for the double bass. The music is characterized by a wide range of dynamics and a focus on the string section's ability to provide a homogeneous tone across a six-octave chord structure.

Figure 17: ( $\downarrow = c.84$ ) Use of the string section to accompany a solo cellist in Temmingh's *tjellokonsert* (1992).

Throughout Temmingh's *tjellokonsert*, the composer prefers the use of the strings to accompany the soloist, with some interjections by woodwinds and brass. Temmingh's writing, which is much less involved

than the other South African works consulted in this project, is somewhat reminiscent of the orchestration of Shostakovich. His simplistic approach belies a clarity of line and texture that is highly effective in his use of instruments; in this fragment the entire string section takes part in a single texture that is pitted against the soloist with minimal decoration and nuance, yet the strings do not overwhelm the soloist in performance. There is an elasticity to the string sound (which was referred to earlier in this section) that allows firstly for the soloist to project more clearly over the other strings and secondly for the strings to maintain their position as a subordinate partner to the soloist.

The image shows a musical score for a piano solo and a string section. The piano solo part is marked 'Piano solo' and 'ff'. The string section is marked 'ff' and 'p f'. The score is in 6/8 time and features a piano solo part and a string section. The piano solo part is marked 'Piano solo' and 'ff'. The string section is marked 'ff' and 'p f'. The score is in 6/8 time and features a piano solo part and a string section. The piano solo part is marked 'Piano solo' and 'ff'. The string section is marked 'ff' and 'p f'.

Figure 18: Exploitation of timbral homogeneity and visual choreography in the second movement (*Più mosso* ♩ = 168) of Grové's *Raka* (1996).

In the figure above, Grové exploits the visual capabilities of the string groups and their position *en masse* in the front of the orchestra to produce a cascading wave of sound from one side of the orchestra to the other. In a traditional orchestral layout, the double basses would be situated to the far right of the stage (audience perspective), with the cellos, violas, violins II and violins I forming a connecting line to the



far left. In a performance note, Grové makes mention of the visual effect of the figure above and how it should connect through all the string groups. The effect Grové refers to is that of bowing, which is the most visual representation of sound production in the orchestra when coordinated in a group (other orchestra instruments generally have less visual modes of sound production), and that can be choreographed in the string groups to striking effect. The indicated *fortissimo* dynamic level will ensure a vigorous attack and an aggressive visual effect. It is not very common for composers to exploit the bowing of the string section in this manner specifically, although it is a constant part of string performance practice, and an important contributor to the dominant visual positioning of the strings. A very well-known example of coordinated string bowing producing a striking visual effect is at the exposition of the first theme in Beethoven's fifth symphony: there the bowing of the full strings is so representative of the sound produced that it would likely be possible to identify the work by the visual movement itself; the same cannot be said of another instrument group.

Figure 19: Exploitation of the string section's ability to perform with dexterous stamina for sustained periods of time at a low dynamic level in the first movement of Hofmeyr's *Sinfonia Africana* (2003).

This example from Hofmeyr's *Sinfonia Africana* expands on the sustaining power of strings witnessed in Fagan (Figure 13) and Klatzow (Figure 14). The passage quoted above (violins II, violas, cellos and basses) is continued for a further 12 measures for a total of 18, and the slashed stems indicate that each note should be bowed twice; in total the string players are required each to produce 162 notes without any pause or break (Violins I take other material). It is in this passage that the unparalleled stamina and

sustained agility of the strings can truly be witnessed, especially at the slow metronome mark of ♩ = c.46-50 that translates to an unbroken performance time of around 52 seconds. In the woodwinds, brass or percussion, the orchestrator would need to make use of a number of special devices and overlapping instruments to produce the same effect. It therefore seems unlikely that such a passage, the likes of which is present in a great number of orchestral works, could be taken as effectively by any group other than the strings.

## 2.4 The shifting importance and function of the percussion section

In contrast to the strings, which were shown above to be seen by a number of orchestrators as the foundation of the orchestra, the percussionists appear historically to take an auxiliary position in the orchestra. In Parrott (1957) and in Jacob (1956), percussion instruments are described as noise makers. Such a description, although doing a disservice to both percussive instrumental practice and orchestrational design, holds a small measure of truth in a large portion of music from the common practice period. Kennan & Grantham (2002) observe that percussion parts of scores older than the twentieth century are of minimal importance, a sentiment that resonates with those of Parrott (1957) and Sevsay (2013). They and Berlioz & Strauss (1991) go on to divide percussion instruments into two broad, musically supportive categories: those that highlight or draw attention to thematic or structural elements of the music, and those that provide a particular colour to the music. Dissimilarly to the strings that occupy a visually dominant space in the orchestra, the positioning of percussion instruments at the far back of the orchestra could be a visual clue in support of these statements by Parrott and Kennan & Grantham. However, Casella & Mortari (2004) place the timpani at the centre of the orchestra, stating that a good orchestra cannot exist without a good timpanist.

From Casella & Mortari, therefore, the percussion family itself is perceived to be divided between the timpani and other percussion instruments, so that in scores throughout the nineteenth century and until the present, the timpanist is assigned an exclusive part (Adler, 2002; Carse, 1964). The timpano, which is

the oldest percussive member of the orchestra, has gained a greater measure of integration with orchestral tradition than have, for example, the idiophonic instruments, which is why Jacob (1956) ranks the timpani on a higher artistic plane than the rest of the percussion family. Kennan & Grantham (2002) place the timpani at the lead of articulating form in orchestral music, and Del Mar (1983) shows how a number of timpani techniques developed specifically from their use in the orchestra. For example, the need for players to tune pitches rapidly in orchestral music, as tonal vocabulary became expanded in the nineteenth century, directly resulted in the intricate tuning mechanisms that are used on timpani today. Lastly, the timpani's placement on the orchestral score, just below the brass and above other orchestral instruments, is a visual indicator of its long-standing traditional relationship with the trumpets, before the brass family was expanded by the requirements of orchestrators in the nineteenth century<sup>59</sup>.

Towards the second half of the twentieth century, the percussion family undergoes tremendous growth within the orchestral sphere as composers search for new sound possibilities and a break away from tradition (Kennan & Grantham, 2002; Adler, 2002; Sevsay, 2013). A dramatic change in view of the percussion family is noticeable when comparing these sources with others written before 1960 (Forsyth, 1914; Piston, 1961; Jacob, 1956; Parrott, 1957; Casella & Mortari, 2004). Compare Parrott with Kennan & Grantham, for example: Parrott describes the principle function of percussion as that of accessory, going on to say that no percussion instrument could provide a concert worth of music on its own; Kennan & Grantham, in contrast, note that the basic sound of recent scores is often provided by the percussion family and that they are of equal importance to the other instrumental families in the orchestra. A large body of works for percussion produced in the twentieth century appears to support Kennan & Grantham's

---

<sup>59</sup> Bowles (2002) explains that European timpani, adapted from an older Ottoman model, were paired with trumpets to announce the arrival of a regiment, normally consisting of cavalry. By the late 16<sup>th</sup> century, timpani and trumpets were adopted by European nobility as a symbol of status, and a number of years thereafter became incorporated into the orchestra by composers writing within the court. Alessandro Scarlatti, under patronage of Pietro Ottoboni and Ferdinando de' Medici (Pagano, 2014), is the first composer attributed to make use of timpani in his work *Mitriadate Eupatore* in 1707 (Bowles, 2002), although Henry Purcell's *Music for the Funeral of Queen Mary* (1695) already employs the timpani together with brass a number of years before Scarlatti. Jacob (1956) refers to trumpets and timpani as a unit throughout his text, labelling them (as was previously stated) as noise makers in the orchestra.

standpoint, although Parrott's statement that percussion provides accessory is also true in a number of works.

In contemporary orchestral scores, some percussion instruments that have been used frequently throughout history will generally be present, like the timpani, bass drum, cymbals and some smaller instruments. The order in which instruments appear on the score is only loosely predetermined, so that the manner in which they are presented on the orchestral score or in the parts do not really follow any system yet and will likely need many years more to become fully standardised (See Table 5: p.72)<sup>60</sup>. The advent of software like Finale, Sibelius and MagicScore that the majority of composers/orchestrators make use of today will likely play a central role in the development of such systems. Although the most common instruments can be expected to be present in any orchestra, many instruments cannot be guaranteed to be present. One reason for the latter is that professional quality orchestral percussion instruments are highly priced, and whereas a string or wind musician would normally only purchase between one and five instruments, percussionists would need to purchase at least 30-50 instruments to begin to cover all the basic orchestral possibilities. For this reason, orchestras and institutions generally own a large number of percussion instruments, which they build up over many decades (it is to be expected that some instruments will be quite old and possibly slightly damaged from extended use and transport). In-house percussionists make use of these. Professional orchestras will normally be able to afford the cost of importing instruments that are unavailable to them, but more amateur orchestras might not. The orchestrator cannot give a solo to any percussion instrument, therefore, because the correct instrument displaying the required sound qualities, range and expressive capabilities might not be available.

---

<sup>60</sup> The ordering of percussion instruments on the score is made problematic furthermore by the fact that in some scores, instruments are presented according to player, so that instruments shift around between staves. Furthermore, the instruments are often arranged for the unique requirements of every score, so that there is little likelihood of instrumental order remaining constant between different works or composers. Orchestration authors state this fact as a major debilitating factor in the development of a standardised approach to orchestral percussion (Piston, 1961; Del Mar, 1983; Kennan & Grantham, 2002; Adler, 2002; Casella & Mortari, 2004; Sevsay, 2013).

In the following table, the eight South African orchestral works studied in this project are listed according to the order in which the composers have chosen to display the percussion instruments on their scores. This table serves to demonstrate the lack of a standardised system of scoring for percussion in the orchestra, even in works as recent as *Sinfonia Africana* (2003), explained in part by the fact that composers favour a system of scoring where players move around on stage to share a common group of instruments, so that their order on the score depends on which instrument is utilised by which player at a given point in the score. Such a lack of standardisation, which is a symptom of the relatively recent expansion of orchestral percussion, has resulted in the percussion section retaining a greater sense of flexibility within the orchestra than other instrument groups; the timpanist, however, is exempt from this flexibility and does not move to other instruments during performance. It is interesting to note in the works by Van Wyk (1960), Zaidel-Rudolph (1986) and Temmingh (1992) that they do not place their timpani part above the percussion, as is the norm described in all orchestration textbooks. In Blatter (1997), Kennan & Grantham (2002), Adler (2002) and Sevsay (2013), orchestrators are advised to score by instrument and not by player, and to place the instruments from top to bottom in order of timpani, accessories, cymbals, mallets, and lastly drums, from highest to lowest in pitch. By comparison, the assignment and ordering of instrument in other sections of the orchestra are completely standardised.

Table 5 -- Percussion layout in eight South African orchestral scores, highlighting some major differences between scores. Line breaks separate different players:

Van Wyk <i>Primavera</i> (1960)	Fagan <i>Karoosimfonie</i> (1976)	Klatzow <i>Incantations</i> (1984)	Zaidel- Rudolph <i>Tempus Fugit</i> (1986)	Roosenschoon <i>Magic Marimba</i> (1991)	Temmingh <i>tjellokonsert</i> <sup>61</sup> (1992)	Grové <i>Raka</i> (1996)	Hofmeyr <i>Sinfonia Africana</i> (2003)
Tambourine Xylophone	Timpani	Timpani	Marimba T. blocks Crotales Tambourine	Timpani	Roto toms Xylophone Triangle	Timpani	Timpani
Bass drum Sus. cymbal Tenor drum	Triangle Sus. Cymbal Tam-tam	Vibraphone Cymbals F. cymbal 1 Xylophone Gong 1	Xylophone (Celesta) Wood block	Marimba 1 Crotales Gong Maracas	Timpani	Tom-toms Wood block Marimba Bass drum	Tam-tam Bass drum Tenor drum Sus. Cymbal Triangle Wind chimes Glockenspiel Wind machine
Cymbals Snare drum Triangle	Bass drum Cymbals Whip Snare drum Glockenspiel	Gong 2 Crotales Sus. cymbal Snare drum Wood block Tambourine F. Cymbal 2	Vibraphone Tom toms Maracas Claves Sus. cymbals Roto-toms	Xylophone Sus. cymbals Claves Bongos Tom-toms	Snare drum Tam-tam Sus. cymbal Bass drum	Gong Tenor drum Guiro	Snare drum Field drum Sus. cymbal Tubular bells Snare drum Glockenspiel Vibraphone Marimba Tam-tam Bass drum Wood block
Timpani	Vibraphone Xylophone (Celesta)		Timpani	Marimba Cowbells T. blocks Tambourine Guiro			
			Snare drum Bass drum Tenor drums Bongos Whip	Glockenspiel Tubular Bells Triangle Bell-tree Tam-tam Bass drum			

The position of the percussion family in the throes of its developmental trajectory within the orchestra becomes clear when the extreme growth of the percussion family is witnessed in the twentieth century, starting with Stravinsky in *L'Histoire du Soldat* of 1918. For the first time, it is required of one percussionist to perform on a substantial battery of instruments: these include two snare drums of

<sup>61</sup> See footnote 38, p.48 about the use of minusculation of *tjellokonsert*.

different sizes without snares as well as a one snare drum with snares, a bass drum, cymbals, a triangle and a tambourine. This method of writing is referred to by contemporary orchestrators as multi-percussion (Kennan & Grantham, 2002; Adler, 2002; Sevsay, 2013). Musically, as Del Mar (1983) notes, the percussion in the twentieth century was also gaining an elevated musical position within the orchestra, in the sense that it was not only providing realistic or immersive colour anymore, but providing a pivotal role in the structuring, sonority and sound pallet of the orchestration<sup>62</sup>. Later, in Stravinsky's *Les Noces* (1923), six percussionists were required to play on timpani, bass drum, chimes, crotales, tambourine, snare and military drums both with and without snares, xylophone, triangle and cymbals. A significant number of instruments were invented or common items appropriated for orchestral use in the twentieth century, including the wind machine, musical saw, flexatone, ondes Martenot, vibraphone and brake drums. It is not surprising then that the percussion family and its flexible approach to performance provided rich ground for composers to experiment in. Varèse's *Ionisation* of 1931, which was composed for 13 percussionists and a wide variety of instruments (including lion's roar drum and 2 alarm sirens) is an early example of highly effective experimental writing for percussion; the work remains a model for contemporary orchestrators although it is not an orchestral work itself. Alexander Tcherepnin composed an entire movement only for percussion in his first symphony of 1927.

In the following table, the eight South African orchestral works studied in this project are shown in chronological order and with an exposition of the number of percussion players and instruments used in each of the scores. In this table, three trends reveal themselves: firstly, there is a clear expansion of the percussion section as the century progresses, until in the works of Zaidel-Rudolph and Roosenschoon, a very large number of percussion instruments and players is required<sup>63</sup>; secondly, the expansion of the size and complexity of the percussion section witnessed in Europe from the turn of the twentieth century, is in

---

<sup>62</sup> The timpani, one should note, was already fulfilling this role far earlier in the history of orchestration.

<sup>63</sup> One timpanist and three percussionists is described as the standard for a full orchestra in Kennan & Grantham (2002), and although it can be said that these numbers vary greatly in practice, four percussionists (and 19 instruments) apart from the timpani place these two scores at the apex of percussion expansion.

these scores followed a full 50 years late<sup>64</sup>; thirdly, as is customarily found in concertos, fewer percussion players are utilised in the smaller accompanimental orchestras of Temmingh and Grové. There are two possible reasons (and probably others as well) for the second observation: firstly, the great geographic distance between European and South African centres of music creation could stymie the spread of trends from the one to the other especially when one considers that the knowledge bearers of new European techniques and procedures would likely not make regular voyages to South Africa; secondly, the high cost of purchasing new percussion batteries, together with expensive importing procedures, would make it a prohibitively costly endeavour that would probably not keep tempo with changing trends. Even today, some instruments like the celesta, crotales and tubular bells are rare in South Africa and the few existing specimens are shared by a number of different ensembles throughout the country.

Table 6 -- Comparison of percussion instruments and players in eight South African orchestral works:

Year	Composer, work	Number of players and instrument sets	Instrumentation
1960	Arnold van Wyk, <i>Primavera</i>	1 Timpanist, 2 (3) Percussionists <sup>65</sup> , 9 Instruments <sup>66</sup>	Timpani, triangle, military (snare) drum, tenor drum, bass drum, tambourine, cymbals, suspended cymbal, xylophone.
1976	Gideon Fagan, <i>Karoosimfonie</i>	1 Timpanist, 2 (3) Percussionists <sup>67</sup> , 12 Instruments	Timpani, glockenspiel, xylophone, large suspended cymbal, cymbals, tam-tam, bass drum, triangle, vibraphone, snare drum, whip, (celesta) <sup>68</sup> .

<sup>64</sup> Van Wyk's use of percussion in *Primavera* (1960) is about equal to that of Strauss in *Rosenkavalier* (1910). Within that trajectory, one could place the number of percussionists in Zaidel-Rudolph (1986) and Roosenschoon (1991) in line with Hindemith's *Symphonic Metamorphosis* (1941), although large works by Ravel and Stravinsky before that already make use of an extended battery of percussion. In Roosenschoon (1991) specifically, the really involved use of percussion and the sound attained from the percussion instruments is more reminiscent of Ligeti, however, who in *Apparitions* (1959) also makes use of 4 percussionists and a large battery of instruments.

<sup>65</sup> In Van Wyk's *Primavera*, the bass drum and cymbals/tambourine are designated to be played simultaneously by one player, but in contemporary performance practice two separate players will split this part so that a total of three players will be required for concert. The practice of sharing these instruments is an outmoded practice originally carried over from the military band, but in Casella & Mortari (2004) and other textbooks, its use is strongly discouraged because neither of the instruments can be played with much control or nuance in that way. An interesting exposition of the friendship between cymbals and bass drum is given in Del Mar (1983).

<sup>66</sup> Instruments or sets of instruments: therefore, timpani count as 1 instrument. Timpani are included in this count.

<sup>67</sup> Fagan, like Van Wyk, makes use of an outmoded practice in his orchestration whereby one player is assigned the simultaneous performance of bass drum and cymbals. In contemporary performance, an additional player will be assigned to fulfil this role.



1984	Peter Klatzow, <i>Incantations</i>	1 Timpanist, 2 Percussionists, 13 Instruments	Timpani, vibraphone, xylophone, 2 gongs, cymbal, 2 finger cymbals, crotales, side drum, suspended cymbal, woodblock, tambourine.
1986	Jeanne Zaidel-Rudolph, <i>Tempus Fugit</i>	1 Timpanist, 4 Percussionists, 21 Instruments	Timpani, marimba, 5 temple blocks, crotales, tambourine, xylophone, (celesta) <sup>69</sup> , dual-pitched woodblock, vibraphone, 3 tom toms, maracas, claves, 2 suspended cymbals, 4 roto-toms, snare drum, bass drum, 2 differently pitched tenor drums, 2 bongos, whip.
1991	Hans Roosenschoon, <i>The Magic Marimba</i>	1 Timpanist, 4 Percussionists, 20 Instruments	Timpani, 2 marimbas, crotales, gong, maracas, xylophone, 2 suspended cymbals, claves, 2 bongos, 4 tom toms, 3 cowbells, 5 temple blocks, tambourine, guiro, glockenspiel, tubular bells, triangle, bell tree, tam-tam, bass drum.
1992	Roelof Temmingh, <i>tjellokonsert</i>	1 Timpanist, 1 Percussionist <sup>70</sup> , 7 Instruments	Timpani, snare drum, roto toms, tam-tam, suspended cymbal, triangle, xylophone, bass drum.
1996	Stefans Grové, <i>Raka</i>	1 Timpanist, 2 Percussionists, 9 Instruments	Timpani, marimba, xylophone, guiro, wood block, 4 tom toms, tenor drum, bass drum, large gong.
2003	Hendrik Hofmeyr, <i>Sinfonia Africana</i>	1 Timpanist, 2 (3) Percussionists <sup>71</sup> , 17 Instruments	Timpani, bass drum, tenor drum, field drum, snare drum, tambourine, triangle, suspended cymbal, large tam-tam, tubular bells, glass wind chimes, wood block, wind machine, glockenspiel, vibraphone, xylophone, marimba.

Following this developmental trajectory, it is also possible to reflect on the complexity of writing for these instruments in the scores shown above in order to find a musical counterpart to their mechanical development:

---

<sup>68</sup> See footnote 69, p.75.

<sup>69</sup> Celesta, which is designated to the percussion family in Jeanne-Zaidel, will almost always be played by a keyboard player, unless the part is extremely simple.

<sup>70</sup> Like with Van Wyk and Fagan, Temmingh also requires of the percussionist to play on multiple instruments at once (in this case, suspended cymbal and xylophone). Temmingh's choice of shared instruments is far more feasible, however, because they can be set up to accommodate the player as well as the technical performance requirements of both instruments.

<sup>71</sup> Practically speaking, Hofmeyr's writing is too involved for the two percussionists who are required to perform on 16 instruments, especially because of the involved doubling between bass drum & tam-tam, bass drum & tenor drum, tubular bells & suspended cymbal, and even between tubular bells & tam-tam.

Figure 20: (Poco lento, teneramente  $\downarrow = c.60$ ) The first 61 measures of percussion in Van Wyk's *Primavera* (1960), showing the timpani (top staff) as well as the bass drum and tambourine (bottom staff).

In Van Wyk's *Primavera*, as a first example, the percussion's absence from the exposition of the musical material in the first 55 measures gives an idea of the auxiliary role of these instruments in his orchestration. The timpani plays a more nuanced role in the music, providing musical punctuation and reinforcement of flow in certain key moments. The bass drum and tambourine are, however, merely doubling a rhythmic pizzicato idea already present in the orchestra and appear to contribute little more than a typical oom-pah ambience. While the bass drum and tambourine provide colour to the music, it does not seem like their absence would in any way harm the musical or structural integrity of the work.

Figure 21: (Molto lento  $\downarrow = 30$ ) Use of percussion in the opening of Fagan's *Karoosimfonie* (1976).

In Fagan's *Karoosimfonie*, the use of percussion is focussed more exclusively on colour effects. In the example above, a timpano roll provides a subtle nuance to the repeated pedal in cellos and double basses,

while the tam-tam and suspended cymbal provide a lush yet subtle shimmering to the flutes and clarinets. The tam-tam and cymbal are placed in such a manner that their attacks fall in between the attacks of other instruments; in this manner they contribute to a more complex texture while retaining overall transparency. Here, as in other moments of the *Karoosimfonie*, the percussion adds colour to an existing musical texture, providing musical punctuation between the bassoon and English horn solos. However, the percussion is not an autonomous or essential musical voice within the orchestra, and although it provides valuable colour to the work, it is not an integral component of the musical content or structure. It is interesting also to note that in comparison to Van Wyk, where the timpani appear to function on a higher artistic plane than the other percussion instruments (as Jacob, 1956, suggested it would), the timpani here are rather demoted to the level of the other percussion instruments in providing mostly colour or effect.

In Klatzow's *Incantations* (1984), a clear and definitive development of the percussion family is noticeable, so that his use of the percussion instruments can be placed in four distinctive roles: the first is that of colour (Figure 22); the second is of punctuation (Figure 23); the third is that of creating a sense of dialogue (Figure 24); and the last is that of fully emancipated solo voice within the orchestra (Figure 25). These divergent roles place Klatzow's work in *Incantations* in a position of cross-over between an older and a more contemporary use of percussion in the orchestra.

18

vibraphone  
mp  
sempre ped.

harp  
mp

pp Vlns. II  
pp Ob.+bsn 3  
Vcls+basses  
ppp

Figure 22: (Lightly ♩ = 72) Use of percussion in Klatzow's *Incantations* (1984) as a colouristic orchestration device.

In the figure above, the vibraphone is integrated into a larger texture with instruments from other sections. This tendency to create inter-sectional groupings of instruments that function as compound instruments (in this case, harp and vibraphone become such a coupling) within the orchestra is not found in Van Wyk or in Fagan, so that it constitutes a new development in Klatzow. Throughout *Incantations*, Klatzow makes greater use of melodic percussion than his predecessors, pointing towards an increased reliance on percussion instruments to contribute to the melodic and harmonic content of his orchestration.

The musical score for Figure 23 is divided into four systems. The first system (measures 76-79) features a Timpano part in 3/8 time, a Finger Cymbal part in 6/8 time, and woodblock accompaniment for strings and winds. The second system (measures 80-83) continues the percussion parts and shows the string and wind sections playing chords. The third system (measures 84-87) shows the percussion parts continuing with dynamic markings like *sfz* and *ff*. The fourth system (measures 88-91) shows the percussion parts concluding with a final chord.

Figure 23: ( $\downarrow = 76$ ) Use of percussion in Klatzow's *Incantations* (1984) to add punctuation to material in strings and winds.

In Figure 23 above, the percussion plays a supportive function in providing articulation to the antiphonal treatment of two large instrument groups. The wood block provides an incisive edge to the higher instruments, while the metallic warble of the finger cymbal provides nuance to the extremely high-placed strings. In the bass register of the cellos, trombones and double basses, the timpano gives punch to the softer string attack and bolsters the trombone sound. The wood block and finger cymbal are a more interesting combination than would be the traditional snare drum and cymbal, while the timpano placed on its own within a wide interval of the bass chord is an unusual choice.

The musical score for Figure 24 consists of four staves. The top staff is for the Vibraphone, starting with a measure rest in measure 170, then playing a rhythmic motif in measure 171 with a dynamic of *mp*. The second staff is for the Crotales, with a measure rest in measure 170 and a single note in measure 171 with a dynamic of *pp*. The third staff is for the Piano, playing a rhythmic motif starting in measure 170 with a dynamic of *ff*. The bottom staff is for the Harp, playing a rhythmic motif starting in measure 170 with a dynamic of *mp*. The score includes various musical notations such as slurs, accents, and dynamic markings.

Figure 24: (Tempo Primo ♩ = 72) Percussion offset with other instruments in order to create a sense of dialogue in Klatzow's *Incantations* (1984).

In Figure 24, the vibraphone is an effective counterpart to the harp, where the two instruments juxtapose a simple rhythmic/interval motive. The dry staccato of the piano in a high register is followed by the harp's softer yet distinct attack; the harp is echoed by the vibraphone with a more consonant version of the harp motive, while the crisp and transparent sound of the crotales played at the same moment provides a link between the metallic timbre of the vibraphone and the percussive timbre of the piano that enters shortly after. This inter-sectional dialogue is especially effective in performance because the choice of instruments creates an interesting and discernible interchange of timbre. This kind of material is significant in comparison to Van Wyk (1960) and Fagan (1976), because of the integral role played by the percussion in the structuring of the music.

209 *Xylophone solo*  
*pp*  
*Finger cymbal*  
*mf*  
*Vlms I+II*  
*Vlas+Vcls+Basses (+bsn, hrns)*  
*p*  
*Vlms I*  
*ppp*

Figure 25: (Meno mosso  $\downarrow = 54$ ) A representative example of solo percussion in Klatzow's *Incantations* (1984).

In Figure 25 and elsewhere in *Incantations*, Klatzow takes a definitive step towards a modern sounding orchestration by giving solo melodic material to the percussion. The placement of the xylophone, in an exposed position of relative quiet over a foundation of sustained strings, accentuates the structural significance of this moment in the work. The xylophone is answered by violins I and flute in the following measure to create an antiphony between the percussion family and the respective leaders of the strings and woodwinds. Although it would be erroneous to state that a percussion instrument had never before taken a solo role in South African orchestral music, the solo material assigned to percussion in Klatzow is different in the sense that percussion not only serves an instrumentational function now, but also an orchestrational role<sup>72</sup>.

<sup>72</sup> This is meant in the sense employed by Sevsay (2013), which is discussed in the background chapter to the thesis.

Marimba solo  
ad lib., legato

mp f mf ff mp sffz f p

attacca!

I Timpano

Tenor drums

Vlms I+II  
Flutes

D.basses

p mf

mf

mf f

mf f

sf mf mf

Figure 26: (Pacato ♩ = c.72, then ♩ = 66) Opening measures of Zaidel-Rudolph's *Tempus Fugit* (1986), showing the use of percussion and in particular the use of solo marimba.

In Zaidel-Rudolph, the percussion serves a more integrated purpose within the orchestra, albeit by a small margin, than in Klatzow (1984) – as the trajectory described in Del Mar (1983) and earlier in this chapter predicted. The example above, showing the first bars from *Tempus Fugit*, immediately puts the percussion section in a central position with regards to the sound pallet of the orchestration by giving an extended solo to the marimba. Further on, in measures 140-143, the characteristic sound of the marimba tremolo is again placed in an exposed position when linking the two main sections of the work, so that the listener can be reminded of the opening measures and therefore have a greater chance to perceive the larger structure of the work. Note also in measure 1 how the orchestra provides a sonic space for the timpano and tenor drums to sound in isolation and with clarity. In this composition, the characteristic sound quality of the percussion instruments (and particularly, the marimba) contributes to the form articulating function of orchestration on the same level as the other instrument families.

The musical score for measures 132-135 of the first movement of Roosenschoon's *The Magic Marimba* (1991) is presented in 3/4 time. It features six staves: Timpani, Marimba 1, Marimba 2, Xylophone 3, Tubular bells, and Organ. The organ part begins in measure 132 with a forte (*ff*) dynamic. The percussion instruments enter in measure 133 with a forte (*f*) dynamic. The organ part continues in measure 134, and the percussion instruments continue in measure 135. The score shows a complex integration of the organ and percussion parts.

Figure 27: The use of percussion in the first movement of Roosenschoon's *The Magic Marimba* (1991).

In the example above, Roosenschoon's use of percussion in *Magic Marimba* (1991) is substantially more involved than his predecessors, so that passages such as these are not uncommon in his orchestration. This example is interesting for two reasons: firstly the organ pedalling from measure 132 appears to be carried over into the timpani part, so that while the overall texture and tessitura are altered, the material is carried forth in the percussion section. In measures 133-135, the organ and percussion material are integrated to the extent that it is not possible in the heterophonic texture to determine whether the percussion is derived from the organ or whether the organ is composed around the percussion. Here, as in other sections of *Magic Marimba*, Roosenschoon's writing for percussion is fully integrated into the musical texture and contributes substantially to his antiphonal treatment of various combinations of orchestral instruments.



The image displays a musical score for the first movement of Hofmeyr's *Sinfonia Africana*. The score is written in 4/4 time and features five staves. The top staff is for the Timpani (Timpani), starting with a *p* dynamic and a triplet of eighth notes, followed by a *cresc. poco a poco* leading to a *f* dynamic. The second staff is for the Tenor drum and Bass drum, also starting with a *p* dynamic and a triplet, and following the same crescendo to *f*. The third staff is for the Snare drum (snares off) and Field drum, starting with a *p* dynamic and a triplet, and following the same crescendo to *f*. The fourth staff is for the Clarinets, starting with a *ppp* dynamic and a triplet, and following the same crescendo to *mf* and then *ff*. The bottom staff is for the Piano, starting with a *pp* dynamic and a triplet, and following the same crescendo to *ff*. The score includes various dynamic markings and a *cresc. poco a poco* instruction throughout.

Figure 28: Use of percussion with supporting piano and clarinets in the first movement (Quasi Marcia funebre ♩ = c.58-63) of Hofmeyr's *Sinfonia Africana* (2003).

In Hofmeyr's *Sinfonia Africana* (2003), the development of symphonic percussion witnessed in Klatzow (1984), Zaidel-Rudolph (1986) and Roosenschoon (1991) is put forth with smaller forces. Hofmeyr employs only three percussionists instead of Roosenschoon's five, likely as a compensation for the less robust sounds of solo voice and choir now present in the orchestra, but his writing is as involved in some instances as in *The Magic Marimba*. The use of percussive effects on the harp, piano and strings is an interesting complement to the percussion section; in the example above, the piano and clarinets are utilised in such a manner that they become a part of the sound of the percussion (and not the other way around, as would traditionally be the case). Towards the end of the phrase, the clarinets grow in volume to rise above the percussive texture with the rest of the woodwinds in a scowling fanfare. As with Zaidel-Rudolph, the percussion instruments feature so prominently at the opening of *Sinfonia Africana* that their sound is immediately fixed as a central component to Hofmeyr's orchestration.

In contrast, the two concertos by Temmingh (1992) and Grové (1996) appear to take a step back towards a more conservative application of percussion within the orchestra. Understandably, the smaller orchestras employed by these two composers for use in a concerto could perhaps necessitate a decrease

in the number of percussionists, but throughout their works, percussion serves mostly the purpose of providing colour or adding volume to a crescendo. By comparison, concertos composed around the same time by Einojuhani Rautavaara (Piano concerto no.2 of 1989), Christopher Rouse (Trombone concert of 1992), John Adams (Violin concerto of 1993) or Tobias Picker (Viola concerto of 1994) also show a more outmoded approach to the use of percussion. It is possible that the highly salient sounds of the percussion family in general might seem to these composers to be unsuitable for use in a concerto, where a solo instrument already has to compete with a large group of instruments. It is also possible that the driving force of originality and the search for new sound possibilities which aided in the expansion of percussion in other symphonic genres, did not spill over onto the concerto. A later and sudden development of percussion-use in concertos can however be seen in Thomas Harvey's recorder concerto (2008), Georg Haas's baritone saxophone concerto (2008), and Frank Ticheli's clarinet concerto (2010), where percussion becomes an integral component of the orchestral sound.

## 2.5 The development of heterogeneous voices in the woodwinds section

Whereas instruments of the string family have remained relatively unchanged over the last two centuries (a probable factor in their dominant position in the orchestra)<sup>73</sup>, the woodwinds have undergone considerable technical development to ease out mechanical difficulties, registral contrasts and tuning problems (much like the percussion). The spacing of toneholes and keys on a woodwind instrument affects the tuning and ease of playing on the instrument, and in many cases the favouring of the one will negatively impact the other (Casella & Mortari, 2004). The modern fingering system used on the flute today was designed by Theobald Böhm in the mid-nineteenth century in order to facilitate volume production on the instrument and improve intonation in the tempered system of tuning (Baines, 1991)<sup>74</sup>. Böhm's system

---


<sup>73</sup> This is evidenced by the fact that some stringed instruments, which are over 300 years old, are in high demand by contemporary performers. In comparison, instruments of the woodwind family that are of that age can rarely be used, or are useful only in very specific applications of historically informed performance practice.

<sup>74</sup> Instruments of the violin family do not share this predicament, because the tuning of the instrument is controlled by the performer and the tuning of specific notes is controlled with the placement of fingers on the string.

eventually inspired the development of similar modern systems of construction on the clarinet, oboe, bassoon and saxophone. Over the previous century, a myriad of small developments has taken place in order to improve the technical functioning of woodwind instruments. On the flute for example, the trill



was made possible by the introduction of a special key in the twentieth century, but the addition

of the key made substantially more difficult the tremolo . If a key was introduced to make the latter more feasible, then the former would become nearly impossible (Casella & Mortari, 2004; Phelan & Burkart, 2005). On flutes where both problems are dealt with by separate mechanisms, other problems are again created. Today, many possible variants of the Böhm system exist, with additions like the offset-G key, the split E mechanism and the low B foot being found on many, but not all, instruments<sup>75</sup>. Other wind instruments experience similar inconsistencies, like with the piccolo where only some instruments can reach the low C and C#, or the clarinet and bassoon where numerous additional trill keys and auxiliary keys have been designed by instrument builders in order to facilitate in registral transitions or forked fingerings<sup>76</sup>. The inconsistencies found between different instruments are somewhat of a hindrance to orchestrators, who either have to compose for the lowest common denominator, or risk writing a part that cannot be performed by any given instrumentalist. In comparison, the string section displays greater consistency between different orchestras<sup>77</sup>.

In many textbook cases the woodwinds are compared to the strings in terms of technique and sound consistency by orchestration authors, and generally the strings are found to be superior. The mechanical

---

<sup>75</sup> The same can be said for other members of the woodwind family. In the bassoon, for example, two main systems of construction are found today: the German (Heckel) system and the French (Buffet) system. The Heckel system favours a larger bore with some holes shifted in order to bring alignment to the overtones and homogeneity to the different registers, as well as to increase the overall volume potential of the instrument (Baines, 1991; Casella & Mortari, 2004). The Buffet system has a softer sound, but greater control in the uppermost register. For both systems there exists different fingering systems, most notably the English, German and French systems (Baines, 1991).

<sup>76</sup> Forked fingerings occur when performers are required to change fingers in both hands at once. Such changes can become exceptionally challenging in prolonged, fast or intricate musical figures.

<sup>77</sup> It should be noted that in the top orchestras of the world today, these inconsistencies are not really the problem of the orchestrator anymore, who can expect nearly the impossible from performers (Blatter, 1997; Adler, 2002).

difficulty encountered by the flute when producing trills in its lowest register (see above) are not problematic on stringed instruments, which can produce those and many other variants throughout their entire ranges. In Kennan & Grantham (2002) for example, the speed of tonguing possible on the flute is described to be almost as agile as the bowing speed possible on the violin. In Jacob (1956) and Adler (2002) the necessity for woodwind instruments (and brass) to take pause for breath is compared to the ability of the string choir to play unbroken sounds for long periods. Problems of projection and intonation in the weaker registers of the wind instruments are also not found in the string section, where the number of instrumentalists playing together equalises individual problems of projection and intonation. Furthermore, whereas the string section of the orchestra is almost completely standardised in its configuration (Violins I and II, Violas, Cellos and Double Basses), with the only question remaining as to the number of players in each choir, the instruments available in the woodwinds are firstly of a far wider variety and secondly of inconsistent availability except for the core members of each family (flute, oboe, soprano clarinet, bassoon).

A wider variety of woodwind instruments is necessitated by the relatively small range of each of them when compared to the strings, and then the orchestrator is faced with the extremely divergent qualities of the outermost tessituras of wind instruments in comparison to the strings. In order to match the full registral compass of the violin, for example, the orchestrator requires the use of three different flutes (alto flute, flute and piccolo), of which the lowest one is not necessarily available to all orchestras (Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002); likewise, in order to match the compass of the viola, the orchestrator would have to make use of bass flute as well, which is extremely rare in the orchestra<sup>78</sup>. The orchestrator can therefore make use of combinations of various woodwind instruments in an attempt to match the full registral possibilities and homogenous sound quality of the strings, or utilise

---

<sup>78</sup> Although some examples of the bass flute's use in chamber ensembles or opera exist, most notably Hans Pfitzner's *Palestrina*, it has not found a position within general orchestral writing. This is likely due to the extremely soft and delicate sound of the bass flute that is easily overshadowed by other instruments. Catherine McMichael's work, *Three Philosophies*, for string orchestra, harp, percussion and low flutes (alto, bass and contrabass) is one of the most prominent contemporary examples of a large chamber work that makes use of these instruments.

the heterogeneous timbres and the characteristic disparity between registral extremes of each of the woodwind instruments as a contrast to the string sound. In works like Rimsky-Korsakov's *Scheherazade*, Stravinsky's *Le Sacre du Printemps* or Ravel's *Daphnis et Chloé*, the woodwinds are used to heterogeneous effect so that it can be postulated that they serve to represent individual characters or storytellers within the music.

In terms of these registral differences between woodwinds and strings, as well as their registral overlaps, it is more practical to display them graphically (this representation is approximate, see Addendum A for a full exposition of instrument ranges as they are printed in various orchestration textbooks):

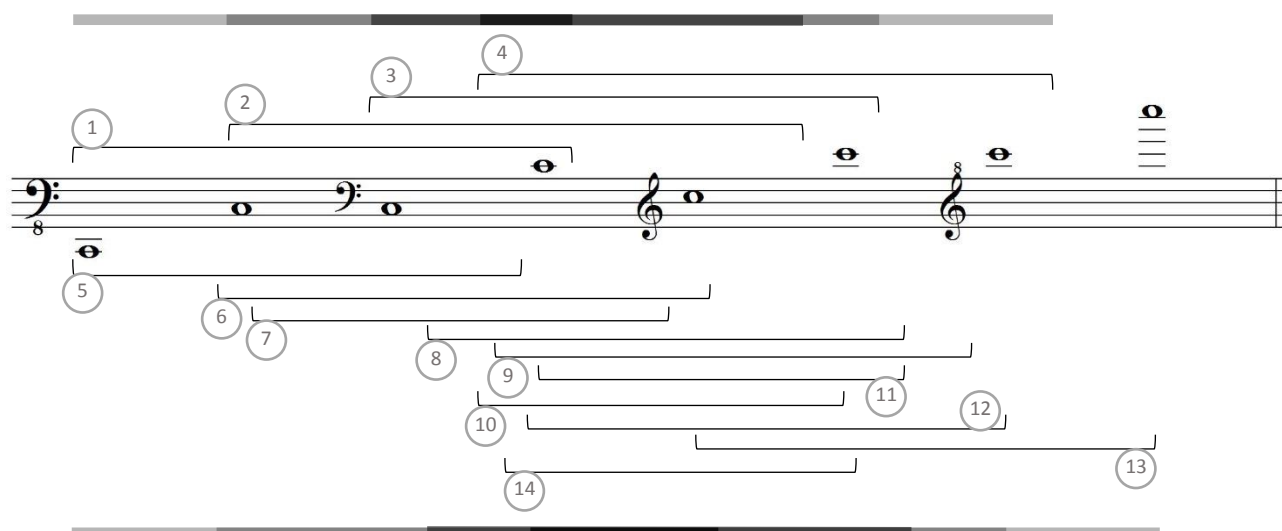


Figure 29: Approximate registral comparison of orchestral woodwinds to strings, showing overlaps.

#### Strings:

1. Double Bass (with C extension)
2. Violoncello
3. Viola
4. Violin

#### Woodwinds:

5. Contrabassoon
6. Bassoon
7. B $\flat$  Bass clarinet
8. B $\flat$  Soprano clarinet
9. E $\flat$  Piccolo clarinet
10. English Horn
11. Oboe
12. Flute
13. Piccolo
14. Alto Flute

Except for the outermost ranges (C1-2 and C7-8), any woodwind instrument in the orchestra can be replaced with another instrument from the same family that provides more options for mechanical and expressive control within a less salient timbral environment. Therefore, for purposes of balance and blending, which are discussed elsewhere in the thesis as integral mechanisms of effective orchestration<sup>79</sup>, the salient and highly colourful timbres of the outermost tessituras of the woodwinds are less ideal; to compensate for these registers, other more suitable instruments of the same family can be utilised instead<sup>80</sup>. In the upper octave of the flute for example, where the instrument gains a piercing quality and loses its expressive capacity, the piccolo is able to play with greater ease and a less coloured tone in its middle octave; likewise, the lowest octave of the flute, which gains a characteristic languid tone, can be played with more control and a more neutral colour on the alto flute. The lowest tessitura of the oboe, which has an almost overwhelming nasal and pungent tone, can be replaced with an English horn for a more sombre and neutral tone, while the dark and menacing *chalumeau* register of the soprano clarinet can be replaced by the middle octave of the bass clarinet. The uppermost tessitura of the soprano clarinet is more easily dealt with by the piccolo clarinet, which is also often used in conjunction with the flute in its upper octave for a supporting function (Casella & Mortari, 2004). Like the piccolo trumpet, the piccolo clarinet does not necessarily serve to extend the range of the clarinet family, but provide strength and brilliance in the highest tessitura of the instrument family.

The following examples aim to show some of the most typical or characteristic uses of woodwinds in the eight South African scores that were studied as part of this project. These examples cannot provide an extensive description of the use of woodwinds, however, but can show how composers have made the best use of their unique characteristics and limitations in various musical contexts.

---

<sup>79</sup> See *Perspective seven: The meaning of effective orchestration*, p.226.

<sup>80</sup> At the same time it must be stated that many composers have exploited the unusual and highly colourful sounds of the extreme registers of woodwind instruments to exceptional effect, although these works demand great energy and attention from performers to make them communicate in a convincing manner. Stravinsky's *Le Sacre du Printemps*, which arrives at its characteristic sound quality because of the extreme registers utilised by many of the instruments (like with the famous bassoon solo), is perhaps the most notable historical example of such a work.

5 *Piccolo solo (sounding 8va higher)*  
*pp dolce*

*Violins II, Cellos*  
*pp*

*Violas*

*Flute solo*  
*pp dolce*

*Violins I*  
*p* *f*  
*pp*

*pp*

*p*

Figure 30: Exchange of melodic material between piccolo and flute in the first movement (*Poco lento, teneramente* ♩ = c.60) of Van Wyk's *Primavera* (1960)<sup>81</sup>.

In the example above, Van Wyk juxtaposes the extreme differences of timbre between the flute and piccolo within the same range. The first melodic entry by the piccolo in its lowest octave, which has a breathy sound that is slightly reminiscent of a soprano recorder in its lowest tessitura (see Addendum A), would have a much richer and secure sound if it was given to the flute – clearly Van Wyk's intention was to place the weakest range of the piccolo in an exposed situation to highlight those qualities of the instrument. The piccolo combined with the sustained background of open string harmonics, creates a pastoral sound reminiscent of Grieg or Dvořák. The entry of the flute with nearly the same pitch material in the same octave, with its stronger tone and more secure projection, is a convincing contrast to the piccolo.

<sup>81</sup> In the original score, the first measure of the example is displayed in a different time signature, but this extract is only read from the last crotchet of that bar and so the time signature is carried back from the second bar.

Here, the flute takes a typical orchestral function of playing solo material against a quiet backdrop of sustained strings.

Figure 31 shows a musical score for piccolo and flute. The piccolo part (top staff) is marked 'Piccolo solo (sounding 8va higher)' and begins at measure 13. It features a melodic line with triplets and dynamic markings of *mf* and *f*. The flute part (bottom staff) is marked 'Flute solo' and features a bass line with triplets and dynamic markings of *p* and *f*.

Figure 31: Interchanging of piccolo and flute to counteract reduced saliency of the piccolo's lowest octave in the first movement (Andante  $\text{♩} = 72$ ) of Grové's *Raka* (1996).

Grové utilises the same technique of timbral interchange as Van Wyk in order to create a kind of musical dialogue between flute and piccolo. Although it would have been possible for either the flute or piccolo to take the entire passage, it would necessitate a registral change in both instruments that in the piccolo would result in some notes being breathy and weak, while in the flute some notes would gain a shrill quality. By combining both instruments in the same mechanical registers, Grové maintains greater timbral control over the passage while improving the basic dialogical properties of the phrase.

Figure 32 shows a musical score for woodwind section in 3/4 time. The score includes parts for Oboe, Bassoon 1, Eng. horn, and Bassoon 2. The Oboe part is marked with *pp*, *mp*, *mf*, and *p*. The Bassoon 1 and Bassoon 2 parts are marked with *pp*, *mp*, *mf*, and *p*. The Eng. horn part is marked with *mf* and *p*.

Figure 32: Exploitation of registral saliency in the woodwind section in the first movement ( $\text{♩} = c.46-50$ ) of Hofmeyr's *Sinfonia Africana* (2003).

This passage of Hofmeyr in *Sinfonia Africana*, composed for the double reeds, displays an interesting application of chord voicing and an advanced instinct for timbral saliency in order to produce the desired



balance of instrumental voices. The voicing follows an interlocking pattern (a standard method of chord voicing described in nearly all textbooks<sup>82</sup>), which would usually be applied in order to facilitate a blended sound between instrument groups. In this example, however, the first bassoon plays well into its highest range reaching its fourth octave. The resultant sound will be highly salient<sup>83</sup> and will demonstrate an increased audibility in performance (see Addendum C). It seems likely that the effect is planned by Hofmeyr to compensate for the full-bodied sound of the oboe in its low tessitura, in contrast is the English horn that blends more easily in its low octave so that it should not disrupt the balance of the instruments in Hofmeyr's choice of position.

The musical score is for a woodwind and string ensemble. It is in 7/4 time and consists of four systems. The first system includes Flutes and Clarinets (Flts + Cls), Oboes, Piccolo (sounding 8va higher), and B. Clarinet. The second system includes Violins I+II, Violas, Cellos, and D. Basses (sounding 8va lower). Dynamics range from fortissimo (ff) to pianissimo (pp). The woodwinds play a complex, interlocking pattern of chords, while the strings play a more sustained, harmonic accompaniment.

Figure 33: Woodwinds performing a supportive role for the string section in Zaidel-Rudolph's *Tempus Fugit* (1986).

In the example above referring to Zaidel-Rudolph's *Tempus Fugit*, a typical function of woodwind instruments as reinforcement of the strings can be studied. It is fairly typical in this composition for woodwinds to double with various string groups; in the example the flutes and clarinets double the first

<sup>82</sup> Chord voicing and chord tone distribution are discussed in *Perspective seven: The meaning of effective orchestration*, p.226.

<sup>83</sup> Saliency is a factor of an instrument's ability to be differentiated from other instruments in a musical texture. It is further discussed in another chapter of the thesis titled *Perspective four: An orchestrator's view on hearing and sound perception*, p.141.

and second violins, while the oboes double the violas. The result is greater body in the string sound, with greater focus of tone provided by the directional projection of sound by the winds. The result is a fairly blended sound in these three groups, because the characteristic qualities of each of the woodwinds are neutralised by the strings while the characteristic tone of woodwind is added to all three string groups. It is interesting to note that once the dynamic level drops from *fortissimo* to *pianissimo*, Zaidel-Rudolph is more daring with her doubling of tone, placing the bass clarinet with the cellos an octave higher than the double basses, and the piccolo four octaves above the double basses. The bass clarinet provides enough focus of tone to the cellos, so that the double basses and piccolo have an anchoring point from which to adjust their intonation. That being said, this example remains an extremely challenging one in terms of tuning because of the extremely wide spacing and divergent tone colours.

The image shows a musical score for the woodwind section of Roosenschoon's *The Magic Marimba*. The score is written in 4/4 time with a tempo of 168. The dynamic marking is *ff* (fortissimo). The instruments listed are: Piccolo, Flutes, Oboes, Eng. horn, Picc. clar., Clarinets, Bass clar., A. saxophone, Bassoons, and Contra bsn. The score shows chord tones for each instrument, with the Piccolo and Bass clarinet parts being particularly prominent. The Piccolo part is written in the treble clef, and the Bass clarinet part is written in the bass clef. The other instruments are grouped together in the middle staves. The score shows a series of chords, with the Piccolo and Bass clarinet parts being particularly prominent. The Piccolo part is written in the treble clef, and the Bass clarinet part is written in the bass clef. The other instruments are grouped together in the middle staves. The score shows a series of chords, with the Piccolo and Bass clarinet parts being particularly prominent.

Figure 34: Spacing of chord tones between instruments of the woodwind section in the second movement of Roosenschoon's *The Magic Marimba* (1991).

In *The Magic Marimba*, as with other orchestral works by Roosenschoon, groups of instruments are often pitted against one another in an antiphonal dialogue that focusses on stark and exciting contrasts. This technique occurs especially at the exposition of material: see for example the section starting at measure 29 of the first movement (listed in Table 7 below). In other sections, these dialogical units overlap one another to create broad shifts of sound throughout the orchestra. It is uncommon for the entire orchestra to partake in a mixed texture all at once (a striking example of such a section occurs at measure

209, at the announcement of the end of the first movement). Roosenschoon's antiphonal use of orchestral sections necessitates a well-structured method of ensuring instrumental blend and balance, which appears to spill into his orchestral tutti: the opening of the second movement of *The Magic Marimba* displays the doubling of all chord tones the strings, brass and woodwinds. The placement of all chord tones in all the instrument groups is an accepted traditional method of ensuring chord balance in all instrument sections (Jacob, 1956; Rimsky-Korsakov, 1964; Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002).

Table 7 -- Juxtaposition of instrument groups in Roosenschoon's *The Magic Marimba* (1991):

Occurrence	Length	Instrumentation
mm.29-31	3 bars	Strings and timpani
mm.32-34	3 bars	Piano and tam-tam
mm.35-37	3 bars	Brass and timpani (and piano)
mm.38-40	3 bars	Strings and organ
mm.41-42	2 bars	Woodwinds, tam-tam and marimba
mm.43	1 bar (link)	Cellos and basses
mm.44-46	3 bars	Strings and woodwinds
mm.47-49	3 bars	Piano, triangle and claves

In Figure 34 above, the distribution of chord tones between the various instrument families of the woodwinds almost follows the tradition of classicism: flutes above oboes, oboes above clarinets, and clarinets above bassoons (the saxophone is a new addition to the orchestra that has not yet developed a tradition within this context). Roosenschoon exploits the greater number of clarinets (four compared to three in the other groups) to bind together the collective sound of the woodwinds, by placing the piccolo clarinet above the oboes with the flutes, and by placing the bass clarinet below the saxophone within the realm of the bassoons. The second bassoon and contrabassoon are placed in their lowest tessitura in order to provide maximum resonance to the foundation of the chord, while the other woodwinds are placed in a more subdued register to conduce greater balance.

The image shows a musical score for two staves. The top staff is labeled 'Flts+Obs+Cls' and the bottom staff is labeled '{Bsns+{Trbs}'. Both staves start with a dynamic marking of *f* (forte). The top staff contains a melodic line with various note values, including eighth and sixteenth notes, and rests. The bottom staff contains a harmonic accompaniment consisting of chords and single notes, primarily using eighth and sixteenth notes. The key signature has one flat (B-flat), and the time signature is 4/4. The score is marked with a box containing the number 34 in the top left corner.

Figure 35: Application of woodwinds both as a unified voice and in support of another instrument group in the sixth movement (Molto agitato  $\downarrow = 132$ ) of Grové's *Raka* (1996).

In all eight South African works the lack of agility of the bassoon, in comparison to the clarinets or the flutes, tends to result in a functional split within the woodwind section: when the upper woodwinds are required to perform technically demanding and agile material, the bassoons are regularly assigned longer note values, pedal tones, silence, or the doubling of another instrument section (visible in Figure 35, Figure 36 and Figure 37). The doubling of trombones and bassoons, like Grové has notated in the example above, is a common occurrence in orchestral writing. It is, however, far less common in contemporary orchestration for flutes, oboes and clarinets to double a single melodic line, because the secondary colours resulting from instrumental doubling are less favoured than the primary colours of solo woodwinds. However, Grové's writing in *Raka* tends to favour contrapuntal melodic practices, so that there is little or no room for decorative or harmonic material; it is then necessary to compose broadly doubled lines in tutti sections like that shown in the figure above.

The musical score shows four staves. The top staff is for 1 fl. (solo cl.) in 6/8 time, starting with a melodic line. The second staff is for 2 obs., playing a decorative flourish. The third staff is for Eng. horn, playing a chromatically downward moving figure. The bottom staff is for 2 bsns and c. bsn, providing a bass line. The score includes dynamic markings like *p*, *mp*, and *f*, and a tempo change to 3/4 time in measure 62.

Figure 36: ( $\downarrow = \downarrow = 54$ ) Use of woodwinds as heterogeneous voices within the orchestra in Klatzow's *Incantations* (1984).

In Klatzow's *Incantations*, the woodwinds do not function with the same kind of structured ordering as in the previous examples. In the figure above, the woodwinds are drawn together from different rhythmic and melodic textures until they reach a point of unity together with the other instrument groups in measure 62. Before that, the flute and clarinet perform a melodic fragment in octaves, while the English horn engages in a chromatically downward moving figure doubled by half of the cellos. The oboes, doubling with violas and second violins, interject with a decorative flourish, while the bassoons, cellos and double basses assert their presence in the bass and tenor registers. The varying rhythmic and registral profiles of the instruments are intelligently planned to provide timbral separation of the melodic layers. The flutes and clarinets, whose colours are not tempered by doubling with a string group, become a distinguishable primary melodic function within the dense texturing of dissonances. As with previous examples where woodwinds doubled string groups, it appears to be a primary function of the woodwinds to double with these groups in order to provide their otherwise homogenous timbre with greater qualities of projection and a more distinguishable colour profile.

(♩ = c.138)

573

2 flts

ff

2 obs

2 cls

ff

2 bsns

c. bsn

brass+strings

ff

Figure 37: Use of woodwinds to increase the brilliance of the orchestral sound at the conclusion of Temmingh's *tjellokonsert* (1992).

Lastly, in Temmingh's *tjellokonsert* (concerto for cello and orchestra) the entire orchestra partakes in a loud and violent registral crescendo: bass instruments of the string, brass and woodwinds sections extend downwards, while the upper woodwinds expand to their highest extremes. Upper strings and brass remain in the middle register, where they too are expanded into a densely populated cluster of tones. The spacing of the woodwinds is intelligently planned to reinforce the partials of the brass and strings, the effect of which is a considerable contribution to the perceived brightness of the orchestral tone. The clarinets, which have a more piercing high range than the oboes, are placed above them; the oboes tend to sound thinner and less piercing as they play higher, so in this example they maintain a position within their middle register (see Addendum A and C). Both oboes double the foundation of the chord in the centre of the string/brass cluster, in order to reinforce its presence within the orchestral mass and bind the colours of the upper woodwinds with the foundation provided by the bass instruments.

## 2.6 The slow and gradual incorporation of the brass section

The position of the brass section in the orchestra, as with the woodwinds, is uncertain when compared to the strings, and mostly for the same reasons: the brass section is less homogeneous in sound quality than the strings (although more homogeneous than the woodwinds), each of the instruments has a smaller range compared to instruments of the violin family, brass instruments cannot produce as many different tone colours and articulations as their counterparts in the string section, brass instruments have until recently still undergone significant mechanical developments, and brass instruments produce a highly projected tone that tends to stand out against other sounds of the orchestra. The ability of the brass to produce a truly robust *forte* has historically placed them in the role of dynamic reinforcement within the orchestra, something akin to pulling all the stops on an organ; in Verdi's operas, for example, the brass were always reserved for special volume or effect<sup>84</sup>, and generally the whole of the brass section is only utilised when a rich and hearty *forte* sound is required. The tendency for brass instruments to sound overly loud against the orchestra also creates difficulties of balance in chords, where special procedures must be followed to allow brass instruments to blend with their orchestral surroundings<sup>85</sup>. Problems of balance and blend are exacerbated by the highly projected quality of brass tone; the horns are, however, not included here because they project away from the audience so that their sound is more diffuse.

---

<sup>84</sup> For example, the Triumphal March from Verdi's *Aida*, or the use of horns in his *Falstaff*.

<sup>85</sup> See *Perspective seven: The meaning of effective orchestration*, p.226.





Figure 38 shows a typical occurrence of layering of instruments within the orchestration of a passage in order to increase the weight<sup>86</sup> and dynamic strength of the sound. A number of observations can be made about this example. Firstly, the orchestra has roughly been divided into two groups, with woodwinds and strings in bar 216 already providing a *forte* sound carried through from the preceding passage, while the brass and percussion enter as a unit in the next measure to drive the *crescendo* to greater strength; secondly, the horns enter a bar earlier than the other brass instrument to increase the robustness of the *forte* and to link the string and woodwind timbres with the coming brass timbres. Following that, the strings, tuba and horns, which project upward or away from the audience, are given sustained material over which the woodwinds and other brass instruments can project; this sustained tone is fortified by the bass trombone. The flutes are omitted from the passage while the oboes and clarinets are placed low in their tessitura – in likelihood this is done so as to give the sound a darker and sombre tone, as the usual placement of the woodwinds in their higher octaves during such a robust passage would result in an exceptionally bright and penetrating sound. In performance, however, with the number of trumpets and trombones playing at such a high dynamic level, the woodwinds stand little chance of being heard at all. The close traditional relationship between brass and percussion, functioning together here as dynamic reinforcement, is especially evident; it seems difficult, however, to imagine how any other arrangement of instruments could provide such an enormous weight of sound and especially how any instruments but the trumpets and trombones would be able to project over the immensity of sound emanating from the percussion. Lastly, in this example, Van Wyk has followed a practice that is advised in Jacob (1956), Blatter (1997), Kennan & Grantham (2002) and Adler (2002), which is that of writing for the bass drum at a lower dynamic level than the other instruments in respect of its ability to overshadow the entire orchestra if played too forcefully.

---

<sup>86</sup> The concept of perceiving sound as having weight is discussed in *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141.

[Con fuoco (♩ = c. 108)]

55

Fls *mf cresc.* *fff dim.*

Obs *fff*

E. Hn *mf cresc.* *fff dim.*

Cls Bb *mf cresc.* *fff dim.*

B. Cl. *fff*

Bsns *ff* *f* *fff*

Cbsn. *fff*

Hns (4) *ff* *f* *fff* 1.2. 3.4.

1.2 Tbn *fff* *f* *cresc.* *fff dim.*

3 Tuba *fff* *f*

Timp. *fff* *ff* *f* *fff*

B. drum *fff* *dim*

Whip Cymb *fff* *dim*

Pno. *f* *fff* *f*

[Con fuoco (♩ = c. 108)]

Vlns I *mf* *cresc.* *fff*

Vlns II *mf* *cresc.* *fff* *dim* V

Vlas *mf* *cresc.* *fff* *dim*

Vcls *fff* *ff* *f* *fff*

D.Bs *fff* *ff* *f* *fff*

Figure 39: Use of brass in a forceful tutti in the fourth movement ("Storm") of Fagan's Karoosimfonie (1976).

In Fagan's portrayal of a Karoo thunderstorm in his *Karoosimfonie* (1976), the orchestral sections work together to provide a realistic sound portrait of the cracking lightning, booming thunder and howling wind. A clap of the whip, together with crash cymbals, gives a bright white crack of sound to portray a crack of lightning; immediately following that the orchestra booms in led by the timpani and bass drum at *fortisissimo*, which gives way two measures later to a howling gust of wind portrayed by the upper strings and woodwinds. In order to balance out the tremendous volume of the percussion section playing at *fortisissimo*, the upper strings and woodwinds are grouped together as a unit, while the lower strings, woodwinds and brass are grouped together to give greater weight to the low-frequency vibrations. In this section, the tuba and trombones are employed to reinforce the bassoons, cellos and basses with massive volume, but it is arguable that for this section to work effectively Fagan would need more of every instrument to have a more stable sound. At the extremely high dynamic levels prescribed in this orchestration, the sounds of each solo instrument become more difficult to control and the brass are especially prone to spread in tone<sup>87</sup>. The levels of balance and control maintained in loud sections of the orchestrations of Strauss (*Symphonia Domestica*), Stravinsky (*Le Sacre du Printemps*) or Brian (Symphony no.1) are to a large extent reliant on the gargantuan orchestral forces which they employ. The most notable feature of Fagan's use of brass here is the grouping of four horns on a single melodic line: the horns are able to project such a line with a great deal of volume (more than the woodwinds would be capable of), but without the highly directional quality of (for instance) the trumpets and therefore with a higher capacity to blend successfully with the orchestra. It is possibly for this reason that Fagan chose to omit the trumpets from this tutti.

---

<sup>87</sup> When woodwind and brass instruments are blown very forcefully, the vibrations of the upper partials are distorted by the much stronger vibration of the fundamental and low partials. This affects the listener's perception of the instruments' intonation as sounding slightly below and unfocussed in pitch. Textbooks and players often refer to the effect as spreading of tone.

[Quasi marcia funebre ( $\text{♩} = \text{c. } 56-60$ )]  
480

rall. **Energico**  $\text{♩} = \text{c. } 100-108$   
frullato

Fr. -  
Picc. -  
Ob. -  
C. A. *mp cresc.*  
Cl. Bb. *mf cresc.*  
B. Cl. *cresc.*  
Bsn. *cresc.*  
C. Bsn. *f*

Hns 1 *pp cresc.* *aperto (o)*  
Hns 2 *pp cresc.* *frullato gliss.*  
Tpt. *pp*  
Tbn. *cresc.*  
Tba. *cresc.*  
Timp. *cresc.*

Perc. I B. Drum wooden sticks *cresc.*  
Perc. II Bell *f*  
tam-tam *f*

Pno. *f*

Hp. *ff* *gliss.*

Voice *ff* toe U die storm word, die

[Quasi marcia funebre ( $\text{♩} = \text{c. } 56-60$ )]  
Vlna I *div. sul pont.* *mp cresc.* *rall.* **Energico**  $\text{♩} = \text{c. } 100-108$  *div a3*  
Vlna II *div. sul pont.* *p cresc.* *ff* *div a3* *fp*  
Vlaa *div. sul pont.* *pp cresc.* *f* *div a3* *fp*  
Vca *sul pont.* *pp cresc.* *f* *div a3* *fp*  
Vcb *sul pont.* *pp cresc.* *f* *div a3* *fp*  
D. Bs. *sul pont.* *pp cresc.* *f* *div a3* *fp*

Figure 40: Use of brass in the second movement of Hofmeyr's *Sinfonia Africana* (2003) to reinforce other sections of the orchestra in a dramatic crescendo.

In this forceful tutti *crescendo* of the orchestra towards the climactic “storm” of the soprano solo in Hofmeyr (2003), the brass section is split into two groups to support the rest of the orchestra in building a large volume of sound. The lower brass join the low woodwinds and strings to provide a resonant bass foundation for the *crescendo*, the horns and trumpets give an incisive quality to the upper strings. It is rare in Hofmeyr’s *Sinfonia Africana* for the horns to split off from the other brass instruments, so that the horns’ support of the woodwinds and voice in measure 484 is a unique occurrence. Traditionally, the horns would take a more involved engagement with the woodwinds and strings, but Hofmeyr tends to avoid this practice in his orchestration of *Sinfonia Africana*, probably because there are fewer brass instruments in his orchestra and they therefore require reinforcement from the horns<sup>88</sup>. In instances like Figure 40 where the brass is required to provide volume support for the orchestra, it is inevitable that it will be required of the horns to bolster the brass. Throughout the work, Hofmeyr tends to over-orchestrate some passages, so that some dynamic contrasts become difficult to articulate: this passage is a good example of a section where more strategic entries of instrumental doubling could have contributed to more varied shifts in colour and a more natural development of sound volume.

---

<sup>88</sup> Hofmeyr only uses 2 horns, 1 trumpet, 1 trombone and 1 tuba, most likely to compensate for the presence of the more fragile sounds of choir and solo voice.

[♩ = 168]  
6

Picc. *ff* *p* solo *p*

Fls. *ff* *p*

Obs. *ff* *p*

E. Hn. *ff* *p*

Cl. Eb *ff* *p*

Cl. Bb *ff* *p*

B. Cl. *ff* *p*

Alto Sax. *ff* *p*

Bsns. *ff* *p*

C. Bsn. *ff* *p*

Tpt. 1-3 *ff* *p*

Hns. 1 *ff* *p*  
3  
2 *ff* *p*  
4

Tbns. 1 *ff* *p*  
2  
3

Tuba *ff* *p*

Timp. *ff* *p*

Xyl. Cymbals soft sticks *p*

Pno. 2 *lv* *8va*

Vlns I *ff* *p*

Vlns II *ff* *p* soli pizz *p*

Vla. *ff* *p*

Vcl. *ff* *p*

D. Bs. *ff* *p*

Figure 41: Thinning out of the instrumental groups during an orchestral decrescendo in the second movement of Roosenschoon's *The Magic Marimba* (1991).

The figure above shows a very typical tapering of instruments per section in order to achieve a more gradual decrease in volume and shift in instrumental colour. It would also have been possible to taper the instruments individually in order to achieve a completely gradual effect, but the sectional tapering of sound is more in keeping with Roosenschoon's segmented and antiphonal approach to orchestral sections in *The Magic Marimba*. This tapering is also representative of the dynamic relationships between the instrumental groups: brass instruments are the loudest, followed by woodwinds, while strings are the softest; therefore, the most natural order of tapering would be to cut the brass first, followed by the woodwinds and lastly the strings. The orchestrational functioning of brass as dynamic reinforcement is seen at work in this example, and furthermore in Roosenschoon's tapering, he achieves a very striking and nuanced shift of colour by maintaining the higher woodwinds for longer than the bass instruments; this upward tapering of sound is in opposition to the physical laws of natural atmospheric sound absorption that determine that low-end vibrations are attenuated more slowly than high-frequency vibrations traveling the same distance. Because of this "defiance" of the natural laws of sound decay, this section is guaranteed to draw the attention of the audience.

The horns are different from the rest of the brass section in a number of ways (this was already mentioned earlier in this chapter). Firstly, because they project away from the audience and produce a more diffuse sound, they have historically played a role where they could bridge the disparity between the brass section and the rest of the orchestra, especially the woodwinds. Secondly, the ability of the hornist to control the tone and intonation of the horn's sound by means of hand stopping means that the horn is capable of far greater levels of expressive nuance than other brass instruments. Historically, this ability to stop the tone by hand has also given the horn greater chromatic possibilities than the trumpet. Coupled with the fact that the horn already engages with the highest and most chromatic partials possible on brass instruments (at least until the 15<sup>th</sup> partial, and at times beyond the twentieth), this translates into an instrument that is generally more versatile (albeit more temperamental) than other members of the brass family. Whereas the trumpet maintained a strong military association and link to the timpano in the early to mid-nineteenth century, the more versatile horn was already then being used outside of its traditional

hunting music context<sup>89</sup>. By the turn of the twentieth century, composers were making use of the horn in unique and virtuosic ways, like with Richard Strauss's famous horn solo in *Till Eulenspiegel* or his utilisation of the extreme upper range of the horns in *Sinfonia Domestica*. Benjamin Britten, in his *Serenade for Tenor, Horn and Strings*, initially utilises the horn in a decidedly traditional fanfare style, but further on in the *Elegy* the horn takes on a uniquely modern tone and is expected to perform extremely virtuosic feats of expression. In contrast, the trumpet and trombone only became more fully realised as virtuoso instruments by the dramatic changes brought about by the advent of Jazz, dance and popular styles of performance (Herbert, 1997; Carse, 1964; Casella & Mortari, 2004).

---

<sup>89</sup> Beethoven's orchestrational struggle against the arpeggio-bound possibilities of the trumpet are mentioned in nearly every orchestration textbook, but especially in Carse (1964) and Casella & Mortari (2004).



[Allegro non troppo ma Con brio ( $\text{♩} = c. 108$ )]

123

1. Fl. *f* *mf espr.*

2.3. Ob. *f* *mf*

E.hn *mf* *mf espr.*

Cl. Eb *f*

Cl. Bb *f* *mf*

B. Cl. *mf*

Bsn. *mf*

1.2. Hn F *f* *mf*

3.4. *mf*

Vlms I *f* *f* *mf* *pizz*

Vlms II *f* *mf* *mf*

Vlas *f* *f* *pizz*

Vcls *f* *pizz* *f* *pizz*

D.Bs *f* *div* *f pizz* *arco*

Figure 42: Use of horns as supporting mechanism for woodwinds in the first movement of Van Wyk's Primavera (1960).

Here in Figure 42 the horns are seen fulfilling two of their most common functions in orchestral writing. In the first six measures, Van Wyk utilises the horns as an expansion of the woodwinds, giving them some sustained material to support the woodwinds, but also giving them contrapuntal figuration to accompany the two primary melodic functions in the woodwinds. In the last three measures, the horns are given a sustained pedal tone over which the woodwinds project their melodic material. When horns are utilised with woodwinds, it is almost always in either of these two capacities – tradition seems to have shown that the horns are well equipped to fulfil these functions. Pedal tones in the horns are especially prevalent in the orchestration of the works by Mozart, Beethoven, Schubert and Brahms (and many others) and often at moments where a pastoral quality of sound is aimed at. If Van Wyk's writing for horns here is compared to his use of strings in Figure 30, it is possible to argue that a pastoral quality of sound is the aim here as well.



Klatzow has already been shown to prefer the use of woodwinds as heterogeneous voices contributing to a complex texture of sound ideas in Figure 36, but here his distinctive style also includes the use of horns. As with Van Wyk in Figure 42, the horns here are characterised by their slightly more sustained quality in comparison to the woodwinds; the diffuse quality of horn sound within the enclosed space of a concert hall places them in an ideal position to provide sustained sound without interfering with existing instrumental lines<sup>90</sup>. Here they are placed in a low-midrange position and at a low dynamic level to fill out some of the harmonic foundation laid by the contrabassoon, while the bassoons can project over them with a more salient sound in their high register (see Addendum C).

♩ = c.152

89

The musical score for Figure 44 consists of six staves. The top staff is for Horns, starting with a dynamic of *f* and later *ff*. The second staff is for Flutes, Oboes, and Clarinets (*Fls+Obs+Cls*), with dynamics *ff* and *ff*. The third staff is for Bassoons (*Bsns.*), with dynamics *ff* and *ff*. The fourth staff is for Solo cello, with a dynamic of *ff*. The fifth staff is for Violins I and II (*Vlns I+II*), with dynamics *ff* and *ff*. The sixth staff is for Violas and Violoncellos/Double Basses (*Vlas+Vcls* and *D.basses*), with dynamics *ff* and *ff*. The score is in 6/8 time and includes various musical notations such as slurs, accents, and dynamic markings.

Figure 44: Use of horns as a complement to the woodwind section in Temmingh's *tjellokonsert* (1992).

<sup>90</sup> The horns are capable of producing a psychoacoustic effect whereby they sound extremely distant from the audience if performed softly. This is because the first reflection of their tone, which would enable the listener to determine sound direction and distance, is soft enough to become indistinct from the various other sound reflections that make up reverberation. The effect, called *lontano* (Italian for distant), is a technique unique to the horn, and a result of how the instrument projects within the concert hall.

In this example from Temmingh's concerto for cello and orchestra, the four horns are utilised without the other brass instruments to provide first a contrasting colour and texture to the strings and woodwinds, and then to add weight and volume to their sound. The punchy quality of the *forte* staccato in the horns is a very typical brass technique that Temmingh employs here to aid in distinguishing the horns from the other instrument groups. Temmingh was careful to mark the horns a dynamic level lower than the other instruments, and also omitted all other brass; the most likely reason was to maintain a greater semblance of transparency in the passage, especially with the solo cello already competing against the ensemble. In the second last measure, the horns are placed in an ideal position to blend with the strings and woodwinds without overwhelming them. The placement of the two flutes at a dynamic level of *fortissimo* on a low E is perhaps not prudent, because they will not be heard within the orchestral mass, but may however present severe intonation problems.



capable of providing a robust forte sound than the bassoons, so the horns are often called upon to provide support to the bassoons when other woodwind instruments are not available to double them.

Unlike the woodwinds, all the standard brass instruments of the orchestra function on the same technical foundation: a vibration of the player's lips at a frequency sympathetic to the overtones of the instrument's fundamental frequency causes the instrument to vibrate as well and transfer the kinetic energy as sound. In itself this system of sound production is problematic for three reasons: firstly, one pitch can only be produced in one manner so that its intonation cannot be adapted to the harmonic environment of the orchestra; secondly, there are considerable gaps between the lower overtones (a perfect fifth between the first two); and thirdly, because some of the overtones are noticeably out of tune with modern systems of temperament (most notably the 6<sup>th</sup> and 10<sup>th</sup> overtones, or 7<sup>th</sup> and 11<sup>th</sup> partials). Historically, this has been the greatest setback in the process of incorporating brass instruments into the orchestra (Carse, 1964; Del Mar, 1983), and a number of measures have been applied throughout history to circumvent the issues caused by this method of sound production (most notably the crook system). The sackbut and trombone, which have always had chromatic capabilities because of their use of a telescopic slide, were only generally accepted into the orchestra late in the classical period with their prominent use by Beethoven in his 5<sup>th</sup>, 6<sup>th</sup> and 9<sup>th</sup> symphonies (Carse, 1964; Kennan & Grantham, 2002; Herbert, 1997). The invention of the valve system by Friedrich Bluhmel and Heinrich Stölzel in 1818 meant that players could change the fundamental frequency of their instruments' tuning by up to six semitones easily and consistently and therefore access the full chromatic scale, although the mechanism only came into general use by the end of the nineteenth century (Herbert, 1997). This late development of brass instruments into fully functioning members of the modern orchestra, compared to the string section for example, has put them at a disadvantage to the rest of the orchestra with regards to their performance practice and technical development (Jacob, 1956; Kennan & Grantham, 2002; Adler, 2002).

The complex interplay of mechanical procedures which make up the use of valves and tuning slides (or hand stopping), together with the mentally intuitive tuning of each note by the performer, render the

playing of brass instruments as generally more involved than other families. Orchestration text books caution the orchestrator against intervallic leaps that cannot be readily sung (Kennan & Grantham, 2002; Adler, 2002) or wide leaps in tessituras where overtones are close together (Jacob, 1956; Piston, 1964; Blatter, 1997). Orchestrators are furthermore encouraged to write only such material as suits the instruments well by making use of patterns and figures that are common in brass writing and fall comfortably within the overtone series (Jacob, 1956; Parrott, 1957; Piston, 1964; Blatter, 1997; Casella & Mortari, 2004). Casella & Mortari, however, provide an excellent resource for orchestrators to use in the form of a table outlining every possible position of an overtone on either a three- or a four-valve instrument (or a slide trombone), thereby making it easier for the orchestrator to determine which lines are idiomatic and which lines are not. Casella & Mortari furthermore provide the orchestrator with extensive lists of trills and tremolos to give further understanding of the technical complexities of tone control on brass instruments. The multiplicitous pitch possibilities of the double horn in F and B<sup>b</sup> are also illustrated to show further how the horn player can reduce the complexity of a line with intelligent use of the interchanging trigger. There still appears to be a complex procedure involved in controlling the exact tone colour and intonation either by use of the tuning slide on the trumpet, trombone, euphonium and tuba, or the stopping hand in the case of the horn, which orchestration authors fail to describe adequately. Some aspects of brass performance therefore remain closed off from individuals who do not play the instruments, and characterises to some extent the difficulties of writing effectively or idiomatically for the brass section<sup>91</sup>.

In terms of range, the same problem of the woodwinds compared to the strings occur, namely that each individual instrument possesses a range inferior to each of the stringed instruments. Furthermore, from the standard collection of brass instruments used in the orchestra (trumpet, horn, tenor trombone, bass trombone and tuba), the collective range is inferior to both the strings and the woodwinds, and the upper limits of the instruments are highly dependent on the ability of the player and the specific design of

---

<sup>91</sup> This is reminiscent of the previous Perspective, which dealt with unknown factors that require compensation for in the orchestration process.



the instrument (Carse, 1964; Herbert, 1997). Orchestration authors also tend to make note of the relatively weak sounding quality of the lowest fifth of each of the brass instruments as well as the tense quality of the highest fifth, stating that these ranges present technical and sound problems (Jacob, 1956; Piston, 1964; Blatter, 1997; Kennan & Grantham, 2002). As with the woodwinds and strings, a graphical representation of the ranges of the various instruments aid in understanding some of these differences (as before, this representation is approximate, see Addendum A for a full exposition of instrument ranges as they are printed in various orchestration textbooks):

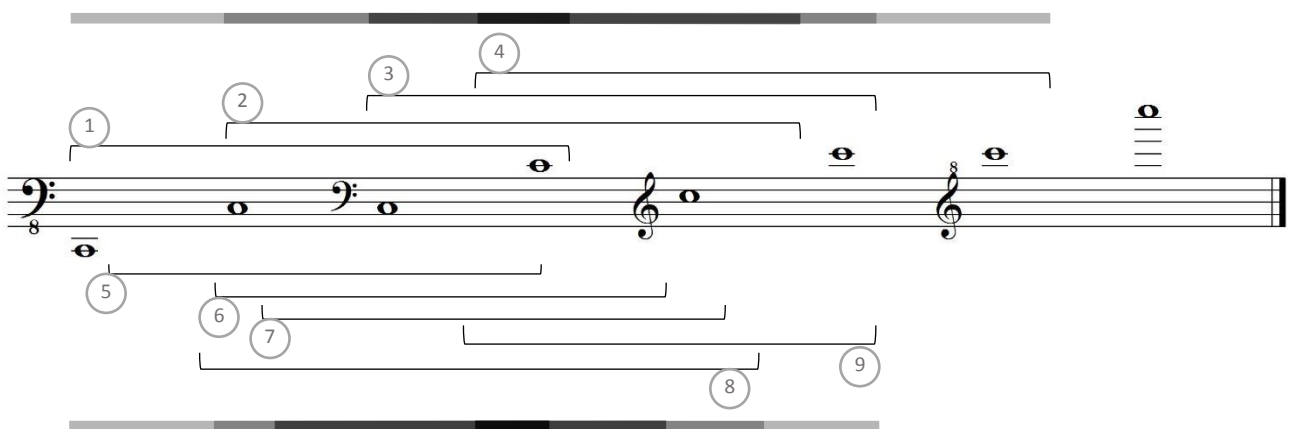


Figure 46: Approximate registral comparison of orchestral brass to strings, showing overlaps.

#### Strings:

1. Double Bass (with C extension)
2. Violoncello
3. Viola
4. Violin

#### Brass instruments:

5. Tuba
6. Bass trombone
7. Tenor trombone
8. French horn
9. Trumpet

A number of observations can be made to complement the visual example. Firstly, the modern orchestral brass family has no instrument to match the high tessitura of the violins. Furthermore, the only true soprano voice in the brass is that of the trumpet (compared to the woodwinds where the clarinet, oboe, flute or piccolo can fill that role – see Figure 29, p.144); the horn, which can take the role of alto below the trumpet, is really a tenor instrument that tends to sound like it is playing higher than it actually is in its upper range. The piccolo trumpet, which is rarely prescribed in modern orchestrations, is customarily

used by orchestral trumpeters in late-baroque and early classical works (such as those by Handel and Haydn) to replace the trumpet in its highest tessitura<sup>92</sup>. The tenor trombone provides either the baritone or the tenor of the brass, where the horn can also provide a supporting role. The true bass of the orchestra is the tuba, which in its lowest register can be heard through the full orchestra. In order to expand on the colour possibilities of the brass section, composers can call on a variety of mutes to alter the volume or timbre of the instrument, but only a small number of these are in standard use today (Kennan & Grantham, 2002; Adler, 2002).

Following are four examples from South African orchestral works that display some of the most common uses of the brass section in the contemporary symphony orchestra.

The image shows a musical score for a trumpet solo and a brass choir. The score is in 4/4 time and features a fanfare-like trumpet melody in the first two bars, followed by a brass choir entry in the last two bars. The trumpet part is marked 'solo' and 'f', while the brass choir parts are marked 'mf'. The brass choir parts include Horns, Tbn (Tenor Trombone), and Tuba. The score is divided into two systems, with the first system containing the trumpet solo and the second system containing the brass choir entry.

Figure 47: Fanfare-like trumpet followed by the brass choir in the first movement (*Qausi Marcia funebre* ♩ = c.58-63) of Hofmeyr's *Sinfonia Africana* (2003).

In the example above, Hofmeyr displays very characteristic use of brass in *Sinfonia Africana*: the double-dotted figuration of the first two bars, followed by the upward leaps at the end of the second and third bars, creates a typical fanfare-like sound. Hofmeyr has adapted the figuration excellently to suit the tonal framework of the work with its predilection for semitones and tritones in a Phrygian environment. The trumpet, which brings its ancient military connotation to the orchestra with this melody, gives a solemn, *serioso* quality to the music that another instrument could not. In the last two bars, the horns,

<sup>92</sup> One of the rare examples where the piccolo trumpet is used to add much brilliance and an exotic colour to the brass is in Ravel's *Boléro*. In his orchestration, the piccolo trumpet is a valuable asset in providing substance and articulation in the highest range of the normal trumpet, but without the drawback of excessive volume and tension in the sound.

trumpet and lower brass perform a homophonic, harmonic passage very typical of brass sections of late Romantic orchestrations – the brass excel at these types of passages, to which they give an organ-like and stately quality that is unachievable in other instrument groups.

Figure 48 shows a musical score for the opening first movement of Grové's *Raka* (1996). The score is in 4/4 time. The top staff is for Horns, and the bottom staff is for Trumpet. The Horns part consists of a series of chords with dynamics *mp*, *pp*, *mp*, *pp*, *mp*, *pp*, *mp*. The Trumpet part features a fanfare with dynamics *p*, *p*, *mf*.

Figure 48: ( $\text{♩} = \text{c.84}$ ) Trumpet fanfares and horn padding in the opening first movement of Grové's *Raka* (1996).

In Grové, the trumpet again performs the role of military fanfare, interrupting a peaceful tonal scene with quietly insistent warnings of *Raka*'s imminent arrival. At the dynamic level required, it could be very effective for the oboe to play the material as well, although the trumpet brings with it connotations of violence and danger that woodwinds cannot. The horns also take a typical function for them by providing a kind of sound pad to the orchestra. The ability of the horns to provide sustained background sound to the orchestra has already been discussed, but here their use in a cluster gives an interesting portrayal of insect sounds in the background of Grové's sound texture.

Figure 49 shows a musical score for the opening first movement of Temmingh's *tjellokonsert* (1992). The score is in 6/8 time. The top staff is for Trumpets, the middle staff is for Trombones, and the bottom staff is for Snare drum. The Trumpets part features a series of chords with dynamics *ff*. The Trombones part features a series of chords with dynamics *ff*. The Snare drum part features a series of rhythmic patterns with dynamics *f*.

Figure 49: ( $\text{♩} = \text{c.100}$ ) Stabbing trumpets and drum, eroica-horns, and trombone triads in Temmingh's *tjellokonsert* (1992).

Throughout his concerto for cello and orchestra, Temmingh displays a penchant for uncovering the basic functions of instruments in their most idiomatic guises. His writing, which brings out the primal qualities of the instruments in the passage above, shows this to good effect. The horns, acting as a choir, take a melodic passage of an *eroica* and surprisingly vocal character. In their highest register, they are reminiscent of tenors singing in their highest tessitura. The trumpets, in contrast, take a sustained rhythmic figure (again reminiscent of a military fanfare, at least in rhythm) that is further accentuated by a snare drum. The long-standing cooperative relationship between trumpet and drums is here brought to the foreground by Temmingh. Lastly, the trombones, which are praised for performing triads in wide spacing to exceptional effect, are used for exactly that function here; however, the effect is lessened here by their application at a very high dynamic level, at which point the trombonists lose their sustaining power and subtle colouristic attraction.

The image shows a musical score for brass instruments, specifically trumpets (Tpts), horns (Hms), trombones (Tbs), and tuba (Tba), in 3/4 time. The tempo is marked as ♩ = 66. The score is divided into two systems, with the first system starting at measure 20. The key signature is one flat (B-flat). The dynamics range from *f* (forte) to *fff* (fortissimo). The score features complex rhythmic patterns, including triplets and accents, and is marked with *sim.* (sustained). The brass instruments play a variety of rhythmic figures, including eighth and sixteenth notes, and rests, creating a polyrhythmic texture.

Figure 50: Polyrhythmic brass stabs in Roosenschoon's *The Magic Marimba* (1991).

The last typical use of brass in contemporary scoring is found in Roosenschoon's *The Magic Marimba*. Because the brass family is capable of a more robust forte than the rest of the orchestral sections, brass instruments are especially effective in producing stabbing *crescendos*. In the passage above, Roosenschoon divides the brass instruments into a slow polyrhythmic texture of delayed *crescendos* and *sforzandos* in order to create a constant shift of texture and focus; in between that, the tuba, third trombone and third trumpet carry the primary material in a sustained, accented *forte*. The brass instruments are used predominantly in their high register here so that they are balanced in timbral intensity. Passages like these are found frequently in twentieth century scoring and have an especially contemporary sound quality.

## 2.7 Concluding remarks

In this Perspective, it was shown that orchestrators perceive the orchestra as a compound instrument consisting of four principle groups of instruments (strings, woodwinds, brass and percussion). Other instruments which form part of the orchestra assume an auxiliary position within that structuring. Evidence from textbooks and scores pointed to a set of internal hierarchies existing between these instrument groups. These hierarchies were shown to come from patterns of traditional use, technical development, musical traditions, economic factors, and historical influences.

The strings were shown to take a dominant position in traditional orchestral writing due to their homogenous sound, early mechanical perfection, technical versatility and ease of listening. These factors together with the unparalleled stamina of the strings contribute to a less involved technique of scoring for these instruments. It was also found, however, that idiomatic writing for the strings relies on a very thorough knowledge of the mechanics of string technique (especially bowing). The woodwinds, in contrast, were shown to undergo mechanical development much later than the strings (and continue to do so today). Woodwinds were shown to provide the orchestra with heterogeneous tone colours that orchestrators can exploit to create timbral contrasts. The brass family, like the woodwinds, only achieved a measure of mechanical perfection late in the nineteenth century, but their strength in providing the

orchestra with dynamic support caused them to assume a central function within the orchestra by the twentieth century. The timpani, which were a permanent addition to the orchestra as early as the eighteenth century, are an exception to the percussion family that only achieved permanent and substantial inclusion in the orchestra in the last 80 years. Like the brass family, percussion instruments aid in dynamic reinforcement, but like the woodwinds they also provide contrasting colour possibilities. Both the rhythmic and melodic capabilities of the percussion family have been exploited extensively since the twentieth century.

The orchestral sound, as it is known today, is the result of substantial collaboration between the four main contrasting instrumental sections. This collaboration was shown to involve a search for common sound qualities and capabilities between the instrument sections, but was also shown to involve an exploitation of the characteristic and contrasting qualities of each section. Lastly, whereas developing musical traditions have had a pronounced impact on the use of instruments in the orchestra (drastic changes in the use of the percussion section early in the twentieth century shows this), the development of individual instrumental technique has also impacted the capabilities of the orchestra as an important medium of musical expression, and has therefore contributed to the development of musical traditions in a reciprocal relationship of function.

The following diagram shows (as in the previous chapter) how some of the most important concepts of this Perspective link with each other and with other Perspectives discussed in this thesis. This is achieved in the form of a concept map of intuitive design:

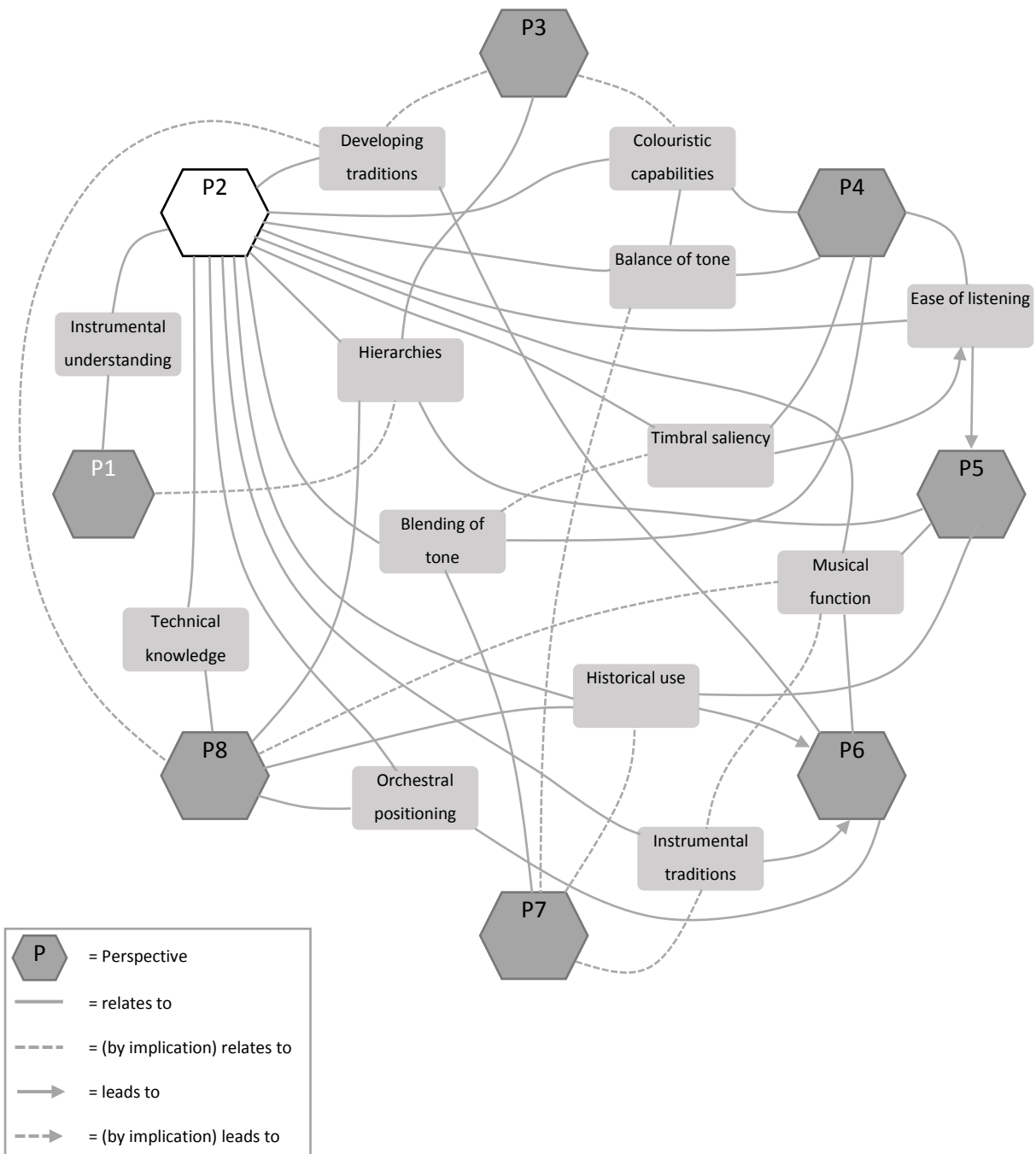


Diagram 2: Concept web showing interrelatedness of concepts in Perspective 2 with other Perspectives.

## Perspective three: Changing and interchanging of material in orchestration

### 3.1 Introduction

Change and interchange of material are prevalent ideas in orchestration textbooks and highlight a more utilitarian side of orchestration in which the instrumental and musical needs of the orchestrator at a given moment supersede either the instrumentational patterns already laid down in a work, or (in the case of transcription) the instrumentational framework provided by a composer. Sometimes the imperative to introduce change is directly referenced in a textbook, and in Widor (1906) the need to change the instrumentation at important moments in the music (like at a point of modulation) is shown to be a core principle of orchestration. The very act of transcription necessitates a change of material, so that orchestrators have developed it into notions of preservation of ideas (underlying structures) at the expense of changing material (surface structures). The orchestrational procedures of the last 200 years have also become more focused on the notion of regular change within the orchestral sound, so that interchange of material is a major component of contemporary orchestration. As will be noted in the following pages, some aspects of the orchestration procedure are more open to mechanisms of change and interchange, while other aspects are immune to one or the other. A kind of hierarchy, therefore, presents itself in the internal instrumentational mechanisms of a musical work, whereby the structures of some components like melody and harmony may generally not be changed in transcription, while other elements may; or, that when a phrasic structure is repeated in an orchestral work, it should generally not be repeated with the exact same instrumentational characteristics.

In this chapter it is impossible to separate transcription and orchestration if the matters of change and interchange are discussed; therefore, orchestral transcription, being such a prevalent part of orchestration and of learning to orchestrate, is briefly discussed in the following section before the underlying topics of coloristic structuring, timbral modulation and freedom of tone colour are explored. The manifestation of some of these ideas in orchestral music will also be shown by way of short examples and discussion; however, because the eight South African works referred to in this study were composed



originally for orchestra, and not some other instrument group, the inclusion of other examples of transcription have been necessities for discussing orchestral transcription. Addendum B (page 323), which displays a full list of orchestral examples from eight major orchestration textbooks, shows that Ravel's orchestral transcription of Mussorgsky's *Pictures at an Exhibition* is a suitable choice, because it is one of the most referenced works in orchestral literature (see Table 13, p.221), and because it is one of the most transcribed piano works of the last century (see footnote 31, p.41).

### 3.2 Some notes on changing and interchanging of material

Piano-to-orchestra transcription is an important mechanism by which students learn to orchestrate effectively, as is evidenced in all modern textbooks on orchestration<sup>93</sup>. For example, Kennan & Grantham (2002) advocate the sketching of an orchestration at the keyboard before writing out the actual score; though not strictly advocating transcription as a learning tool, the important historical link between the keyboard and the orchestral score is emphasised. An alternative to the keyboard score would be a short score (*particelli*) that sketches the basic outlines of a score for easy reference and development, normally on three staves. Klatzow (2015, personal correspondence) sketches an orchestration in this fashion on four or five staves in order to accentuate elements of form and to clarify his musical ideas. A large number of historically significant composers are also known to have orchestrated in this manner, and two significant examples of works orchestrated in this manner would include Stravinsky's *Le Sacre du Printemps* and Schoenberg's *Variations for Orchestra*. Sevsay (2013) makes mention of the importance of producing a *particelli* on the way to producing an orchestral score.

Keyboard music provides a vast and useful source of transcription material to students, from which many basic techniques of orchestration can be studied and practiced. However, a number of potentially contentious orchestrational practices and traditions, which are going to be described in the following

---

<sup>93</sup> The importance of transcription as a process by which knowledge is gained about orchestration is explained further in the chapter titled *Perspective eight: Knowledge and orchestration*, p.260.

section, also find their origin in this kind of transcription; in my research, orchestrators showed a general lack of awareness of their potentially controversial nature. Furthermore, jargon phrases like ‘spirit of the music’, ‘intentions of the composer’, ‘taste’ and ‘good judgement’ seem to point to the idea that orchestral transcription involves itself with gaining a deeper understanding of musical material so that emergent musical qualities in a work can be preserved and exploited when transcribing for another medium; also, that transcription of material implies balancing the ideas and outcomes of the composer with those of the transcriber<sup>94</sup>.

The following example taken from the final 13 measures of *Pictures at an Exhibition*, shows how two orchestrators translate the piano score to fit the expressive capabilities of the symphony orchestra. Tushmalov’s transcription is referenced, because he was the first known orchestrator to arrange the work; Ravel’s transcription is referenced, because it is the best-known arrangement of the work. Horowitz’s transcription for solo piano (1946) is also included to show how he exploits the pianistic gestures of Mussorgsky’s composition in his own concert piano interpretation. The first figure shows the original piano score, from which a number of observations can be made regarding material and idea:

1. In terms of material, a number of chords in minims and semibreves are presented, of which four are built on pedal tones (E<sup>b</sup>) in both the right and left hands. Some of the chords are too great in compass for all the notes to be played at once, so that the pedal tones are written as *acciaccaturas*. The composer has placed pauses on the first two chords and an accent on the last B<sup>b</sup> octave. In the left hand, Mussorgsky has placed the chord tones close together.
2. In terms of idea, the passage can be interpreted to represent a grandiose chordal climax to the work. The tempo indication, which asks for a slow and decreasing tempo throughout, together

---

<sup>94</sup> Good taste and good judgement are frequently referred to by orchestration authors, and seem to be firstly prerequisites for orchestration to take place (*Perspective five: Instrumental constraints and orchestrational creativity*, p.165), secondly a characteristic of effective orchestration (*Perspective seven: The meaning of effective orchestration*, p.226), and thirdly an important kind of knowledge gained through score study and frequent practice of orchestration (*Perspective eight: Knowledge and orchestration*), p.260).

with the pauses on the first two chords, could infer a *senza misura* feeling in this section. The use of *acciaccaturas* could imply that Mussorgsky would use even more chords tones if he was able. The pedal tones might have been omitted in the fourth measure to avoid their repetition creating a hackneyed effect, but in performances of Kissin (Mussorgsky, 2002) and Ashkenazy (Mussorgsky, 2006) the pedal tones in measure three are carried over via the sustain pedal through the fourth measure which seems like an appropriate interpretation of the score. The high dynamic indication of *fortissimo* implies a percussive effect and a highly energetic attack. The open B<sup>b</sup> octave, with a decrease of pitches in both hands, seems to suggest a closing off of the phrasic structure.

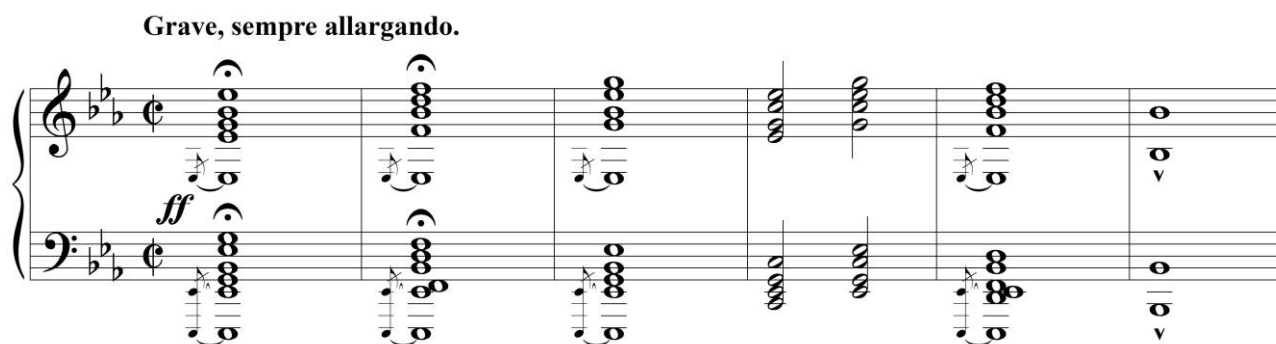


Figure 51: The start of the final climactic phrase of Mussorgsky's Pictures at an Exhibition (1874), here shows in its original form for piano.

In Horowitz's transcription, the percussive effect of the left hand, the grandiose character of the passage, and the booming quality of the pedal tones are exploited to maximum effect. In this version, the pedal tones are carried through all the measures, and the registral compass of the chords are increased considerably. The expansion of the *acciaccaturas* into trills adds greater sustaining power and sonic energy to the passage. Note that Horowitz doubles the first two measures for dramatic effect so that the passage is now eight measures long. In this version, there is a substantial change of material:

**Allegro moderato ma grave**

Figure 52: The start of the final climactic phrase of Mussorgsky's *Pictures at an Exhibition* (1874), as transcribed for solo piano by Horowitz (1946).

In Tushmalov's transcription for orchestra, closer adherence is observed to the original score. The passage has not been extended, but pauses are used as in Mussorgsky's version. The pedal tones  $E^b$  have been sustained throughout, and a standard array of percussion instruments (triangle, bass drum and crash cymbals) have been utilised together with a bell in order to enhance the *maestoso* character of the passage. The dynamic range of the passage has also been extended in the top half of the orchestra:

The image displays a page of a musical score for a symphony orchestra. The score is in 3/4 time and the key signature has two flats (B-flat major). The dynamic marking is fortissimo (ff). The instrumentation includes Piccolo, Flutes, Clarinets, Oboes, Bassoons, Trumpets and Horns, Trombones, Tuba, Timpani, Bell, Triangle, Bass Drum, Cymbals, Violins, Violas, and Cellos/Basses. The score shows the first six measures of the piece, with the first two measures being a sustained chord of E-flat major.

Figure 53: The start of the final climactic phrase of Mussorgsky's *Pictures at an Exhibition* (1874), as transcribed for symphony orchestra by Tushmalov (1886).

Ravel's transcription follows the same lines as Horowitz in some respects and Tushmalov in others. Ravel has chosen to dispense with the pauses in Mussorgsky in favour of extending the first two chords over two measures each (as Horowitz did). As in both the previous transcriptions, Ravel extends the pedal point E<sup>b</sup> through the entire phrase up until the final B<sup>b</sup>. Ravel's transcription shows greater separation of instrumental colours than Tushmalov's, but the colouristic structuring of the two transcriptions is nearly the same.

The image shows a page of a musical score for a symphony orchestra. The score is in 2/4 time and features a variety of instruments including woodwinds, brass, strings, and percussion. The music is marked with a forte (ff) dynamic and includes a tam-tam drum. The score is arranged in a standard orchestral layout with multiple staves for each instrument group.

Figure 54: The start of the final climactic phrase of Mussorgsky's *Pictures at an Exhibition* (1874), as transcribed for symphony orchestra by Ravel (1922).

As a topic of discussion, orchestral transcription (although described in the bulk of instructional texts from the twentieth century) feature most prominently in Jacob (1956)<sup>95</sup>, Wagner (1959) Kennan & Grantham (2002) and Adler (2002). In these texts, the subject of transcription is not only discussed, but also to some extent defended, probably in reaction to views of other orchestrators who describe orchestral transcription as existing on a lower artistic level than orchestral composition<sup>96</sup>. Jacob defends transcription by stating that the ability to arrange music for another medium than it was originally designed for is an important part of any musician's technical equipment, not only the composer. It provides the transcriber with a deeper knowledge of the material that could not be gained otherwise (like by analysis alone). Adler

<sup>95</sup> All the examples shown in Jacob (1956) are devised and orchestrated by the author himself.

<sup>96</sup> Orchestral composition versus orchestration transcription is discussed in the introduction of this thesis. Hofmeyr (2015, personal correspondence) for instance writes that ideally, orchestration should mean "writing for orchestra rather than arranging for orchestra", because the orchestrator should "think directly in orchestral terms when conceiving an orchestral work".

promotes the subject of transcription in his text, noting that a large number of orchestral works from the standard repertoire find their origin at the keyboard<sup>97</sup>; in Widor (1906), Jacob (1956) and Wagner (1959), many examples are self-devised orchestral transcriptions of keyboard works. There is an advantage to transcribing music for the orchestra, Kennan & Grantham (2002) state, because the orchestra is capable of articulating a greater number of colours and textures than any keyboard instrument or small ensemble – the orchestra can communicate musical lines with a clarity and independence that brings to the music a three-dimensional quality that is unobtainable on other instruments or ensembles<sup>98</sup>.

In the following example, Mussorgsky's version of the fourth movement of *Pictures at an Exhibition* (*Bydlo*) is shown at the top, while Ravel's orchestration of the passage is shown below that. Ravel's orchestration is an excellent example of how the different instrument groups and registers of the orchestra can be used to enhance the 3-dimensionality of a passage's textural layers. Whereas the homogeneous timbre of the piano sound hinders the differentiation of the various harmonic and melodic mechanisms of the passage, the heterogeneous timbres of the symphony orchestra facilitate in separating these components:

---

<sup>97</sup> Stravinsky's early ballets (and perhaps most importantly *Le Sacre du Printemps*), all but three of Ravel's orchestral works, and a number of works by Strauss, are listed by Adler as examples of orchestral works originally composed at the piano before being transcribed for symphony orchestra by the composers themselves.

<sup>98</sup> This three-dimensionality of the symphonic orchestral sound is a product of the contrasting qualities of the various instrument sections, as well as the contrasting manners in which they contribute to the orchestral sound. See *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

The image displays a musical score for measures 21-26 of 'Bydlo' from Mussorgsky's *Pictures at an Exhibition*. It is presented in two systems. The top system is the original piano score, featuring a grand piano (pp) dynamic at the start, which gradually increases through a crescendo to a forte (f) dynamic by measure 26. The bottom system is Ravel's orchestration, which begins with a mezzo-forte (mf) dynamic and also includes a crescendo leading to forte (f). This orchestration introduces various instruments: Oboes (Obs.), Clarinets (Cls.), Bassoons (Bsns.), Harp, Violins 2 (Vlns 2), Violins (Vlns), Violas (Vcls), and Basses playing pizzicato (Basses pizz.). The score is written in 2/4 time and D major.

Figure 55: Measures 21-26 of *Bydlo* from Mussorgsky's *Pictures at an Exhibition* (1974), showing the original piano score (top) and Ravel's orchestration (1922).

The first contentious problem in orchestral transcription involves the literal rewriting of material from one instrument, often the piano, to the orchestra. It is not customary in orchestral transcription to preserve material literally and with exact precision, so that it is possible that pitches may be moved to other octaves or different instruments, may be articulated differently, may be doubled over several octaves, completely omitted, or changed in a number of other ways. Ravel, in his orchestral transcription of Mussorgsky's *Pictures at an Exhibition*, even adds extra material to his version that was not composed in the original<sup>99</sup>. The pitch and rhythmic material of a composition therefore becomes malleable in the orchestration process. Two exceptions to this malleability-principle of material are the melody and the harmony, which may generally not be substantially altered in a transcription (except by transposing the whole work to a different key, which is acceptable). A number of transcriptions, which do make substantial

<sup>99</sup> Ravel's orchestration omits the fifth return of the promenade, repeats small sections of linking material in a number of movements, and lengthens the duration of certain chords (as shown in Figure 54) to increase dramatic effect.



changes to harmonic or melodic frameworks, are often rather viewed as arrangement or recompositions<sup>100</sup>. Kennan & Grantham state this last rule of preservation of harmony and melody explicitly. With these thoughts to inform the orchestrator, the reader is led towards understanding orchestral transcription (and by inference, orchestration) as existing in a state of tension between what is material and what is idea in music. The idea must be preserved at all times, although the material may change to varying degrees in order to suit the judgement and requirements of the orchestrator.

In Parrott (1957), Jacob (1956), Wagner (1959), Adler (2002), Kennan & Grantham (2002) and Sevsay (2013), the tension between material and idea is articulated as the difference between transcribing music literally and interpreting the music in order to preserve its fundamental intentions (while changing some elements). Jacob writes that to transcribe literally will be to ignore the intentions of the composer and therefore represent his intentions inadequately. Adler also refers to an understanding of the intentions of the composer as a fundamental aspect of orchestrating a work written originally for another instrument. It is unlikely, however, that musical analysis of a score can reveal to the orchestrator the intentions of a composer, although it can provide more insight into the mechanisms that give the music a sense of coherency<sup>101</sup>. What is likely meant by Jacob and Adler is that the musical purpose served by an instance of musical material in a score can be revealed or interpreted through its analysis, and is more important than the material itself when transcribing it for orchestra. Kennan & Grantham (2002) advocate translating the effect of the material in question rather than the material itself as a better solution to orchestral transcription. Adler and Jacob refer to the translation of musical idiom as the point of departure for orchestral transcription, advocating a change of material in order to preserve the spirit of a work.

---

<sup>100</sup> Lutosławski's transcription of Paganini's 24<sup>th</sup> Caprice first for two pianos and later for piano and orchestra, which follows the same structure as the original, makes considerable changes to its harmonic and melodic paradigms. Whether it should still be called a transcription or rather be labelled as a recomposition/arrangement is debatable.

<sup>101</sup> The intentions of the composer is a contentious matter in musical analysis. Whereas analysis can reveal much detail about the musical text itself, it is not really possible to presume that it gives the analyst access to the inner workings of the mind of the composer. The reader is referred to Nicolas Cook (1994, 2015) for more about this.

As one could expect from a well-developed branch of orchestration, some traditions are well-rooted in orchestral transcription of piano music specifically. Thick chords that are registerally spaced far apart in the piano, or almost any close-spaced chords in the lower register of the instrument, will generally be reconstructed in order to place wider intervals in the bass and to even out registral distribution of pitches throughout. Beethoven, in his piano sonatas (*Hammerclavier* opus 106 is a good example), often uses close-spaced chords in the bass for percussive harmonic effect, but this is not preferred practice in the orchestra where an even spread of tones according to overtone series is preferred (Parrott, 1958; Kennan & Grantham, 2002; Adler, 2002)<sup>102</sup>. Thickness of sound, which is often used for special effects in keyboard literature, is avoided in orchestral writing where clarity of sound and texture takes precedence, unless a thick sound lacking in clarity is the specific aim of the orchestrator<sup>103</sup>. Another pianistic effect which is regularly altered when writing for orchestra is that of the arpeggio, or often any effect of an arpeggiated nature. Broken chords are mostly omitted entirely when transcribing for orchestra (Jacob, 1956), or they are changed by large to suit the orchestral medium better without altering the harmonic framework (Kennan & Grantham, 2002). Orchestral arrangements can often be improved upon by finding alternative figures for pianistic effects and arpeggios that are technically more suited to the instruments of the orchestra, thus ensuring a better performance of the music (Adler, 2002).

The following figure shows the opening four measures of the last movement from Mussorgsky's *Pictures at an Exhibition*, with the original piano version at the top, and Ravel's orchestration below. Note how the thick voicing of chords in the left hand of the piano is revoiced in Ravel to have wider intervals in the bass register and to fill in the gap between the left and the right hands. Octaves and fifths at the

---

<sup>102</sup> The overtone series, which is called into play when sounds are doubled vertically, is discussed in the following sections of the thesis: *Perspective seven: The meaning of effective orchestration*, p.226; *Perspective five: Instrumental constraints and orchestrational creativity*, p.165; *Perspective four: An orchestrator's view on hearing and sound perception*, p.141.

<sup>103</sup> The relative effectiveness of such an effect is discussed in *Perspective seven: The meaning of effective orchestration*, p.226, while the characteristic of sound that allows it to be described as thick is discussed in the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception*, p.141; lastly, the goal of clarity in orchestral sound is discussed in the section titled *7.3 Clarity of effective orchestration*, p.242.

bottom of a chord have the added advantage of increasing the resonance of the sound, because overtones are in greater agreement. The orchestra is more susceptible to sounding dull if overtones are in not in alignment with each other, but the brass section is able to produce a bright and sonorous sound if chords are voiced according to the overtone series. In this passage, which is marked *forte*, increased resonance appears to be preferable:

Figure 56: The opening four measures of the last movement of Mussorgsky's *Pictures at an Exhibition* (1874), showing the original piano version (top) and Ravel's orchestration (1922).

In piano writing, as with most solo instrumental writing, the vertical doubling of sound is a special effect employed to enhance certain features of the music<sup>104</sup>, whereas vertical doubling is a standard procedure in orchestral writing. As two extreme examples, polyphonic writing of the Renaissance and Baroque as well as serial music of the twentieth century would generally consider vertical doubling of a line as inappropriate practice. Even in romantic keyboard music of the nineteenth century, vertical doubling is less often utilised than would generally be thought. Take, for example, Felix Mendelssohn's *Song Without Words* op.19b no.1 in which the melody is never doubled at any interval, and compare it to his third *Song Without Words* op.19b no.3, where considerable doubling is employed. The composer is able to create contrasting sound worlds because of his use of vertical doubling. Orchestral writing, by contrast, has a rich

<sup>104</sup> Most often in solo literature, melodic material is doubled at the octave or at several octaves to increase its resonance and prominence within a texture. In the last movement of Beethoven's first piano sonata (opus 2 no.1), the doubling of the melody at the octave enhances its cantabile qualities, while doubling the melody in chords produces a richer, more percussive sound.

tradition of vertical doubling, especially when transcribing music from another instrument. As Parrott (1957) states, one should not refrain from doubling at the octave in the orchestra only because the original instrument is not able to (like the flute, for instance).

The practice is so common, in fact, that general rules for doubling have been devised by authors such as Kennan & Grantham (2002) and Adler (2002); these rules state that octave doubling may be employed at any time according to the effect aimed towards, or that even in polyphonic music of Bach the top voice may be doubled higher and the lowest voice an octave lower. As a general guideline, Jacob (1956) states that the top three voices of any given harmony may be reduplicated above, and the bass an octave below. Such changes of sonority, Piston (1961) argues, is part of the transcribing process, because (as was previously stated) the two instrumental forces have different idioms and traditions that will necessitate a change of material in the translation process. Two further reasons are given for this rule: firstly that the most-used middle register of the piano does not read well in the orchestra and necessitates expansion via octave reduplication<sup>105</sup> (Kennan & Grantham, 2002), and secondly that octave doubling should not be considered as adding an additional texture, but a widening of the vertical plane of sound that is mostly perceived as a single sound unit (Piston, 1961)<sup>106</sup>. Questions of style and historical practice aside, this freedom of vertical doubling shows how orchestration has developed to utilise fully the qualities of sonority and register that are inherent to the orchestra.

The following example displays typical registral expansion in the orchestra by the woodwinds and strings of a passage written originally for piano. In the figure below, the final four measures of the opening promenade from Mussorgsky's *Pictures at an Exhibition* is shown with the original piano part at the top and

---

<sup>105</sup> See *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141.

<sup>106</sup> Arguably, other intervals than the octave can be included here if they fall within the overtone series. In Ravel's *Boléro*, at the eighth occurrence of the main theme, two piccolos double the horn melody at the second and fourth overtones (Perfect 12<sup>th</sup> and Major 17<sup>th</sup>) while the celesta doubles it at the 3<sup>rd</sup> overtone (two octaves); here the overtone doublings are marked sufficiently softer than the melody to be absorbed into its tonal weight and form a single sound unit. This is reminiscent of the organ, which regularly utilises overtone doublings via mutation stops or *aliquots*.

Ravel's orchestration of it below. In order to maintain resonance and weight in the passage, the piano part must be limited to the lower and middle registers of the instrument where longer and thicker strings preside. In the orchestra, however, the upper woodwinds and strings gain greater brilliance in their upper tessituras, so that registral expansion is a convenient manner to drive a passage to its climax.

The image displays a musical score for the final four measures of the opening promenade of Mussorgsky's *Pictures at an Exhibition*. The score is presented in two parts: the original piano version (top) and Ravel's orchestration (below). The piano version is written for a grand piano in 6/8 time, featuring a melody in the right hand and a bass line in the left hand. The orchestration is written for a full orchestra, with parts for Woodwinds, Brass, and Strings. The woodwinds and brass parts are marked with a forte (*f*) dynamic, and the strings are also marked with a forte (*f*) dynamic. The orchestration uses a variety of instruments to create a rich, textured sound, with the strings providing a solid foundation and the woodwinds and brass adding color and brilliance. The score is written in a standard musical notation style, with treble and bass clefs, a key signature of one flat, and a 6/8 time signature.

Figure 57: The final four measures of the opening promenade of Mussorgsky's *Pictures at an Exhibition*, showing the original piano version (top) and Ravel's orchestration (below).

Another well-described orchestrational practice that centres on changing of material, deals with the concept of constant shifting and interplay of colour. This practice is related to some degree to the concepts of vertical doubling that were discussed previously. After the orchestral music of Debussy and Ravel, symphonic orchestration has generally taken strongly to the ideas of colour change and interchange; if one assumes that the goal of orchestration is to define or articulate the form or structure of a musical work,

then effective tone colour development becomes a vital tool to the orchestrator<sup>107</sup>. The symphonic orchestra, being a compound instrument of many different instrumental colours, is well suited to differentiate a large number of sound colours with detail, and often colourful works are commended for the orchestrational skill that they display. Ravel's *Boléro* is an excellent example of a twentieth century orchestral work that is focussed exclusively on colour techniques and development<sup>108</sup>, which is considered a masterpiece and is regularly performed<sup>109</sup>. In orchestral music composed after 1900 (and even as early as Beethoven<sup>110</sup>), it is uncommon to find immediate repetition of material with the exact same instrumental colours; this is perhaps why Piston (1961) and Adler (2002) advocate changing the instrument combination in order to maintain interest in the music<sup>111</sup>. Following Carse (1964) and Del Mar (1983), who give extensive expositions of the development of orchestration and the orchestra throughout their histories, it seems likely that late romantic and twentieth century orchestrational focus on colour change is a natural development of antiphonal techniques of the Baroque and Classical periods.

Following is a table that outlines the melodic and rhythmic structure of Ravel's *Boléro*, showing all the thematic entries throughout the course of the work. Each entry takes place with a different instrumental combination, so that there is a constant interchange of timbre within the unchanging melodic and rhythmic patterns.

---

<sup>107</sup> Some central functions of orchestration that tie in with the concept of effective orchestration, such as definition of form, is discussed in the chapter titled *Perspective seven: The meaning of effective orchestration*, p.226.

<sup>108</sup> In an interview with *The Daily Telegraph* in July 1931, Ravel himself called his *Boléro* "a piece lasting 17 minutes and consisting wholly of orchestral tissue without music – of one very long, gradual crescendo".

<sup>109</sup> Both *The Guardian* and *The Daily Mail* have printed articles pertaining to the number of times Ravel's *Boléro* has been performed, claiming that it is one of the most frequently performed classical work of all time with a gross royalties income of \$60 million (Henley, 2001; The Daily Mail, 2009). These claims are, however, likely exaggerated, and no official statistics could be consulted for reference in this study.

<sup>110</sup> Already in his first symphony (example mm. 33-41 and 45-49), Beethoven intersperses strings with winds in various combinations in order to procure a sense of coloristic development from melodic repetition.

<sup>111</sup> Here Adler (2002) uses the term "dovetail" to describe the gradual transition of one colour to another by having the instruments overlap – a term which is first seen in Gordon Jacob's *Orchestral Technique: A Manual for Students* of 1956 and presumably borrowed from there by Adler. Blatter (1997) and Kennan & Grantham (2002) also make extensive reference to dovetailing.

Table 8 -- Development of instrumental colours throughout Ravel's Boléro (1928):

Entries of the main themes	Instrumental division		
	Rhythmic accompaniment	Melodic instrument	Harmonic accompaniment
1 <sup>st</sup> A	Snare drum (remains throughout)	Flute	Violas pizzicato, Cellos pizzicato
repeat	Flute	Clarinet	same
2 <sup>nd</sup> B	Flute	Bassoon	same plus Harp
3 <sup>rd</sup> B	Flute	E <sup>b</sup> piccolo clarinet	same
4 <sup>th</sup> A	Bassoons	Oboe d'amore	Strings except 1st Violins
5 <sup>th</sup> A	Horn	Flute, Trumpet con sord.	Strings except 2nd Violins
6 <sup>th</sup> B	Trumpet con sord.	Tenor saxophone	Flutes, Strings
7 <sup>th</sup> B	Trumpet con sord.	Saxophone	Strings, Oboes, Cor anglais
8 <sup>th</sup> A	Flute, Horn	Horn, Piccolos, Celesta	Strings, Harp, Bassoons, Bass clarinet
9 <sup>th</sup> A	Trumpet con sord., Horn, Violins, Violas	Oboe, Oboe d'amore, Cor anglais, Clarinets	Strings (remainder), Trumpets con sord., Harp, Bass clarinet, Bassoons
10 <sup>th</sup> B	Violas, Flute, Horn	Trombone	Strings (remainder), Clarinets, Bass clarinet, Harp, Contrabassoon
11 <sup>th</sup> B	Trumpet senza sord., Horn, Violins	All woodwind except Bassoon/Contrabassoon, Tenor saxophone	Strings (remainder, Violas pizz.), Harp, Bass clarinet, Bassoon, Contrabassoon
12 <sup>th</sup> A	Horns	Flutes, Oboes, Clarinets, Piccolo, Violins	Strings (remainder, 2nd Violins pizz.), Horns, Timpani, Bassoons, Contrabassoon
13 <sup>th</sup> A	Horns	same plus Cor anglais, Tenor saxophone, 2nd Violins	Sopranino saxophone, Harp, Bassoon, Contrabassoon, Horns, Timpani
14 <sup>th</sup> B	Horns, later, 2nd Horn will turn to the theme (interchanging with the 1st Trumpet)	All woodwind except Clarinets, Bassoon and Contrabassoon, Trumpet, Violins, Violas, Bass clarinet (later)	Clarinets, Bassoons, Contrabassoon, Tenor and Sopranino saxophone, Trombone, Tuba, Timpani, Harp, Strings
15 <sup>th</sup> B	All Horns	All woodwind except Bassoons and Contrabassoon, Sopranino saxophone, Trombone, Violins, Violas, Cellos	Bass clarinet, Bassoon, Contrabassoon, Trumpets, Trombones, Tuba, Timpani, Harp, Double basses
16 <sup>th</sup> A	Oboes, Clarinets, all Horns, Violins, Violas, Cellos	Flutes, Piccolo, Trumpets, Piccolo trumpet, saxophones, 1st Violins	Bass clarinet, Bassoons, Contrabassoon, Trombones, Tuba, Timpani, Harp, Double basses
17 <sup>th</sup> B	same	same	same
Final climax: all instruments			

Lastly, one can garner evidence of one other orchestrational practice by looking at one statement of Adler (2002), that there would be no reason not to transcribe a work to a particular medium because it contains, for example, an English horn solo that would not sound right on any other instrument. In contemporary orchestration, the idea that a musical idea could only sound satisfactory on any one instrument is strongly negated; the opposite is advocated, in fact, that new and interesting colours and combinations should be utilised to bring new nuance of meaning to an existing musical line. Often, the

choice of an instrument or instrument change is dependent on the registral strength or an orchestrator's personal taste for registral colour; an instrument of the same or similar family should take over material from an instrument that is no longer in a suitable position to perform it well<sup>112</sup>. Jacob (1956) writes that the oboe, which sounds thin and ineffective in its highest register, can rather be replaced by the superior sounding flute in that range. To some, however, the different modes of sound production between these two instruments might make them incompatible to replace one another in this way. The contrabassoon is quoted as another such example by Kennan & Grantham (2002), which should according to them be replaced by the bassoon or bass clarinet rather than playing in its high range. Again it might not always be a case of fortuitous instrumentation, but a conscious choice of colour. In other cases it might be out of necessity that the orchestrator replaces one instrument with another; it is described by Jacob (1956), for instance, as effective to replace four horns with two horns and two bassoons when four horns are not available<sup>113</sup>. These kinds of interchanges can aid the composer in achieving or mimicking colour effects that were previously out of reach or scope. In the previous examples (Figure 53, Figure 55, Figure 56, Figure 57), the bassoons are regularly called on to assist the brass in passages where greater volume and resonance is required.

### 3.3 Concluding remarks

This chapter, which mostly focussed on transcription as a tool with which to learn orchestration, showed how material is constantly changed in orchestral writing. This focus of change and interchange of material emerges as both an instrumental and a musical imperative. Hofmeyr (2015, personal correspondence) for instance wrote that creative orchestration is the core principle of scoring for orchestra, and that the orchestra offers an almost infinite source of possibilities of individual and collective

---

<sup>112</sup> The woodwinds and brass are especially dependent on this mechanism, and much of their development as instrumental groups has occurred in order to even out these registral problems. For more on this, see the chapter titled *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

<sup>113</sup> Horns and bassoons share a long standing relationship of support and sharing material that is born of their ability to blend well with each other. This relationship is further described in the section titled 2.2 Instrument families, p.55.



timbres. Klatzow (2015, personal correspondence) avoids utilising the same instruments for too long in his orchestration, because the eventual sound result becomes uninteresting or “bland”<sup>114</sup>. Therefore, the given material, whether it is the orchestrator’s own or provided by another composer, is subject to change at a timbral level, but also sometimes at a rhythmic, harmonic or melodic level. In the process, the differences of contribution between orchestrator, transcriber, arranger and composer become somewhat blurred.

The educational contribution of transcription is highlighted in this chapter as a method with which students can gain knowledge about abstract musical ideas that are inaccessible in textbook learning. Good taste and judgement are referenced as examples of concepts that play an important role in successful orchestral transcription, and by inference in the changing and interchanging of material written for orchestra. In order to achieve idiomatic orchestration, the pitch and rhythm material sometimes must be changed to similar material that preserves the idea of the music. There is a tension between idea and material in orchestration that is highlighted in this chapter; material is often altered in order to give preference to idea. Analysis of the musical material before orchestration commences is shown to be an important mechanism in gaining the necessary knowledge about the idea of the music.

Lastly, the use of vertical doubling as a standard tool in orchestration and orchestral transcription is shown to be based to a large degree on the natural spread of intervals within the overtone series. Vertical doubling occurs so frequently in orchestration that authors have devised generic rules by which orchestrators can perform doubling safely. Doubling becomes another mechanism with which colour change and interchange is secured.

As in previous chapters, a number of key concepts that are discussed in this Perspective of orchestration practice is displayed in the diagram below in order to show how they relate to other chapters of this thesis:

---

<sup>114</sup> The overuse of a single colour is described in *Perspective 4* (p.141) as a major contributing factor to aural fatigue, so that regular changes in timbre is necessitated as a characteristic of effective orchestration. See *Perspective seven* (p.226) for more about effectiveness in orchestration.



## Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra

### 4.1 Introduction

This category concerns itself with the physical and psychological aspects of hearing that are regularly mentioned and discussed in orchestration textbooks. It will be shown that orchestrators are generally aware of the basic tenets of psychoacoustics, although in colloquially transmitted or traditional contexts and not in scientifically informed ways. These principles relate to perception of loudness, timbre, audio masking, saliency and weight. I attempt therefore to highlight the central concerns of orchestrators and describe them according to the psychoacoustic principles by which they are underlined. It was mentioned previously in another chapter that Casella & Mortari (2004) is the only source that dedicates full sections to describing the basic propagation of sound from a string or tube, looking at how various physical properties affect the overtone composition and projection of sound – it is however not substantial enough to provide more than a rudimentary understanding of the subject.

The largest section of this chapter focusses on human hearing, spectral sensitivity and the concept of aural fatigue (the most often mentioned psychoacoustic procedure in all sources about orchestration). The importance of echoic memory to the orchestrator is discussed afterwards, and a short section is dedicated to the role of echoic memory of the audience as well (although it is not much mentioned in orchestrational texts, it is relevant in this context). Lastly, some supplementary ideas are discussed, particularly those surrounding tonal weight and the overtone series.

### 4.2 The effect of human hearing and of aural fatigue

The effect of sound on the human ear in the context of symphonic orchestration is referenced in all textbooks about and treatises on orchestration from Berlioz through Sevsay. This attests to the fact that, as their primary goal, orchestrators should aim towards a musical product that is heard in a performance

situation by audience members at least as much as they should consider other musical factors in their orchestration. Parrott (1957) states as a further point in this regard that the effect on the listener of an orchestration is at least as important as the comfort of the performer. This statement draws a direct link between orchestrator, performer and audience member and considerably widens the scope of orchestration, which could otherwise have been perceived as focussed only on the score, theoretical principles, or a collaboration with performing musicians. It is, however, impossible for an orchestrator to write for the exact needs of all listeners of the performance product, so that an audience is rather hypothesised for the purposes of formulating the orchestration. Most likely, orchestrators (like composers) write for their own needs, casting themselves in the role of an audience member in order to test various acoustic and psychoacoustic ideas. The hypothetical audience (“the listener” that is referred to in nearly every orchestration textbook) becomes a central consideration in the orchestration process.

One of the primary considerations that revolve around the hypothetical audience is that of aural fatigue. The concept of aural fatigue, i.e. that a listener can grow tired of or become strained from listening to a sound, impacts on how orchestrators utilise instruments in the orchestra, what duration they use them for, and how they combine them with other instruments. Although they are not exactly the same thing, the concept of maintaining aural interest in a musical work functions about the same way – it seems plausible that it could be considered as the complimentary force to aural fatigue. Orchestration books hold unanimous agreement that aural fatigue should be avoided, because effective orchestration holds the attention of the audience members without tiring them unnecessarily<sup>115</sup>. Factors that influence decision-making processes here involve the sound quality of an instrument, the frequency range in which it is used, and how well it can shift between foreground and background textures – together these factors determine how long an orchestrator can make use of an instrument before causing the hypothetical audience (and by extension, the real audience) to experience aural fatigue. The physiology as well as the psychology of hearing should be well understood if an orchestrator aims towards a thoughtful and constructive

---

<sup>115</sup> The effectiveness of orchestration is paramount and the effect of an orchestration on the listener should by extension be effective. Effectiveness as a characteristic of orchestration is discussed further in another chapter of the thesis: *Perspective seven: The meaning of effective orchestration*, p.226.

engagement with these limits; what is striking, however, is the imprecise and colloquial way in which hearing and inner-hearing are described by modern orchestration authors, when many of the principles described by them are well studied in the field of acoustics and psychoacoustics.

Some ideas that are discussed elsewhere in the thesis are intimately tied to the effects of hearing and inner-hearing. Take from the previous chapter, for instance, the idea often stated in Jacob (1956) and Kennan & Grantham (2002) that the middle register of the orchestra is less telling over time, and should be enhanced by a broadening of the sound plane to higher and lower octaves<sup>116</sup>. What the source is describing is, in fact, a combined effect of the equal-loudness contour of the human ear and the principle of temporary hearing threshold shifts. The former is a graphic representation of the sound pressure level (dB SPL) over the range of audible frequencies that are perceived as being of equal loudness, and shows how sensitive the human ear is to certain frequencies in comparison to others (Figure 58, Robinson-Dadson curve ISO 226: 2003, displayed on p.144). The equal-loudness contour shows that human hearing is most sensitive in two places: firstly around the frequency range of 1000Hz and again around 4000Hz; human speech vowels and consonances, and many of the smaller instruments in the orchestra function within these ranges (Zwicker, 2006); the articulative sounds of string bowing occur around the upper peak as well. The latter (temporary hearing threshold shifts) describes how the human ear compensates for the constant stimulus of a frequency band by employing vasoconstriction in the organ of Corti and the cochlea, with the result that the ear becomes less responsive to these frequencies until blood circulation is re-established (Miller, Ren, Dengerink, & Nuttal, 1996). This function serves two purposes: the first is a protective measure to prevent damage to the hearing organs, while the second attempts to filter out background noises and make hearing more functionally suitable for humans. The predominant focus of orchestration on the constant shifting of colour becomes better understood within this context.

---

<sup>116</sup> This statement points to one of the central components of effective orchestration, namely that of change and interchange of material. See the chapters titled *Perspective three: Changing and interchanging of material*, p.122, and *Perspective seven: The meaning of effective orchestration*, p.226.

The combined effect of these two features of human hearing is that the ear, which is generally more sensitive in the middle-high range, will also be more susceptible in this range to physiological response-inhibiting reactions if exposed to constant stimulus, causing decreased sensitivity to finely nuanced details in the musical material, more so than in higher or lower ranges of hearing. Within the area of sensitivity between 1000-4000Hz, there is also a local decrease in sensitivity at ~2000Hz. This is the range in which a person perceives the first number of timbre-determining overtones of a sound produced in the octave around C4 (middle C). A decrease in sensitivity here would contribute to what Kennan & Grantham perceived earlier as a register that does not speak well in the orchestra, not necessarily because the instruments fail to speak well here, but because of physiological and psychoacoustic factors of human hearing that cause a dulled perception of sound in comparison to other hearing registers.

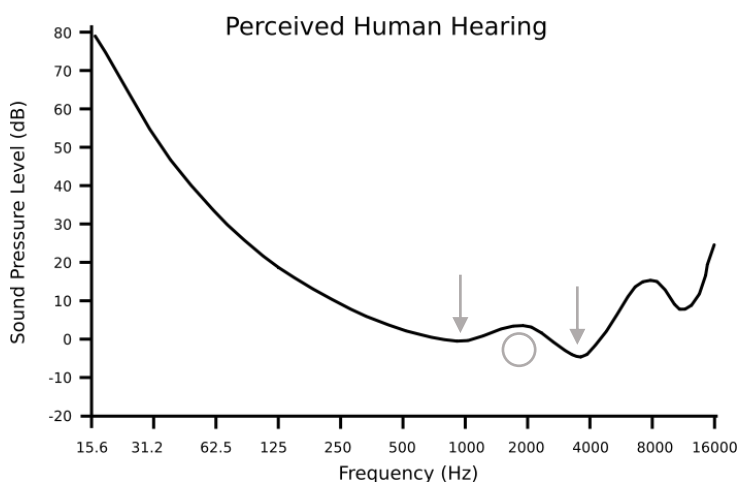


Figure 58: One of a set of Robinson-Dadson curves (ISO 226: 2003) showing the equal-loudness contour of the human ear. Peak sensitivity, according to this curve, occurs at ~1000Hz and ~4000Hz.

With a return to the earlier topic of aural fatigue, which is a concern voiced often by orchestrators, five factors stand out as central to the problem.

1. The first factor relates to the length of time that an instrument is utilised at once by the orchestrator. An instrument that is used for too long becomes less interesting to listen to and is said to

tire the listener's ear (this ties in most closely to the principle of maintaining aural interest in the music that was mentioned earlier). In contrast to this, the first entry of an instrumental colour after a prolonged absence of that specific timbre could be said to reinvigorate the listener's ear and create renewed interest in the music. Compare the two ideas, 1) that an instrument should not be used too long a time, because its tone will tend to pall (Kennan & Grantham, 2002) with 2) that an instrument will sound very fresh at the first moment their sound colour appears in the work (Adler, 2002). The human ear, being more sensitive to higher and lower registers, is also more sensitive to experiencing aural fatigue in these registers.

2. The second factor relates significantly to the first, and deals with instrumental colour. A highly coloured instrument will cause aural fatigue more quickly than one which is less distinctive<sup>117</sup>. In support of the former, Kennan & Grantham (2002) state, for instance, that the highly coloured timbre of an instrument like the oboe becomes tiresome if used for too long at once. In support of the latter, Piston (1961) advises that strings be used to carry more of the music than winds and brass, because listeners do not tire of hearing string tone as soon as they tire of wind tone<sup>118</sup>. It is, acoustically and psychoacoustically, not simple to explain why this would be true. Possibly, an important point of terminology to look towards is that of colour and what the impact of a highly coloured instrument might be within the orchestral texture. In a study by Chon and McAdams in 2012 entitled *Exploring instrument blending as a function of timbre saliency*, the researchers looked at the potential for instruments to blend in an isolated environment as a function of timbre saliency<sup>119</sup>. They found that

---

<sup>117</sup> Although the comparative colour intensity of instruments are referred to in many sources, there appears to be little consensus on the exact qualities of colour intensity. It is still possible, however, to provide the reader with an Addendum that displays graphically the colour intensity relationships between various instruments of the orchestra in different registers or octaves. See Addendum C.

<sup>118</sup> This ability of the strings to sustain sound for longer without causing aural fatigue is one of the most significant contributing factors to the strings' centrality in orchestration. See the section titled *2.3 The foundational role of strings in the orchestra*, p.56.

<sup>119</sup> Saliency refers to the quality of a sound to be able to draw attention from a listener (Chon & McAdams, 2012, *Investigation of timbre saliency, the attention-capturing quality of timbre*). It is a product of overtone construction and timbre, perceived loudness, attack speed and duration. The saliency of an instrument becomes higher with a faster

instruments which displayed a high level of saliency did not blend well with other instruments and tended to maintain independence within the sound combination. In another study conducted in 2013 by Akira, Tanaka, Iwamae, Kim, Yamano and Watanabe, they found that listeners who were subjected to six minutes of sound with little or no timbre variation (in one experiment: a ticking metronome) described the experience as fatiguing. A ticking metronome integrated with a changing musical texture, however, was experienced as less fatiguing. Solo instruments have been shown to be timbrally less prone to fluctuation than a group of instruments playing together, which in contrast displays a large array of pitch and colour variation (Ward, 1970); for that reason, solo instruments are more prone to cause aural fatigue. These factors of timbral constancy, saliency and blend, viewed in combination, could contribute to the predicted differences in aural fatigue experienced by listeners when exposed to instruments of more or less characteristic tone colour.

3. The third factor deals with the perceived sound weight<sup>120</sup> of lower frequency sounds, which carry more kinetic energy than higher frequency sounds at the same perceived volume, and therefore contribute more readily to listener fatigue and temporary threshold shifts in hearing. Orchestrators advise that bass instruments in the orchestra should be used sparingly in order to prevent listener fatigue. Jacob writes, for example, that the continuous use of double basses will quickly lead to aural fatigue and become an irritation to the listener. Another factor involved here could be that of sound masking, where a high-energy sound at one frequency will reduce a listener's ability to perceive another sound carrying lower energy (Gelfand, 2004). In the study conducted in 2013 by Akira et al., the researchers found that listeners perceived severe short-term auditory fatigue when straining to discern musical material from the higher energy sounds (like reverberant bass) that mask them. This problem of kinetic energy affects bass instruments more, because of their larger size that allows

---

attack, played at a high level of loudness and for a moderate duration. Instruments and instrumental registers that are colloquially described as distinctively or highly coloured, like the oboe or the chalumeau register of the clarinet, correlate to findings in Chon's and McAdams's study of a high level of saliency. Tordini (2014) rates a sound as salient when selecting it among others is "as easy" as detecting it in isolation.

<sup>120</sup> Sound weight is discussed to greater length later in this chapter.



greater amounts of kinetic energy to be converted into sound; one might note that the Robinson-Dadson curve ISO 226:2003 in Figure 58 (p.28) displays a severe decline in sensitivity at lower frequencies because of their tendency to carry greater amounts of sonic energy.

4. Percussion seems to be problematic within the orchestra and is the fourth contributing factor to aural fatigue. Here the problem is not only the sound qualities of the various percussion instruments, but also the fact that the majority of material assigned to percussion instruments is of a rhythmic quality. In the study by Akira et al. (2013) mentioned previously, it was found that the degree to which instruments were perceived as being able to blend well with others was influenced strongly by the relative strength of their attack. Instruments with less percussive attacks (colloquially referred to as softer or slower attacks), like the clarinet, French horn or flute, showed the greatest variation in their perceived ability to blend with others. Inversely to this, instruments with percussive attacks (colloquially referred to as sharp or aggressive attacks), like the piano, harpsichord or mallet instruments showed the least variation in their perceived abilities to blend with other instruments<sup>121</sup>. Percussion instruments and the piano also showed the highest level of saliency within the orchestra. Therefore, percussion instruments not only showed the greatest tendency to stand out in an orchestral texture, but were perceived most consistently as doing so. In a study conducted by Francesco Tordini (2014), it was found that 38% of the perceived loudness of a sound was dependent on its saliency, and that there were only minor differences between perceived loudness and measured loudness. Logically, the high saliency of percussive instruments will contribute to them being perceived as louder than other instruments, which in turn will lead to a faster onset of listener aural fatigue. As previously shown in the study by Akira et al. (2013), sounds with little timbral variance (such as cymbals, drums or wood blocks) cause greater aural fatigue if repeated for even moderate periods of time. Understandably then, orchestrators warn against overusing the percussion family, stating that overuse of steady rhythmic figurations in the percussion group can become ineffective or tiresome

---

<sup>121</sup> Note that what is referenced here is not the ability of an instrument to blend well with another instrument or not, but the maximum variation in their ability to do so.

(Kennan & Grantham, 2002), and that overuse of a percussion group can obliterate the rest of the orchestral sound (Adler, 2002). The bass drum and tam-tam possess the ability to mask the sound of the orchestra entirely if played at a sufficiently high dynamic level<sup>122</sup>.

5. The final factor that readily contributes to aural fatigue is overuse of colour and over-frequent changing of colour. It might seem counter-intuitive that orchestration, which holds change and interchange of material as a key aspect of its efficacy, could also suffer from its overuse. However, it has been found to be fatiguing for the listener to discern textures from a complex web of colours for extended periods of time. Orchestrators in general rely on the ability of the listener to distinguish sounds from each other in order to be able to separate what Adler (2002) describes as foreground, middleground and background material in a work, or what Parrott (1957) refers to as vertical and horizontal chains of sound in orchestral music. The human brain has been found to be exceptionally capable of distinguishing equally salient sounds from one another (auditory scene analysis) and also of distinguishing salient sounds from background sounds (cocktail lounge effect). The former effect (auditory scene analysis) was first described by Albert Bregman in 1990 as a model of auditory perception, and describes the process by which the human auditory system can distinguish and organise sounds into separate and perceptually meaningful categories (Bregman, 1990). The latter (cocktail lounge effect) refers to the ability of the human auditory system to filter out a range of sound stimuli in order to focus more clearly on a single element (Shinn-Cunningham, 2008). If the orchestrator is systematic and careful, it is possible to present the listener with a complex set of tone colours that can still be differentiated and mentally processed. Adler (2002) recalls the final movement of Mozart's Symphony no.41 in C major K.551, *Jupiter*, in which a highly complex contrapuntal texture is utilised (ex. mm. 390+); there Mozart systematically establishes and then maintains a fixed constellation of colours for each of the elements, so that the audience is able to discern them from

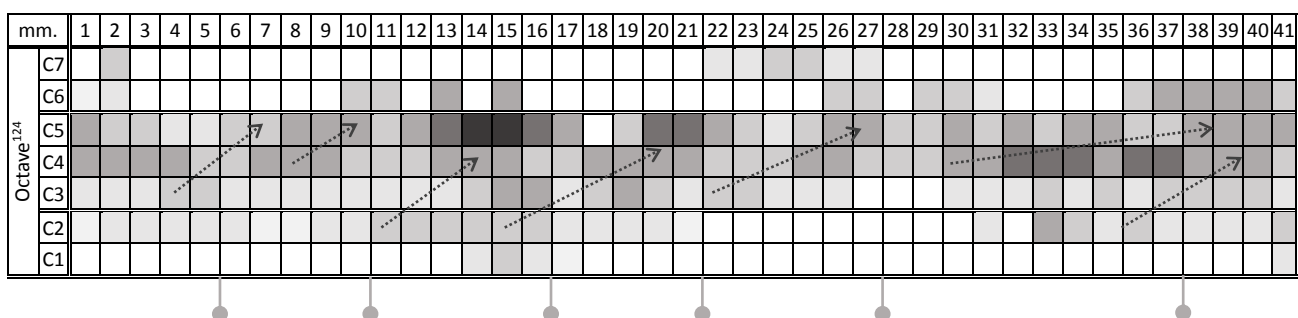
---

<sup>122</sup> Towards the end of Stravinsky's *Le Sacre du Printemps*, the tam-tam and bass drum interject the orchestra at key rhythmic moments, so that at that moment they can perform on their own at a high dynamic level without masking the orchestral sound. Or inversely, Stravinsky perhaps understood that the use of the orchestra at these moments would be futile. Notwithstanding, Stravinsky displays a rare sensitivity for instrumental saliency in his orchestrations.

each other for extended periods. Had Mozart constantly changed his colour combinations, the listener would likely have been overburdened and fatigued by the task of distinguishing the main musical ideas in this section of the symphony. Likely, when orchestration texts refer to the ability of the orchestration to define the structure of a work, it is at least partially in the sense employed here<sup>123</sup>.

Some examples follow to show how a number of South African orchestrators utilise the principles of registral and timbral interchange to counteract aural fatigue, bearing in mind the five principles that were discussed previously about saliency, the weight of the lowest registers, and prolonged exposure to the same instrumental combination within the same octave. Below, the use of the various octaves and registers of the orchestra in the short, final movement of Roosenschoon (1991) is displayed graphically. Three key features about his use of registers become apparent: firstly, even in a short work of three minutes, Roosenschoon make use of frequent registral shifts to maintain interest in the sound and avoid aural fatigue; secondly, his use of lower registers tend to resolve upward, so that an increase in activity in a lower octave is generally followed by an increased use in a higher octave (dotted arrows); thirdly, the unavoidable continuous use of the middle register (especially C4-B5) is mitigated at regular intervals to avoid the onset of aural fatigue (marked below the table).<sup>5</sup>

Table 9 -- Use of different octaves in the orchestra per measure (darker shading = more instruments) in the last movement of Roosenschoon's *The Magic Marimba* (1991):



<sup>123</sup> Clarity of sound, which appears to be an important aspect of what is being described here, is a crucial component of effective orchestration. See 7.3 *Clarity of effective orchestration*, p.242.

<sup>124</sup> Octaves are named according to the *American Standard Pitch Notation* standard. Low, middle and high registers of the orchestra are separated by double lines.

The next example shows Klatzow's *Incantations* (1984) and his adherence to the fifth principle laid out above, namely that instrumental colour should not change too often in order to aid the listener in analysing the auditory scene. In his composition, Klatzow makes use of a great number of experimental colour combinations throughout, but the same colour combination will generally be repeated a number of times before change is introduced. In the example below, three consecutive entries of the same musical material occur. In the first two entries, the instrumentation remains unchanged so that the listener is better able to discern the various textural layers as structural signifiers. Upon the third entry, when the listener has conceptualised and memorised the fragments, the xylophone is changed to piano and clarinet, while the clarinets are changed to trumpets; the strings and finger cymbal undergo minimum change to reinforce the structural unity of the three entries. The listener is able to recognise the change of colour as being a variation of existing material, rather than new material, because of Klatzow's discriminate use of repetition:

The musical score for Figure 59 is in 6/8 time and consists of four staves. The top staff is for Clarinet (Clas.), the second for Finger Cymbal, the third for Violins/Violas (Vlns./Vlas.), and the bottom for Percussion (Vcls./basses). The score shows three consecutive entries of musical material. The first two entries use the same instrumentation, while the third entry changes the xylophone to piano and clarinet, and the clarinets to trumpets. Dynamics include *mf*, *pp*, and *p*.

Figure 59: (Vivace subito ♩ = 144) Use of colouristic repetition and then variation to aid the listener with auditory scene analysis in Klatzow's *Incantations* (1984).

The next example, from Temmingh's *tjellokonsert* (1992), shows the composer's exploitation of the cocktail lounge effect to aid the listener in discerning between solo cello and accompanimental violins within a homophonic context. The repeated quavers by the violins, performed at a dynamic level of *piano* and on pitches which only change after several measures, are placed in an excellent position to be filtered

to the background in favour of the timbrally more salient and rhythmically dynamic cello. After seven measures however (20 seconds at  $\text{♩} = \text{ca.}84$ ), the composer changes pitch material and introduces a new melodic element to maintain listener interest and prevent aural fatigue caused by monotony. Because of his scoring methods, and because the cello is registerally separated from the accompaniment, Temmingh is able to mark the cello barely louder than the violins (one instrument pitted against twenty in this manner might seem counterintuitive):

$\text{♩} = \text{c.}84$

The musical score is presented in two systems. The first system, starting at measure 15, shows a cello part (bass clef) with a melodic line marked 'Solo cello mp' and a violin II part (treble clef) with a rhythmic accompaniment of chords marked 'p'. The second system, starting at measure 20, shows the cello part continuing its melodic line and the violin I part (treble clef) entering with a new melodic line marked 'p'. The tempo is indicated as  $\text{♩} = \text{c.}84$ .

Figure 60: Exploitation of the cocktail lounge effect to differentiate foreground from background material in Temmingh's *tjellokonsert* (1992).

In the following example from Grové's piano concerto *Raka* (1996), the entry of the solo piano in a contrasting register to the foregoing material after a prolonged silence sounds very "fresh" (fresh is a colloquialism taken from Jacob, 1956; Kennan & Grantham, 2002; and Adler, 2002). This new entry of material in the piano creates new musical impetus and functions to renew the listener's interest in the work. As in other sections of this work, Grové displays a robust style of orchestration in which instruments subdivide seldom and especially in which the woodwinds are reduced to one voice. The sudden silence before the entry of the piano serves to provide the listener with a moment of respite after a prolonged section of *fortissimo*, but also serves to build suspense before the acrobatic piano solo:

Figure 61: Use of silence and a new timbral entry to maintain and renew listener interest in the second movement (Più mosso  $\text{♩} = 168$ ) of Grové's *Raka* (1996).

Within the strings, woodwinds and brass of the orchestra, the trumpets, trombones, tuba and double basses (in their lowest octave) are the most salient instruments, and balancing them within a small orchestra such as what Temmingh uses in his *tjellokonsert* (see Table 4, p.48) is more of a challenge than in full orchestral forces. It is likely for this reason, and because of the solo cellist, that Temmingh limits his use of these instruments and the percussion family to the most climactic moments of his composition. In the following example, when the orchestra reaches its highest limits of volume production, Temmingh is still careful with introducing these instruments so as not to disrupt the orchestral sound. The tam-tam, which the composer has instructed must be hit *fortississimo*, would completely obliterate the orchestral balance, so Temmingh has fittingly silenced the orchestra and paired this instrument with only the timpano:

The musical score is for a section of an orchestral work, starting at measure 189. It is written in 4/4 time with a tempo of approximately 88 beats per minute. The key signature has one flat. The score is divided into four systems of staves. The first system includes Flutes and Oboes (Fls, obs.), Bassoons (Bsns), and Trumpets (Tpts). The second system includes Horns (Hns), Trombones (Tbns), and Tubas (Tba). The third system includes Timpani (Timp.) and Tamtam. The fourth system includes Violins (Vlns, vlas), Violas (Vcls), and Basses. The score shows a variety of dynamic markings, including fortissimo (f), pianissimo (pp), mezzo-forte (mf), piano (p), and fortissimo fortissimo (fff). The music features complex textures with many instruments playing simultaneously, creating a rich and dense sound.

Figure 62: Carefully planned and executed utilisation of the most salient instruments of Temmingh's orchestra at a point of climax in *tjellokonsert* (1992).

### 4.3 Echoic memory and remembering sound

In orchestration, the ability to store and recall various kinds of auditory information is a vital skill. Without the ability to hear mentally and accurately the sound of an instrument, a truly creative orchestration cannot be accomplished (Piston, 1961). Piston stresses two points, firstly that an orchestrator should be able to remember and recall sounds accurately and easily, but more importantly that an orchestrator should be well-trained in aural skills in order to be mentally equipped to listen and remember with great skill. Jacob (1956) and Kennan & Grantham (2002) state throughout the textbooks that orchestrators might possess the ability to listen, remember and recall sounds with differing levels of acuity, but that their ability to do so will determine the conviction and authenticity of their work. Echoic memory, or the memory of sound, is developed by listening critically to many different musical scores while engaging with their manuscripts<sup>125</sup>. The process therefore focusses on perceiving and building a memory of sound

<sup>125</sup> The effect of sound editing, mixing and mastering technologies on the sonic composition of recorded music is not explored in this thesis, but their potentially distorting effects on the building of sound memory should be noted. On a

within the conceptual framework of its application in a score. It is not only enough to remember the sound of the oboe, for example, because it is necessary to understand the various scored attributes of articulation, phrasing, dynamics, and the orchestral context within which it is used, in order to gain a truly accurate impression of the instrument.

Two problems exist in this process, however, the first being that a great number of ways exist to produce any one pitch on any instrument so that it is extremely difficult to gain an accurate impression and memory of them all, the second being that a student orchestrator almost never has the opportunity to experiment with an orchestra in order to hear what he or she has orchestrated or imagined. Students can therefore mostly only gain as much information as they can read from well-established scores and performance study; the chance to experiment with new and individual symphonic orchestrational ideas and hear those ideas in live performance is an extremely uncommon occurrence. It therefore seems unproductive of Adler (2002) to advise students against learning information from tables, but to experiment with different sounds and combinations in order to find out what works best; as orchestrations are most often tested not merely in a reading situation, but more likely in an expensive performance situation, it would not necessarily be an appropriate arena for experimental writing and listening.

Echoic memory is a sensory memory register that stores sounds for a short while after they are heard. It functions with greater acuity than does visual memory, because whereas visual stimuli can usually be scanned and rescanned any number of times, auditory stimuli generally occur only once. For that reason, aural stimulus remains in the echoic memory longer than visual stimulus remains in visual short-term memory, in order to provide the brain with more time in which to process and categorise sound material (Carlson, 2010). Then, once sounds have been identified and processed (generally within 3-4 seconds), they are ejected from echoic memory (Clark, 1987). In that processing time, sounds are described by test subjects as resonating in the mind, so that various forms of data about the sound can be extracted, but unless the listener is trained to listen accurately and with attention to detail, little more than

---

general level one could also postulate that any performance environment changes the quality of the perceived sound, so that the process of developing sound memory becomes more complex.



rudimentary insight (such as general pitch or source) is gained about the sound (Radvansky, 2005). For that reason, aural training is a vital component of orchestration, because it leads to a more detailed analysis of sound units. In performance score analysis, the orchestrator who can determine the properties of a sound with greater detail and with faster response times will be able to gain substantially more information from a performance. As Jacob (1956) writes, good scoring is the result of intelligent listening.

Orchestration is likely also concerned with the echoic memory of the audience, although orchestration textbooks do not directly reference it. By inferences about the timbral structure of orchestration, and the manner in which orchestration is meant to define the form of a piece, a number of ideas surface about the sound memory of the audience. As in composition, where the repetition of a rhythmic pattern, a pitch combination or a specific tone colour can be exploited to create a sense of structure within a work, the same can be achieved in orchestration. In orchestration, however, the focus lies almost exclusively with tone colour, because the harmonic and melodic aspects of the music have usually already been fixed. This structuring of repetition to engender musical structure is clearly a direct engagement with the echoic memory of the listener, who hears and remembers specific aspects of a series of sounds; upon recognising those same aspects at a later moment in the performance, the listener is then reminded of the earlier occurrences so that a sense of structure can be perceived. Orchestrators have a unique advantage in this sense, because through the intelligent structuring of characteristic sound colours they are able to manipulate the perceived structure of a musical performance. The previous chapter, which dealt with change and interchange of material in orchestration, comes to mind; whereas regular enough changes in the music is necessary to maintain interest in a work, the repetition of characteristic sound combinations is a necessary counterpart to create logical structure<sup>126</sup>.

---

<sup>126</sup> The development of musical forms and structures throughout the history of western art music can be said to represent an engagement with echoic memory, but in terms of orchestration, the engagement is not on a compositional level. Orchestration is concerned with clarifying and ordering those structures that are *already* present in the music in a manner which is suited to the outcomes and the tastes of the orchestrator (see the chapter titled *Perspective seven: The meaning of effective orchestration*, p.226). As was the case earlier, the orchestration represents the outcome of a tension existing between orchestrator and composer who might have different

The following three figures are taken from Fagan's *Karoosimfonie* (1976), Klatzow's *Incantations* (1984) and Zaidel-Rudolph's *Tempus Fugit* (1986). In these examples, the composers' use of repeated instrument combinations and techniques as an aural mechanism by which to engender a perceived musical structure is displayed. In Fagan, the bassoon motive placed in a high register, juxtaposed with low flutes and clarinets, aids the listener in recalling the exposition of the work at its closing in a passage that is of similar (but not exact) construction. The echoic recall works this example, because the combination of instruments and instrumental registers is strikingly unique. In Klatzow, the exposition and recapitulation of his work use the exact same material and instrumentation; here the orchestrational macro structure is in complete support of the compositional macro structure. In the final example, Zaidel-Rudolph makes use of a single characteristic timbre (solo marimba tremolo) as a unifying link between the two contrasting main sections of her work; by presenting the marimba at these key structural moments, the orchestrator is able not only to remind the listener of an earlier moment of the work, but also to increase the listener's perception of its overall structure. In these three examples, therefore, each composer engages with the echoic memory of the listener in order to communicate meaningful information about form and structure. This is likely an example of what orchestration authors refer to when they state that the orchestration of a work should support and clarify its form (see a following chapter titled 7.3 *Clarity of effective orchestration*, p.243).

The image displays a musical score for Fagan's *Karosimfonie*, divided into two sections: 'Molto lento' (♩ = c.30) and 'Adagio' (♩ = 42). The score is written for a full orchestra, including Bassoon (Bsn.), Flute (Fls.), Clarinet (Cls.), Bass Clarinet (B.cl.), Violins (Vlns.), Violas (Vlas.), and Violas (Vlas.). The first section, 'Molto lento', is in 4/4 time and features a bassoon motive in a high register, juxtaposed with low flutes and clarinets. The second section, 'Adagio', is in 3/4 time and features a similar bassoon motive in a high register, juxtaposed with low flutes and clarinets. The score includes dynamic markings such as *pp* and *ppp*, and includes a repeat sign with first and second endings. The instrumentation is consistent between the two sections, with the addition of Violins and Violas in the second section.

Figure 63: Use of timbral repetition to support structural repetition in the first movement and final movement of Fagan's *Karosimfonie* (1976).

perceptions of the musical qualities of a work. Composer and orchestrator might also be the same person, in which case one can expect that tension to be minimal.

Figure 64: (Lightly  $\downarrow = 72$ ) Use of timbral repetition to support structural repetition in Klatzow's *Incantations* (1984).

Figure 65: (Pacato  $\downarrow = c.72$ , then  $\downarrow = 60$ ) Timbral repetition in the marimba in order to provide structural unity between two contrasting sections of Zaidel-Rudolph's *Tempus Fugit* (1986).

#### 4.4 Some last notes about the perception of sound

Sound, according to orchestration authors, has the perceptual quality of weight. This quality can be measured both of sounds in isolation and in comparison of sounds in combination. A flute in its lowest tessitura, for example, is described as having very little weight, whereas an oboe playing in the same register will be perceived as being far heavier (see Addendum C). This is clearly a psychophysical characteristic, because sound does not consist of mass and therefore cannot possess the attribute of weight. In general psychophysics, Weber's law describes the relationship between the physical increase in the weight of an object, and the perceived change in its weight according to the sensitivity of the perceiver. As an example, think of a person picking up two objects of differing weight: Weber's law states that the perceived difference in the weight of the two objects will be correlative to the actual difference in their weight. The law states that the just-noticeable difference between two stimuli is proportional to the

magnitude of the stimuli and the subject's sensitivity to the change (Ross, 1996). Weber's law was shown to hold true in the perception of sound by Jesteadt, Wier & Green in 1977 so that the actual increase in sonic energy of a heard sound is proportional to a perceived increase in sonic energy. However, the study never defined or attempted to quantify the qualities that were perceived by listeners other than loudness, so that the attribute of sound weight was not defined in the study. Orchestration literature, which describes sound weight regularly, is evidence that such a perceptual attribute does exist; it is however difficult to understand the exact properties of tone weight. Orchestrators (Parrott, 1957; Piston, 1961; Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002) give us clues about what tone weight is with a number of references: weight of a tone can be described with attributes such as breadth (thick or thin), size (large or small), or strength (robust or delicate); together these attributes describe the quality of a sound's weight as heavy or light.

A heavy tone such as that produced by the tuba is described by Jacob (1956) as being obtrusive and difficult to use in balance with other instruments<sup>127</sup>. Its sound is described as ponderous, robust, sonorous, cavernous, rumbling or even unfathomable; Adler (2002) describes the tuba as having a sound quality unlike any of the other brass instruments (although it often functions as a unit with the trombones). The oboe, although it is a substantially smaller and higher pitched instrument than the tuba, can also become obtrusive within the colours of the woodwinds if used in its lowest register. In this low tessitura, the sound of the oboe is rich in overtones of a nasal quality. It can therefore be said that these two instruments display qualities of a weighty sound, because they tend to be more highly coloured than the other instruments in their sections and are therefore more salient. The effect of timbre on the saliency of an instrument and thus its ability to blend with other instruments is described earlier in this chapter, and Addendum C shows in table form how different instruments of the orchestra compare with each other in terms of registral saliency.

---

<sup>127</sup> Jacob (1956: 64) uses the word "subdue" in this regard, giving the idea that a heavy or robust sound needs to be subjugated in some way if it is to fit in with the orchestra.

The description of a sound as robust reveals itself as a contextual label<sup>128</sup>. For example, the trombones, compared to the horns, are described by Parrott (1957) as robust. The horns are in comparison with the woodwinds seen as robust as well, especially when producing a *forte* sound (Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002). The piano, compared to the harpsichord, is more robust, although the harpsichord can at times display a higher level of saliency. The tuba was described previously as having a robust quality of sound, a quality which is likely ascribed to it in comparison to other brass instruments because it is larger and can therefore project more acoustic kinetic energy than its smaller brethren. The oboe is more robust in its lowest register than the flute or the clarinet, because it vibrates with greater volume and a large number of overtones, but in higher registers the flute and clarinet are far more robust than the oboe.

In orchestration and music performance in general, it is commonly believed that higher frequency sounds are perceived as louder than those of lower frequency, and need to be compensated for with a larger orchestral support. Piston (1961), Jacob (1956) and Parrott (1957) make overt reference to the notion that the trumpets, violins, flutes or piccolo are more easily heard above the orchestral sound mass because they are higher in frequency. In reality, these instruments are not necessarily heard more prominently because of the higher frequencies that they produce (compared to other orchestral instruments), but because the greater physical effort required to make (for example) the piccolo speak in its highest register means that the sound it produces will project with a large amount of acoustic kinetic energy compared to other instruments playing at the same time. These instruments, when they are playing high and forcefully, are described as sounding shrill, overpowering, penetrating or strident; they are most importantly described as gaining substantial weight in their registral stratosphere.

In closing this section about sound perception, I refer to a small number of supplementary comments made by Piston (1961), Jacob (1956), Parrott (1957), Kennan & Grantham (2002), and Adler (2002).

---

<sup>128</sup> "Robust" is an example of an extra-sonic descriptor that draws on the common social experience of different people to gain information about the quality of a sound. See *Perspective one: The mystification of orchestration (also an introduction)*, p.23.

Although the overtone series will also be discussed elsewhere in this thesis, it should be mentioned here with regard to sound perception. It is advised by all these authors that, when possible, the spacing of notes should follow the overtone series (wider intervals at lower frequencies and smaller intervals at higher frequencies) in order to have a balanced, “naturally” sonorous sound<sup>129</sup>. If a chord is in root position, the bass note may be doubled above, as happens naturally in the overtone series. If the lowest note is not the root of the chord, however, doubling it above and into the orchestral mass could result in “dire harmonic confusion” (Jacob, 1956: 84). This is because the overtones of the bass note will coincide with higher frequency tones in the orchestral sound if it is also the root of the chord; however, if it is not the root of the chord, conflict with upper tones could cause harmonic misperceptions that would disturb the listener (Piston, 1961). Although these principles become difficult to apply in music of an atonal nature, the basic importance of considering the impact of the overtone series remains constant: the frequency spectrum of a pitch within a certain octave should be considered carefully before being included in the orchestral sound mass. Timbre should be dealt with in the same manner, as Adler (2002) points out in referring to two examples by Mozart. To avoid timbral confusion, Mozart does not give the material in the accompaniment to an instrument that is playing the melody. He will, however, contrast the sound of a single instrument playing a melody with two of the same instrument playing a melody. Two clarinets in combination have a very different sound, for example, than one clarinet alone, because of the different voicing of pitches and the intermingling of overtone content.<sup>130</sup>

---

<sup>129</sup> Natural is a term often applied by orchestration authors to describe an effect or a sound that is perceived as effective within the normal performance capabilities of an instrument or a group of instruments. In a later chapter of this thesis, the relationship between “natural” and “idiomatic” is discussed to greater length. See the chapter titled *Perspective six: Inherited practices and orchestration traditions*, p.193.

<sup>130</sup> Chen, Smith, & Wolfe (2009) performed a study on the role of the vocal tract in clarinet tone production and found that the overtone structure of clarinet sound changed when a pitch was “voiced” differently. Voicing refers to the ability of a performer to mentally shape the overtone structure of a sound by control of the wind tract and vocal chords. The voicing of clarinet tone was shown to change when clarinets played in combination, in much the same way that singers alter their formant in choral singing. Van der Linde (2013) refers to formant alteration in singers’ in greater detail in his thesis. See also a previous footnote: no.58, page 62.

The following examples show how three different South African composers space chord tones within the orchestral registers in order to show the principle of overtone spacing mostly holds true in contemporary orchestral literature. The first four examples are taken from Temmingh's *tjellokonsert* (1992), to show three general principles in Temmingh's spacing of chord tones in this orchestration:

1. The lower parts of each chord are spaced far apart and in general agreement with the structure of the overtone series (octave below, then fifth, then fourth);
2. In pitch-dense chordal structures (such as in the first two examples), the most dense material is confined to the middle register (around the octave above C4).
3. Pitches written in the upper registers (C6-C8) tend to be spaced further apart, and function to reinforce specific overtones produced by lower chord tones. Often, the upper woodwinds all double the trumpets an octave above (Ravel enforces the same doubling principles in *tutti* sections of *Pictures at an Exhibition*: see Figure 54, p.128).

Figure 66: Registrational spacing of chord tones in Temmingh's *tjellokonsert* (1992).

In comparison to Temmingh, Grové appears to take a mixed approach to chord tone spacing in *Raka* (1996). In the first two examples, Grové places dense clusters of tones in lower octaves, resulting in a less resonant sound and an increase in percussive effect. In the third example, the orchestrator combines two incongruent triads an octave apart, but even here the lowest triad will have a grumbling sound. The fourth and fifth examples display greater sonority by the placement of wide and consonant intervals at the bottom of the chords and smaller more dissonant intervals at the top:

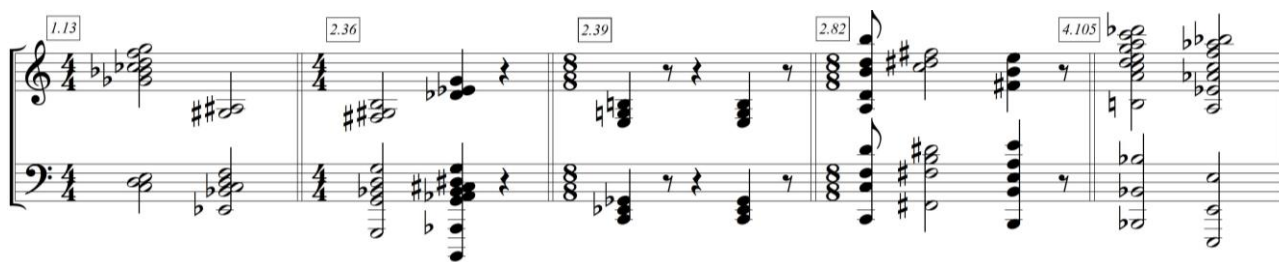


Figure 67: Registral spacing of chord tones in Grové's *Raka* (1996).

In the following passage from Hofmeyr's *Sinfonia Africana* (2003), the spacing of chord tones follows a standard formula for establishing a harmonic foundation in the bass, fixing chord qualities in the middle register, and reinforcing the upper partials in higher octaves. For that reason, in the following figure the bass line is presented at the octave in strings, brass and woodwinds, while brass and strings providing harmonic function in the octave above C4; string harmonics and woodwinds reinforce upper partials in octaves above that. Hofmeyr's method of chord construction ensures maximum resonance by agreement and strengthening of overtones:

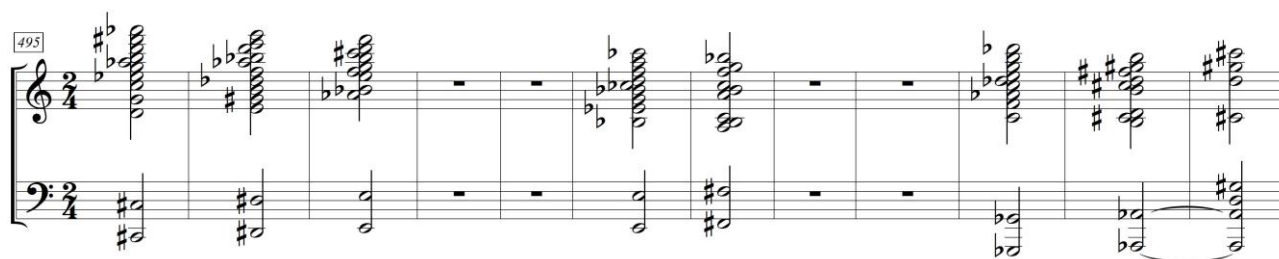


Figure 68: Registral spacing of chord tones in the second movement of Hofmeyr's *Sinfonia Africana* (2003).

#### 4.5 Concluding remarks

In this chapter, orchestration authors' concern with sound perception and the aural result of scored effects was highlighted. It was found that the concept of aural fatigue shows itself as of central concern to orchestrators. General aspects of hearing, which are frequently mentioned in orchestration textbooks, are however not well described in either physiological or psychoacoustic terms. Concepts that appear to be



important in orchestration after aural fatigue include spectral sensitivity, echoic memory, timbral strength and sound weight. Aural fatigue was shown to consist of five contributing factors: the length of time over which an instrument is used at once; the colouristic strength of an instrument's timbre in the register it is being used; the perceived sound weight of the instrument in a specific register; the instrument's capacity to blend with other instruments in the required register; and lastly the overuse of change in colour within a short amount of time. Examples from South African orchestral literature showed how orchestrators instinctively or knowingly adapted their writing according to these principles in order to avoid aural fatigue.

Vertical expansion and doubling effects in the orchestra were described according to physiological characteristics of human hearing, and the various contributing factors of aural fatigue were brought together to describe a single characteristic of instrumental sound, namely saliency. Saliency (which is the main focus of Addendum C) was shown to be a constant consideration of instrumental use at any moment of an orchestration because saliency affects various orchestrational mechanisms such as blend, balance, textural differentiation and other colour effects. Related to this is the concept of sound weight, which is used in many orchestration textbooks but which is not clearly defined. Looking towards psychophysics for guidance, some ideas surrounding sound weight were explored. With regards to human hearing and psychoacoustics, the overtone series and instrumental hierarchies were also visited again.

Lastly, the memories of composer and audience were described according to the contributions they make to orchestration. In terms of the former, echoic memory was shown to be an important learning tool with which composers gain knowledge about and remember sounds, timbres and techniques. In terms of the audience, echoic memory was described as the main form-providing function in music – orchestrators engage directly with echoic memory when using colour repetition for structural reinforcement. While sound memory is not described in orchestration sources as often as some other aspects of hearing, it might be one of the most important aspects of consideration in the orchestration; effective orchestration seems unlikely to be achieved if the orchestrator does not possess a well-trained aural memory or if the listener's aural memory cannot be engaged with effectively.

As with previous chapters, a concept web is included to show how some of these concepts interact with each other and with other Perspectives of this thesis; in this chapter there is considerable intercorrelation so that the diagram is thickly filled in compared to previous illustrations:

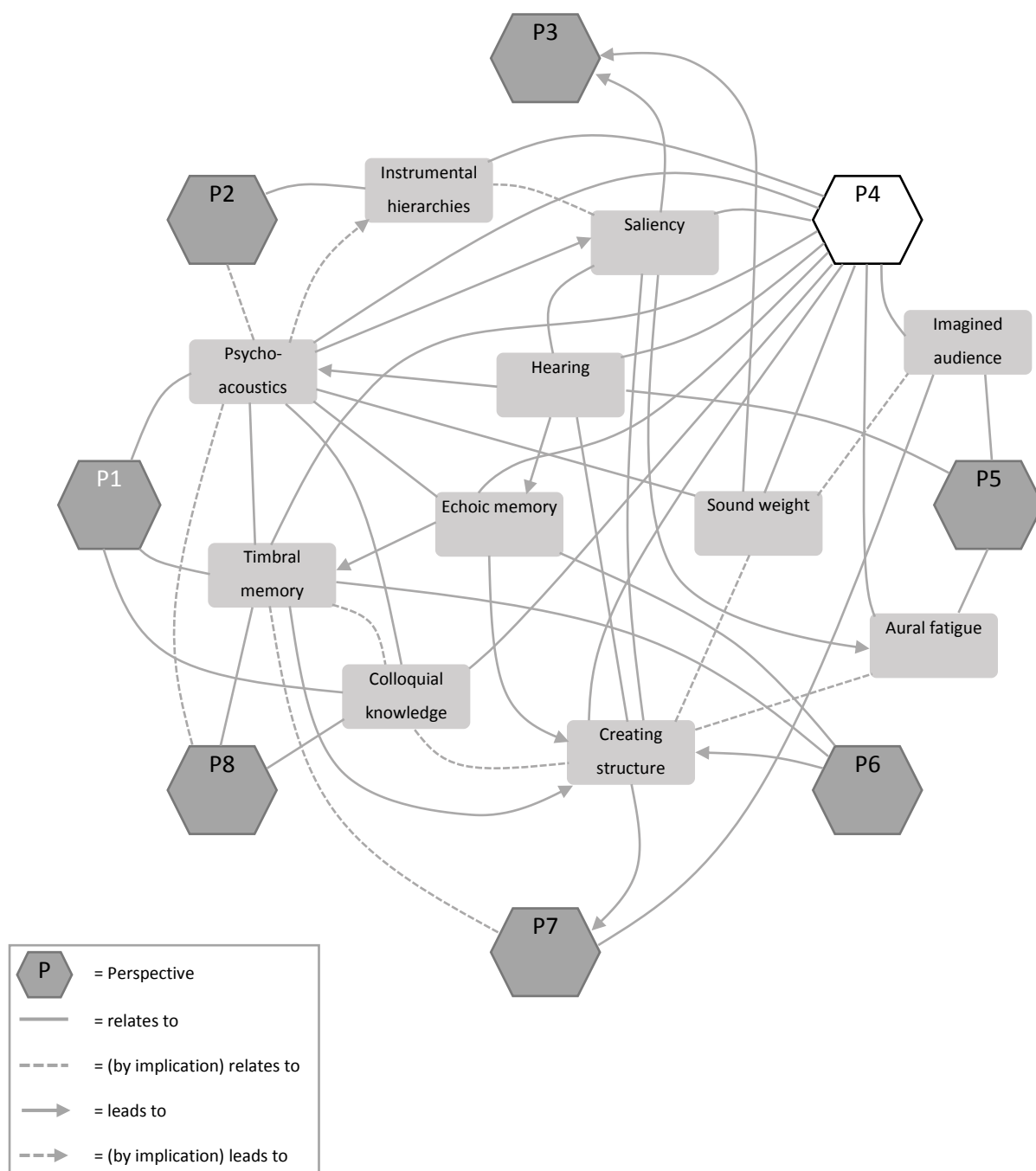


Diagram 4: Concept web showing interrelatedness of concepts in Perspective 4 with other Perspectives.

## Perspective five: Instrumental constraints and orchestrational creativity

### 5.1 Introduction

Much is written about the creative possibilities, the mystical and the unknown aspects of orchestration that present the orchestrator with potentials and unknowns to explore. So far in this thesis, some of these aspects have already been described, which were shown to stimulate creativity in orchestrators, or that those aspects could at least be exploited to stimulate creativity. However, the opposite is also found in writing for orchestra, namely that constraints and systems exist that create the boundaries within which orchestration can take place effectively<sup>131</sup>. These constraints are communicated as should-nots, must-nots, and better-nots or best-avoideds, and show us that orchestrators are as much concerned with what should not be done as what should. Constraints are expressed in technical-instrumental, economic, logistical or musical terms, and they are linked in the sense that technical or physical restraints are articulated through music and thereby become musical or artistic constraints. This category is therefore divided into two sections that recall and describe firstly the technical, physical or economic restraints imposed on orchestration, and secondly how they are tied to or expressed in musical terms. As Jacob (1956) argues, the limits imposed by instruments, players, funding or the musical outcomes of a work are challenges that orchestrators must overcome with skill and creativity in order to become effective orchestrators.

### 5.2 The guiding force of physical constraints in orchestration and the orchestra

The economy of writing for orchestra has become a central determiner in orchestration over the last century, and especially after the Second World War the number of instruments available to an orchestrator has become dependent on the financial viability of their employment; throughout history, the most influential music centres have been those that could afford the greatest musical resources. This is,

---

<sup>131</sup> As with previous Perspectives in this thesis, effective orchestration shows itself as a central concern. See also *Perspective seven: The meaning of effective orchestration*, p.226.

therefore, a constraint that presented itself already in the first days of courtly patronage. As the importance, financial stability and resources of musical centres grew throughout the nineteenth century, so did the number of excellent and varied instrumentalists available to orchestrators. By the start of the twentieth century, composers working in main musical centres had access to an unprecedented number of musicians of the highest calibre performing in orchestras of gargantuan proportions (Adler, 2002). The upkeep of orchestras has always been an expensive endeavour, and by the middle of that century, however, orchestras around the world could feel the growing need for increased economic productivity and decreased financial burden. As one example, in an article published by *The Musical Times* in 1953 (the author is unknown), the changing financial climate in Britain and its effect on orchestras in Liverpool, Yorkshire, Birmingham, Bournemouth and even in London was described as in a state of crisis (Economics and Orchestras, 1953)<sup>132</sup>. This is likely a sensationalist perspective, however. Gordon Jacob, a British composer himself, published his orchestration guide in 1956, shortly after this article. His writing is especially focussed on the matter of economic consideration, notably advocating the use of only two percussionists in the orchestra in order to reduce unnecessary expense. However, although he does not promote an expansion of the orchestra by the addition of extra instruments, he acknowledges that it must be done when the expression of a composer's ideas necessitate it<sup>133</sup>. Kennan & Grantham (2002) state the same, but caution the composer against a too large orchestra not only for economic, but also for musical reasons (which the source does not explain). More specifically, Kennan & Grantham note that many instruments of the orchestra have developed to their modern state of perfection only due to great financial

---

<sup>132</sup> Two tables earlier in the thesis (Table 3, p.47 and Table 4, p.48) show the development of average orchestral forces throughout the history of its existence. Generally speaking, contemporary orchestras and orchestrations are not as large of scope as their predecessors from the Late Romantic, the primary cause of which can be argued is economic limitations.

<sup>133</sup> As has been the case in other parts of this thesis, the orchestrators appear here to exist in a state of tension between their outcomes and the limits of what they are provided with. Previously, the orchestrators' outcomes were placed in opposition to the limits of the instrumentalists, the musical ideals of the composer (in the case of transcription), the creative input of the conductor and musicians, the unknown quantity of the physical spaces of performance, as well as the unknown contributions of the audience to the performance product. These tensions seem to articulate the orchestrators' creativity in engaging with various constraints.

support<sup>134</sup>; and inversely that some instrumental variations (like the five-octave celesta or the alto clarinet) are now generally excluded from the orchestra because they are too costly to be available universally. Both these instruments only ever achieved a modest inclusion in the orchestra, with a small number of examples by Stravinsky (*Threni*) and Holbrooke (*Symphony No.2*). From these ideas, there appears to be a correlative relationship between the development of musical style, instrumental technique and changes in available orchestral forces: musical style adapts to the limits of instrumental expression and instrumental forces adapt to the necessities of musical expression.

In the eight South African orchestral works that form a reference to this study, it is difficult to identify musical examples that display an engagement with these constraints very well. However, Zaidel-Rudolph (1986) in her performance notes to *Tempus Fugit*, states that her orchestration focusses on performance versatility by utilising the instruments in such a manner that either a full symphony orchestra or a smaller chamber ensemble could perform the work. This versatility expresses itself in a number of ways, but most prominently her primary instrumental parts are frequently doubled in other instrument groups, while instrumental parts very rarely divide (the flute is an exception). The instrument group that shows the least flexibility in this regard is the percussion group, which cannot be reduced without removing material, and in *Tempus Fugit* the percussion contributes considerably to the aesthetic of the music. Following is a table comparing two possible instrumental scenarios for the performance of *Tempus Fugit* that would require only minimal editing:

---

<sup>134</sup> The reader is here referred to an earlier chapter in which the development of some instruments over time and within the orchestra is discussed more thoroughly. See *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54. Some instrumental developments within the orchestra are also discussed in a later chapter titled *Perspective six: Inherited practices*, p.193.

Table 10 -- Two possible performance ensembles for Zaidel-Rudolph's *Tempus Fugit* (1986):

	Full orchestral performance (+75 players)	Chamber ensemble performance (22-28 players)
Flutes	3 (doubling alto flute and piccolo)	2 (doubling piccolo and alto flute)
Oboes	3 (doubling English horn)	1 (doubling English horn)
Clarinets	2 + bass clarinet	1 (doubling bass clarinet)
Bassoons	3	1
Horns	4	2
Trumpets	3	2
Trombones	3	1
Tubas	1	1
Percussion	1 Timpanist + 4 percussionists	1 Timpanist + 3 percussionists (with the loss of some material)
Strings	Full strings	4, 4, 2, 2, 1 or 2, 2, 1, 1, 1

The following example from *Tempus Fugit* shows how doubling of parts is exploited by Zaidel-Rudolph to ensure that every textural layer would still be audible after abridgement of orchestral forces. In theory, this kind of versatility could ensure the economic viability of a work for future performances in a variety of instrumental setups. One might also argue that continuous doubling, which produces a mixed orchestral sound throughout, is to the detriment of the coloristic clarity of the music. In the following chapter, which discusses inherited practices (see page 194), it is shown that twentieth century orchestration generally favours primary instrumental colours; Zaidel-Rudolph's style of orchestration in *Tempus Fugit* is in contrast to those ideals. The percussion section plays a vital role in the orchestration by providing punctuation to the various musical layers so that the clarity of Zaidel-Rudolph's musical design remains intact: the snare drum accentuates the musical interjections of the basses, bassoons and violas, while the xylophone provides saliency to the violins, flutes and trumpets.

19

$\text{♩} = \text{ca. } 152$

Fls *f* *ff*

Picc. *ff*

Obs *f* *ff*

Cls Bb *f* *ff*

B. Cl. *ff*

Bsns *ff* 1. *mp cresc.*

Hns *f* *ff*

Tpts *f* *ff*

Tbns *f* *ff*

Tba *ff*

Xyl. *f* *ff*

Timp. *ff*

Perc.  $\text{♩} = \text{ca. } 152$  *f* *f* *whip* *B. drum* *p cresc.*

Vlns I *f* *ff*

Vlns II *f* *ff*

Vlas *f sfz* *ff*

Vcls *f* *ff* *p cresc.*

D.Bs *f sfz* *ff* *p cresc.*

Figure 69: Doubling of musical lines in various instrument groups to improve performance versatility in Zaidel-Rudolph's *Tempus Fugit* (1986).

In *The Magic Marimba* (1991), Roosenschoon sacrifices the versatility of Zaidel-Rudolph's orchestrational approach in order to gain access to a greater variety of orchestral sounds and effects<sup>135</sup>. By utilising the full technical and timbral capabilities of the orchestra, the orchestra is in some instances able to attain a complex layering of textures that would be impossible in any other setting. In the example below, some textural layers are doubled across different instrument groups, while other lines function only as primary colours. As in previous examples, Roosenschoon produces colouristic intrigue by combining smaller ensembles within the orchestra for short periods of time: in this example the organ and strings form a notable combination, with violins, violas and cellos accenting the chordal movement of the organ; double basses, bassoons, contrabassoon and bass clarinet, coloured by trombone *glissandi*, provide counterpoint to the organ and strings; trumpets add rhythmic impetus to the phrase. In the last two measures, percussion is combined with piano and woodwinds in a compact motivic dialogue so that the whole orchestra is employed to accent the *forte*.

In contrast to Zaidel-Rudolph's orchestration, there is a sense of coloristic focus in Roosenschoon's work that necessitates the full involvement of every instrument at any given moment, so that a reduced instrumentation would not suffice to carry the musical lines. Jacob's earlier exception to economic constraints is realised by Roosenschoon in this orchestration, where the larger instrumental forces are justified by the important contributions of each instrument to the orchestral texture. This is, however, not to say that Roosenschoon's use of the orchestra is uneconomical in comparison to Zaidel-Rudolph, but that his nuanced orchestration is not as flexible to changes as is *Tempus Fugit*.

---

<sup>135</sup> A comparison between the two works is viable, because they make use of similarly sized orchestral forces, although Roosenschoon includes piano (2 players) and pipe organ as well in his orchestra. See Table 4 (p.48), Table 5 (p.72) and Table 6 (p.74) for more information about the orchestral forces used in both works.





In the next example from Fagan's *Karoosimfonie*, the orchestrator has attempted to recreate the booms and cracks of lightning strikes and the howling wind as they occur during a thunderstorm. Fagan's orchestration itself is commendable for the level of detail and excitement that is created by fast chromatic runs in the woodwinds and strings, rising figuration in the trumpets, horns and trombones, punctuating trills in the upper woodwinds, a sustained octave in the basses and low brass, the immense boom of timpani and bass drum, and lastly the high-pitched cracks of whip and crash cymbals. However, the proportions of his orchestra are of insufficient size to support the tremendous sonic energy of the brass and especially the drums. The bass drum, timpani, whip and crash cymbals, marked as high in volume as they are, can overwhelm an entire orchestra. The brass figuration, which is compositionally well constructed, requires double the current forces to compete effectively with the percussion, which in turn would require equal expansion in the woodwinds. The strings would then not be able to contribute much more than background support for the orchestra, which would be sufficient if a full Late Romantic complement was available (see

Table 3, p.47). Then, Fagan would be able to achieve the sound proportions of such orchestrations as Mahler's later symphonies, where immense percussive volume is balanced by woodwinds in fours, 8 horns, 6 trumpets, 4 trombones, 2 tubas, and a full string orchestra.

Two ideas that were described earlier in this section regarding the limiting of musical expression by the available instrumental forces, and the tension between the musical ideals of the orchestrator and the economics of the orchestra, are articulated by this example from Fagan (1976). In performance, the dynamic levels of most of the instruments will have to be limited to bring the passage into balance, or the orchestra will have to be expanded to accommodate the musical outcomes, or the passage will be in danger of sounding unconvincing. Later in the chapter, good taste will be discussed as a musical constraint of orchestration; it is possible to argue that good taste would dictate to the composer to avoid such dynamic indications that would render a passage uncontrollable by the available orchestral forces.

Figure 71: A potentially unsuccessful layering of instruments to produce the sounds of a thunderstorm in the fourth movement (*Con fuoco* ♩ = 108) of Fagan's *Karoosimfonie* (1976).

Within the realm of instrumentation itself, orchestrators must continuously deal with constraints imposed on them by the dynamic limits of instruments, which is likely the physical constraint that has the greatest impact on musical expression. This was seen in the previous example from Fagan (1976). Instruments that are loud or have a weighty sound<sup>136</sup> need greater orchestral support, while instruments with a softer or a more delicate sound need special compensation within the orchestration. The constraints imposed by the dynamic limits of instruments place them in a distinct relationship with the orchestra as a whole, as well as with their own instrument sections, and are contextually dependent on the register of the instrument used at the time. The piccolo, as described by Kennan & Grantham (2002), is too weak in its

<sup>136</sup> See the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141, for more about sound weight and perception.

bottom octave to be used with a full orchestra, or sometimes even too weak for general use (Jacob, 1956). The celesta, throughout its range, is too delicate for loud passages and is drowned out easily by the orchestra (Adler, 2002; Kennan & Grantham, 2002; Jacob, 1956). The harp is a prominent case in the orchestra: although it possesses a wide range of extended techniques, it cannot be used to its full extent in the orchestra, because those effects are so soft and subtle that they could never be heard over even a chamber ensemble (Kennan & Grantham, 2002; Adler, 2002). The celesta and harp that are shown by textbooks to constitute central components of the modern orchestra, only feature in the minority of the eight South African orchestrations referenced in this study; the piano, vibraphone and marimba show preferential treatment in these works<sup>137</sup>. It is possible that the delicate means of sound production of the harp and celesta is a contributing factor to this absence, revealing a predilection for more robust sounds in South African orchestration practice.

The following example shows an ineffective use of the harp in a robust orchestral texture by Van Wyk in *Primavera* (1960). Van Wyk utilises the harp in its lowest register, which is shown in Addendum C to be its least salient register, to support the double basses, cellos, horns, clarinets, bass clarinet and piano in a single texture; together with this, other textural material is assigned to the upper strings, timpani, brass and woodwinds at *mezzo forte* and *forte* (not shown here). The harp, which displays an attractive sine-wave quality in its lower strings, will be completely absorbed by the other instruments due to the lack of strong upper partials. In his orchestration, Van Wyk has attempted to increase the resonance of the harp firstly by marking it *molto forte*, and secondly by respelling the notes to an enharmonic equivalent of the other instruments, but in so doing he has decreased the tension of the strings so that the saliency of the harp is lowered even further. Unfortunately, the harp does not possess the resonance of upper partials in the required register to contribute meaningfully to the texture. Jacob (1956) states often in his textbook that

---

<sup>137</sup> Compare Table 3, p.47 with Table 4, p.48.

an instrument should not be used in a *tutti* section if it cannot deliver a meaningful contribution, because even if not heard it can still detract from the clarity of the line<sup>138</sup>.

Figure 72: Use of harp to fortify a robust texture for strings, woodwinds, brass and piano in the first movement (*Allegro non troppo* ♩ = c.108) of Van Wyk's *Primavera* (1960).

The next example shows the resourceful interplay of harp, piano and celesta to provide colouristic accentuation of the brass texture in Fagan's *Karrosimfonie* (1976). In contrast to the previous example from Van Wyk (1960) where the harp was applied to provide volume and sustain to a passage, the orchestration of Fagan (1976) shows a sensitive approach to the fragile sounds of harp and celesta. In the first section of the passage, the horns (which have the lowest saliency of the brass) are coupled with the harp at a low dynamic level; here the harp is able to penetrate the horn sound to add colour and delicate punctuation to the texture. Addendum C shows that the harp and French horns function at the same strength in the registers in which they have been combined. The more percussive attack of the piano replaces the harp once the increased saliency of the trumpets and trombones is employed in the second section of the fragment. Whereas the softer attack of harp might not have been very suited to complement the trumpets and trombones, the piano is able to match them better. In the last section of the fragment, the extreme delicacy of the celesta is used not at the same moments as the brass, but in the rests between them. Although the timbre of the celesta would have been able to contribute in simultaneity of the brass

<sup>138</sup> This is stated as a requirement for effective orchestration. See *Perspective seven: The meaning of effective orchestration*, p.226.

chords, the unique sound quality of the celesta is more successfully perceived when it plays on its own. On the final chord, the harp, piano and celesta are brought together as a unit together with the brass to tie off the structural unit.

The musical score for Figure 73 is in 3/4 time and consists of two systems. The first system includes Horns (piano), Trumpets (piano), and Trombones (piano). The second system includes Harp (piano), Piano (piano), and Celesta (piano). The score shows the interaction between these instruments, with the harp, piano, and celesta providing a delicate accompaniment to the brass.

Figure 73: Use of harp, piano and celesta to add colouristic accentuation to the brass in the second movement (Tempo I ♩ = 100) of Fagan's *Karoosimfonie* (1976).

As was stated earlier, the piccolo normally provides its greatest contributions in its highest registers. In its lowest octave the piccolo is of a breathy and insecure quality, and it can easily be overshadowed by the orchestra<sup>139</sup>. However, because the low register of the piccolo has such a characteristic sound and is seldom heard in the orchestra, its use can be very effective if used at an appropriate moment. A striking and famous employment of the piccolo's delicate and sweet sounding lower range occurs in the final movement of Beethoven's fifth symphony. Two excellent examples exist in the eight South African orchestral works that are referenced in this study, that display the sound quality of the piccolo's low range, as well as the appropriately sparse use of orchestral accompaniment to accommodate its timbral fragility. The first example (Figure 74) is from Van Wyk's *Primavera* (1960), in which the fife-like quality of the piccolo's lowest octave is exploited to recreate the image of a pastoral scene, in much the same way as Roosenschoon does (Figure 75) in *The Magic Marimba* (1991) when the piccolo takes the place of Pamina's

<sup>139</sup> See Addendum A for various descriptions of the piccolo's lowest octave as it appears in orchestration textbooks.

See Addendum C for a comparison of the strength and saliency of the piccolo in its lowest register, compared to other instruments of the orchestra.

soprano voice from Mozart's *The Magic Flute* (1791). In both examples, orchestral forces are restricted to simple accompaniment in the strings, so that the breathy sound of the piccolo can still be heard.

Figure 74 shows a musical score for the opening measures of *Primavera* (1960). The score is in 3/4 time. The top staff is the Piccolo solo, marked *pp dolce* and *Picc. solo (sounding 8va higher)*. The middle staves are for Violins II, Cellos, and Violas, marked *pp*. The bottom staff is for the Viola, marked *p*.

Figure 74: Use of piccolo in its lowest tessitura by Van Wyk in the opening measures of *Primavera* (1960)<sup>140</sup>.

Figure 75 shows a musical score for the final movement of *The Magic Marimba* (1991). The score is in 6/8 time. The top staff is the Piccolo solo, marked *p* and *Picc. solo*. The second staff is the Saxophone, marked *p*. The third staff is the Marimba, marked *p*. The fourth staff is the Glockenspiel (+15va), marked *p*. The bottom staves are for Violins I, Violins 2, Violas, and Cellos, marked *p*. The score includes dynamic markings *pp* and *mp*.

Figure 75: (♩ = 100) Use of piccolo in its lowest octave in the final movement of *Roosenschoon's The Magic Marimba* (1991).

<sup>140</sup> See footnote 81.



Instrumental dynamic constraints are context sensitive: the horns were found earlier in this thesis to be an exceptional case in the orchestra as well, because of their association with both the woodwinds and the brass: within the brass group they are the softest instruments that require careful balancing with trumpets and trombones in order to retain their presence within a sound mass; inversely, within the woodwinds they are potentially the most robust and can overshadow other instruments if not balanced correctly. Constraints of dynamic limitation therefore work both ways; if applied in the correct manner, writes Jacob (1956), combined instruments can considerably increase the brilliance of tone of the orchestral sound. The piccolo, which was mentioned as being very weak against the orchestra in its bottom octave, is extremely piercing in its top octave and then requires a large orchestral mass to support its sound if it is not meant to stand out as a separate entity. All instruments possess dynamic registers, as Rimsky-Korsakov first described in his textbook (1964) and Blatter (1997) shows graphically throughout his orchestration guide<sup>141</sup>; each of the orchestral instruments possesses ideal, strong and weak registers that orchestrators compensate for in combining them with other instruments<sup>142</sup>. It should be clear that orchestration is very much a product of continuous and intricate balancing schemes between different instruments at the hand of the orchestrator; it will be shown later in the thesis how effective balancing contributes greatly to what is perceived as effective orchestration<sup>143</sup>.

Some instruments of the orchestra are impressively agile and have seen their roles develop within orchestral writing to accommodate that agility; other instruments are less agile or dextrous and have adapted their roles accordingly. On one side, the flute and piccolo that are able to perform double and

---

<sup>141</sup> See Addendum A for a compiled list of instrumental ranges from a substantial list of sources. The addendum attempts to show the instrumental ranges in the same manner in which they are displayed in the originating sources, so the approach of the various authors can be compared to each other. Blatter's graphic display of registral intensity is included there.

<sup>142</sup> Addendum C gives a general outline of each instrument's registral strength and saliency (see also 4.2 *The effect of human hearing and of aural fatigue*, p.141) in comparison to the registral strength and saliency of other instruments of the orchestra. The tables, which were compiled from the information available in various orchestration sources, show the discrepancies between each register of each instrument and makes evident the careful planning required from an orchestrator to balance different registers in different instruments.

<sup>143</sup> See *Perspective seven: The meaning of effective orchestration*, p.226.

triple tonguing are often called on to perform decorative flourishes and runs in support of the orchestra, whereas the less agile and more colourful oboe is generally seen as a melodic instrument (the oboe is, however, very agile in some respects). Likewise, the trumpet is better known for rhythmic figures, while the horn is more used for carried notes; the violins can perform runs and passages with much greater ease than the violas. Many more examples like this exist within the symphonic orchestra that guide the orchestrator towards a certain way of writing. Some examples that show characteristic uses of instruments from various orchestration sections are found in a previous chapter of this thesis titled *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

Other instrumental qualities have also contributed to the development of some instrumental practices. The timpani, for example, can only produce one pitch at a time within a relatively small range and are dependent on a pedal mechanism to change their tuning – every textbook of orchestration therefore cautions the orchestrator to give enough resting time between pitch changes for the timpani, and also advises the orchestrator about the importance of understanding that the timpani are not necessarily suited to playing any note required at a specific moment<sup>144</sup>. Similarly, the harp is not very friendly to numerous successive changes of tuning<sup>145</sup> and like the timpani requires some forethought about its use at any moment in the orchestra. Historically, brass instruments posed the same problem of tuning, because any one instrument could only produce the pitches from one overtone series at a time and had to be retuned with crooks in order to reach different tunings<sup>146</sup>. Orchestrators have had to deal with these constraints throughout history, often with an impressive display of creativity, in order to bridge gaps between what is musically required and what is physically possible for the instrumentalist.

---

<sup>144</sup> In some works, this restriction is overcome by implementing an additional set of timpani (Berlioz: *Symphonie Fantastique*) or an additional timpanist (Stravinsky: *Le Sacre du Printemps*). The development of timpani as an orchestral instrument is also discussed in another footnote (footnote 59, p.69).

<sup>145</sup> The harp, which functions diatonically rather than chromatically (the majority of instruments can produce any one of the twelve notes of the just-intoned chromatic scale at any moment, but the harp only has seven strings per octave instead of twelve), so that a set of seven tuning pedals must be used in combination to produce different sets of diatonic scales. Because the pedals are changed by foot, complicated and agile changes are challenging.

<sup>146</sup> This is discussed at greater length in a preceding chapter of the thesis. See the section titled *2.6 The slow and gradual incorporation of the brass*, p.97.

### 5.3 The effect of musical constraints on orchestration and the use of the orchestra

Orchestrators are not only concerned with the physical instrumental constraints placed on them that were described in the previous section: there are also musical concerns that limit the ways in which orchestrators write music for orchestras. The first of these deals with the concept of musical taste, which is expressed relatively often in orchestration texts and in this thesis<sup>147</sup> and has a particular impact in limiting musical instrumental expression within orchestral genres. The development of historically informed performance practice (colloquially often referred to by the acronym HIPP) in the twentieth century has made a strong impact on orchestrators gaining a greater awareness of links between instrumentational design and musical expression<sup>148</sup>.

In Hofmeyr's *Sinfonia Africana* (2003), for example, the composer states in his programme notes to the première that the orchestration is constructed as a march, but the use of strings *pizzicato alla chitarra* in a dotted rhythm in  $\frac{4}{4}$  time, together with the decorative, sombre trumpet melody and percussion instruments accenting the weak beats, create a distinctly Spanish dance atmosphere. This is clearly not Hofmeyr's intention, as the movement and the work deal with Africa and not with Spain. Therefore, the instrumentational design has led to an unwanted musical expression. In the following example, the trumpet

---

<sup>147</sup> Taste and good taste, which are often referred to in orchestration texts, seem to be in accordance with Kant's interpretation of the concept, namely that beauty is not a property of any object, but an aesthetic judgement based on a subjective feeling. Authors appear to write with a kind of awareness about a genuine good taste, but one that cannot be empirically identified. Kant's assessment that a judgement of taste presumes the existence of a *sensus communis* (a consensus of taste) is what authors such as Jacob (1956) and Parrott (1957) presume when referring to a general and obviously identifiable notion of good taste. A judgement about taste, according to Kant and which orchestration texts seem to adhere to, does not take for granted that everyone agrees with it, but proposes that there is a community that shares such an experience. This thesis does not allow for an exhaustive discussion about taste, but the author acknowledges that the concept is informed by a rich history of philosophical writing. The reader is referred to Gronow's *A Sociology of Taste* (1997), for an expansive discussion of taste and good taste. More about taste can be found in the sections of this thesis titled *Perspective one: The mystification of orchestration (also an introduction)*, p.23, *Perspective seven: The meaning of effective orchestration*, p.226, and *Perspective eight: Knowledge and orchestration*, p.260.

<sup>148</sup> In Sevsay (2013), historically informed practice in orchestration is applied throughout his textbook as a pedagogical tool. Sevsay focuses extensively on the practices and techniques of Viennese classicism in his textbook.

is reminiscent of a male voice, the strings of a strummed guitar, and the percussion of foot stomps and clapping that accompany traditional Spanish dancing:

The musical score is for the opening of Hofmeyr's *Sinfonia Africana* (2003). It is in 4/4 time and consists of several staves. The top staff is for the Solo trumpet, marked with a forte (f) dynamic. The second staff is for the Timpani (Timps.), marked mezzo-piano (mp). The third staff is for the Suspended cymbal (Sus. cymb.), also marked mp. The fourth staff is for the Bass drum (B. drum), marked mp. The fifth and sixth staves are for the Violins and Violas (Vlins+Vlas) and Cellos and Basses (Vcls+ basses), both marked mezzo-forte (mf) pizzicato sul ponticello alla chitarra (pizz. sul pont. alla chitarra). The score includes various musical notations such as slurs, accents, and dynamic markings.

Figure 76: Strings pizzicato alla chitarra, percussion and solo trumpet in the opening (*Quasi marcia funebre* ♩ = c.58-63) of Hofmeyr's *Sinfonia Africana* (2003).

The link between instrumentational design and musical expression is described by Kennan & Grantham (2002) both in general terms and in a historically informed context. Within the realm of HIPP, they question the validity of using modern instruments to express old styles of music: for instance, would modern valve trumpets be appropriate for Baroque orchestration, or would the roto-toms or vibraphone be acceptable additions to an orchestration of a Bach work? The question translates in general terms into the idea that orchestrators should always question the best instruments and combinations of instruments to use in order to communicate their musical ideas in the most effective manner; or inversely that if a composer is given a predetermined group of instruments, he or she must develop musical ideas that will best suit the ensemble at hand. This is stated as a prerequisite of effective orchestration<sup>149</sup>. The interdependency of musical requirements, good taste and available instruments is articulated in

<sup>149</sup> The idea that orchestration should be effective is discussed together with some of its parameters in a different section of this thesis titled *Perspective seven: The meaning of effective orchestration*, p.226.

orchestration textbooks; Parrott (1957) for example places musical outcomes and ensemble size in a state of tension by stating firstly that a smaller orchestra requires a more nuanced application of balance and blending and is therefore more difficult to compose for, while noting secondly that a very large force of instruments could become more an exercise in colour and technique than in clear musical thinking. Taste is introduced as a determining factor by Kennan & Grantham (2002) who write that good taste will always determine that an orchestrator will not necessarily use an instrument simply because it is available.

It is likely that good taste and effectiveness are to some extent interchangeable properties of orchestration. On the one side, effectiveness is a characteristic of an orchestration that utilises instrumental techniques, effects, aesthetics, balance and clarity in a combination that is pleasing and convincing. These characteristics are described in a later chapter of this thesis; see footnote 149. In other words, effectiveness is not a constraint, but an orchestrational ambition. Good taste, however, transforms the characteristics of effectiveness into a musical constraint, so that the ideals of effective orchestration become parameters within which orchestration can take place successfully, and outside of which an orchestration is likely to fail. Colloquially speaking, some things are not done in orchestration because they fall outside of what the parameters of good taste dictate<sup>150</sup>. Inversely, if a composer treads outside of the bounds of good taste, and does so to good effect, the result could be surprising and refreshing. Stravinsky's *Le Sacre du Printemps* would be a good example of a work which trod outside of the boundaries of good taste for its time (and elicited an aggressive response at its première), but did so to such good effect that the work is still celebrated for its innovation a century later. In a previous example from Fagan's *Karoo-simfonie*, good taste was mentioned as a consideration of the possibility that the orchestral forces at hand would not be able to perform an orchestrational figuration effectively. In this sense, good taste

---

<sup>150</sup> Unfortunately, the properties of orchestrational good taste are not really described in orchestration textbooks, although authors seem to presume that its characteristics should be universally obvious to any orchestrator. It is likely that they are about the same as the characteristics of effective orchestration.

becomes the guiding force of efficacy in the orchestration process, and informs the orchestrator about the various factors that determine effective orchestration<sup>151</sup>.

A tension exists between musical intent and the characteristic qualities of a specific instrument. In most orchestration textbooks, it is recommended that an instrumental melody be designed in such a way that it sounds as if it was specifically designed for that instrument. In other words, a melody-instrument pair must be chosen that suits each other most ideally. Parrott (1957) describes the requirement from two sides: firstly that the limitations of an instrument must be made into virtues, so that a melody sounds as if it was made for an instrument; secondly that the orchestrator must realise that it is not enough to write an abstract melody and then assign any instrument to it that possesses the correct compass. There is, therefore, a precarious balance between the abstract musical outcomes of the orchestrator and the sound imperatives of the individual instruments for which the orchestrator writes; orchestration authors require of students to be able to balance the two in such a way that the strengths of each are amplified and the weaknesses diminished.

Instrumental imperatives, or the natural qualities of the sounds specific to an instrument, are mentioned in orchestration texts as a constraint to engage with, as was evidenced previously. Idiomatic writing for an instrument<sup>152</sup>, which is often praised as a sign of good instrumental writing, is a result of abstract compositional ideals engaging constructively with instrumental limits and imperatives. The imperatives are described in texts by Berlioz & Strauss (1991), Rimsky-Korsakov (1964), Piston (1961), Parrott (1957), Kennan & Grantham (2002) and Adler (2002) as impacting vertical writing through constraints of range, sound colour, dynamic register and saliency<sup>153</sup>, and horizontal writing through

---

<sup>151</sup> See *Perspective seven: The meaning of effective orchestration*, p. 226.

<sup>152</sup> Idiomatic writing is referred to often in this thesis, as it is in all sources about orchestration. For more ideas about idiomatic writing, see the sections titled *Perspective six: Inherited practices and orchestrational traditions*, p.193, *Perspective seven: The meaning of effective orchestration*, p.226, and *Perspective eight: Knowledge and orchestration*, p.260.

<sup>153</sup> See Addendum A for more about instrument ranges, and Addendum C for more about registral strength and saliency.

constraints of agility, dexterity, projection, rhythmic or cantabile abilities, and the skill of the player. As Jacob (1956) states rather succinctly, the notes must be written and must go somewhere, and part writing is a fundamental necessity of orchestration.

There are, other than aesthetic considerations such as good taste, a number of technical musical constraints placed on the orchestrator: a thorough knowledge of voice leading principles, music theory and harmony are listed in all twentieth century sources as prerequisites for effective orchestration to take place<sup>154</sup>. Many examples exist in the popular and film music industry of composers who have very little or no music theory background, who employ trained orchestrators to realise their music for symphonic orchestra. The practice is so common that an orchestrator's guild exists in the United States of America to protect the artistic and authorial rights of professional orchestrators<sup>155</sup>. Kennan & Grantham (2002) write that effective orchestration is completely dependent on the application of good voice leading, spacing and doubling, and that without it, any amount of mental filigree will produce unsatisfactory results; likewise without understanding harmonic content and form, intelligent scoring is impossible.

Orchestration books by Piston (1961), Jacob (1956), Parrott (1957), Blatter (1997), Kennan & Grantham (2002), Adler (2002) and Sevsay (2013) state a music theory background as a prerequisite to successful orchestration, implying that orchestration is dependent on these subjects and informed by their teachings. Especially in the areas of doubling and chord tone distribution the underlying principles of harmony and voice leading play important roles. Sevsay, in his guide to orchestration, places instrumentation and orchestration in a state of tension whereby instrumentation is the application of technique and orchestration is the realisation of artistic ideals; the link between his definitions of

---

<sup>154</sup> Jacob (1956) describes five skills that the orchestrator should strive to gain from music theory in preparation for undertaking orchestration: a good aural imagination, practical common sense, a clear and well-ordered style, a mind alert for points of interest, and a sense of the dramatic. It can be argued that these skills, though only colloquially described by Jacob, are actually central to all aspects of informed music making, and will likely still be developed while orchestration is underway, making them soft constraints rather than hard limits.

<sup>155</sup> The differences between authorship and ownership of music and the artistic contributions made by orchestrators to existing works of music are discussed in Schonken (2013).

instrumentation and orchestration are the principles of voice leading, harmony, form and music theory that provide the orchestrator with tools to allow artistic expression of musical ideas within pre-existing technical constraints. Kennan & Grantham state that *in lieu* of the fact that universal formulas for chord tone distribution and doubling do not exist, the orchestrator is constrained by harmonic principles in order to realise vertical orchestral textures successfully. As Adler writes, these constraints are not meant to be seen as stifling the artistic outcomes of the orchestrator, but are meant to be utilised by the orchestrator to spark creativity and imagination. However, Adler also warns that orchestral players have a certain dependency on these principles that if not applied in orchestral writing can cause rehearsals to degenerate into a state of disarray that can interfere with the smooth performance of the work.

Following are a number of examples from eight South African orchestral works that show how principles of form, voice leading and harmony underpin the mechanics of orchestration.



[Vivace subito ( $\text{♩} = 144$ )]

165

Fl. *mp*

Picc.

Ob.

E. Hn. *pp*

Bsns. *pp*

C. Bsn. *pp*  
*div*

Hns. *pp*

Tbn. *pp*

Pno. *pp*  
*8va*  
*ped.*

Hp. *pp*

[Vivace subito ( $\text{♩} = 144$ )]

15<sup>me</sup>

S. Vln. *pp*

Vlins I *pp*

Vlins II *pp*

Vlas. *pp*  
*div*



Vcls. *pp*

D. Bs. *pp*

Figure 77: Rhythmic and harmonic differentiation of musical layers leading up to a recapitulation of the opening material in Klatzow's *Incantations* (1984).



In both of the figures above, Klatzow and Zaidel-Rudolph employ basic contrapuntal techniques of rhythmic differentiation to clarify different musical layers in their orchestrations. In Klatzow (1984), the combination of harp and flute at a distance of over three octaves seems unlikely to blend, but their unique rhythmic profile unifies them and separates them from the other orchestral textures as a single unit.

The use of oboe in the place of piccolo in the third bar is an important colouristic shift towards the reappearance of the opening material two bars following, in which the oboe plays an important role (compare with Figure 7). Note also how the chord tones, which in close proximity would create a set of three dissonant semitone clusters () , are separated into two major triads and one minor triad () , so that within a greater context of dissonance, local areas of harmonic stability are created. In Zaidel-Rudolph (1986), a polyrhythmic texture is constructed in the strings and percussion, supported by sustained flutes and horn, over which the trombones project a melodic pattern of semiquavers. Zaidel-Rudolph separates textural elements into two distinct harmonic layers, much like Klatzow did: basses and cellos provide an open octave on C, which combined with the violas on F# create a tritone – this is also the tone structuring of the trombone melody; the horns, flutes, violins and mallet instruments create an A<sup>b</sup> major triad suspended over the tritone. Harmonic textures are further differentiated in Zaidel-Rudolph by the use of distinct and consistent rhythmic profiles. In both Klatzow and Zaidel-Rudolph, an understanding and utilisation of the principles of counterpoint and harmony have contributed to the fundamental structuring of an orchestral passage.

In the following example, Hofmeyr's adherence to the basic principles of voice leading in *Sinfonia Africana* (2003) is displayed in a passage for strings and oboe. Voice leading in this figure basically translates into the correct spelling of pitches according to how they are prepared and resolved; raised pitches resolve upward and lowered pitches resolve downward. The spelling of some notes creates the visual means by which to identify harmonic tension that only resolves a number of beats later. Hofmeyr's adherence to voice-leading principles is not just an exercise in technical accuracy, but also a courtesy to the string players who require proper voice leading for comfortable placement of fingers in the correct

fingering positions. String players link together chains of fingering in positions from open (zero) to seven on either of the strings according to the indicated voice leading. If voice leading is incorrectly spelt, the playing of certain passages becomes counterintuitive, whereas fingering patterns are normally easily identified if spelling is correct.

Figure 79: Correct use of enharmonic spelling to support voice leading in the first movement (Tempo primo, ma tranquillo con rubato ♩ = 69-76) of Hofmeyr's *Sinfonia Africana* (2003).

Three points of interest in Hofmeyr (2003) have been marked in the figure above to show some examples of his use of standard voice-leading patterns in *Sinfonia Africana* in order to accentuate visually the harmonic function and most convenient fingering patterns for the performers. The example serves to show the significance of correct voice leading in orchestration:

1. Here the orchestrator has chosen to use a complex spelling of pitches in the basses, cellos and violas to emphasise their localised functions as raised notes that need to resolve upward. These notes will be tuned higher than their enharmonic equivalents due to their harmonic function. Lastly, the spelling of the notes as C<sup>x</sup> and F<sup>x</sup> rather than D<sup>b</sup> and G<sup>b</sup> places them in a different fingering position.
2. The orchestrator has chosen to respell a pitch enharmonically in the violins II to prepare the players for the change of harmonic function; whereas the D<sup>#</sup> functions as a local leading-tone, the E<sup>b</sup> functions as a lowered submediant. The tuning of the E<sup>b</sup> will likely be slightly different from the D<sup>#</sup>

due to the change of function, and provides the performers with a visual cue to change from the D-string to the G-string.

3. As a final example, the orchestrator changes the harmonic function of the passage by moving away from sharps towards flats. Whereas sharps imply normal or raised functions within the local key environment, the change of  $C^\sharp$  to  $C^\flat$  and  $B^\sharp$  to  $B^\flat$  indicates a preeminent change in the harmonic environment.

## 5.4 Concluding remarks

In this Perspective, a number of constraints were shown to express themselves in orchestration texts as a functioning balancing counterpart to those aspects of orchestration that resist systematisation. These two contrasting aspects of orchestration provide complementary functions and often influence each other constructively; it was shown, for example, that constraints often lead orchestrators to more creative work. Constraints were divided into two distinct groups, referring to those that express themselves physically (mechanical, economic or logistical constraints) and those that express themselves musically (idiomatic, dynamic, timbral, registral and functional constraints). These two groups affect each other in that physical constraints lead to adaptations in musical expression, while developing musical needs and expanding idioms cause technical instrumental development. The first physical constraint, which was economic viability, was shown to impact the orchestra in many fundamental ways and therefore also impact orchestration. Instrumental development, orchestra size, availability of instruments as well as of players were shown to be dependent on economic factors. Expressed in musical terms, economic writing is a concern of orchestrators as well and implies that the use of instruments should be meaningful and substantial within a musical work. Instrumental constraints express themselves in the limits of range, dynamic strength and timbral qualities of each instrument of the orchestra. A number of technical strengths and weaknesses of each instrument has contributed to the commonly perceived idiomatic functions within the orchestra; some instruments have resultantly assumed melodic, harmonic or rhythmic roles and in so doing the instrumental hierarchies that were discussed earlier in the thesis are reinforced.

Musical constraints were shown to express themselves in terms of good taste, historical awareness, effectiveness, idiomatic writing and prerequisite knowledge. Good taste was considered as a complementary force to effective orchestration, and that whereas the latter can be considered the final goal of orchestration, the former is a constraint in orchestration. Historically informed practice raises questions about the link between instrumental capabilities, idiomatic writing and expressive qualities of music. Finally, an interdependency is expressed between musical requirements, available instrumentation and good taste. Practically speaking, this interdependency translates into the notion that an instrument will not be used simply because it is available to the orchestrator, but because it contributes meaningfully to the musical requirements of a work within the bounds of good taste. The musical imperatives of individual instruments express themselves in the form of idiomatic writing, so that it can be said that the material written for an instrument should sound like it was meant to be written for that specific instrument. Often, this will require some small adaptations in the material to augment the positive qualities brought to the technical and musical capabilities of the instrument, while diminishing the less favourable qualities. Lastly, all musical aspects of orchestration and the various mechanisms that constitute writing music for orchestra are highly dependent on prerequisite knowledge about music theory, harmony, voice-leading, and various aspects of sound propagation and perception, without which effective orchestration could not take place.

As in previous chapters, a diagrammatic representation of the conceptual links between some of the most important ideas discussed in this chapter are shown as a visual counterpart to the ideas that were described in this Perspective:

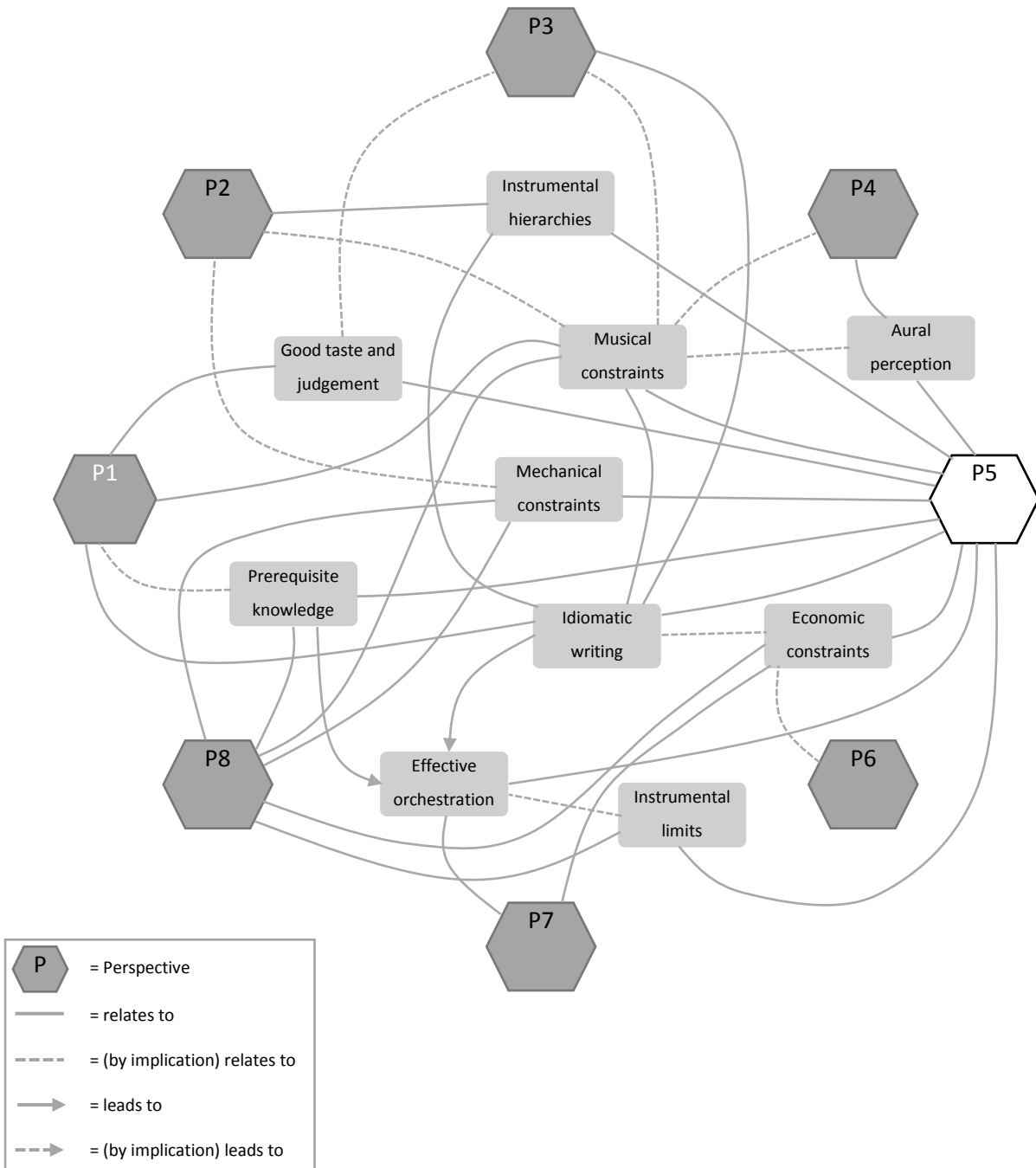


Diagram 5: Concept web showing interrelatedness of concepts in Perspective 5 with other Perspectives.

## Perspective six: Inherited practices and orchestrational traditions

### 6.1 Introduction

Orchestration textbooks of the last century make frequent use of examples of existing music literature to provide the student with a useful selection of orchestrational illustrations, models and possibilities, and thereby preserve existing and/or inherited practices of orchestration; these textbooks, therefore, serve as perpetuators of custom and tradition<sup>156</sup>. A perpetuation of tradition is necessitated by the systems of score study that form integral components of orchestration<sup>157</sup>. However, tradition in orchestration should not be confused with the idea of traditionalism, which would imply a reaction against progressiveness or modernity. Notwithstanding how traditional an orchestrator's approach to instrumentation might be, the resulting orchestration could still represent contemporary ideals of music composition. Yet, the term tradition is not avoided in this thesis: it has valid application in this instance (as opposed to more neutral terms like custom, norms or routines), because contemporary orchestration authors and those of the twentieth century refer to tradition numerous times when discussing practices that have been passed down through the history of the orchestra.

Text fragments that led to the discovery of this category refer to the idea of tradition either overtly or by implication. The latter occurs when authors discuss the successful application of techniques by master composers, the normal use of instruments in the orchestra, the unusual effects achieved by composers who deviate from the norm, or when they attempt to devise formulas for certain techniques by predicting models based on previous attempts analysed in existing scores. Similarly as with the previous category that described certain physical and musical constraints within orchestration, in this category authors often prescribe what they consider to be accepted or normal practice in orchestration, or what customary procedure would entail.

---

<sup>156</sup> A compiled list of examples, as well as the techniques and effects they reference, is included as Addendum B in this thesis. Eight textbooks written since 1900 were consulted for a total of around 1800 references.

<sup>157</sup> Score study as a method of learning orchestration is discussed in the section titled *4.3 Echoic memory and remembering sound*, p.153, and in the chapters *Perspective seven: The meaning of effective orchestration*, p.226, and *Perspective eight: Knowledge and orchestration*, p.260.



In constructing this category, two branches with sub-branches become apparent as two opposing and complementary arguments within inherited practices. On the one hand, existing customs and traditions are explained or are used to justify existing practices; on the other hand, new or changing customs and traditions are explored. In the case of the latter (changing traditions) and especially in discussing the twentieth century and its fast-developing orchestrational practice, authors sometimes attempt to predict new traditions and justify their predictions by comparing them to changes that occurred in the past. The first branch (established traditions) can be further divided into three major ideas: the first deals with instrumental traditions and how they impact orchestration; the second discusses more specifically the orchestral traditions that remain our inheritance in the twenty-first century; and the third appears to justify perpetuated traditions by referring to score examples as ideal models of orchestration. The last branch (changing traditions) can also be subdivided further into two more: the first highlights developing instrumental traditions and effects as tools that impacted and changed the practice of orchestration; the second shows us a perception of the developing art of orchestration as a trajectory following the classical model of the eighteenth century, the romantic interloper of the nineteenth century and the modern apex which points back to the classical model. A diagram displays this branching and sub-branching to greater effect:

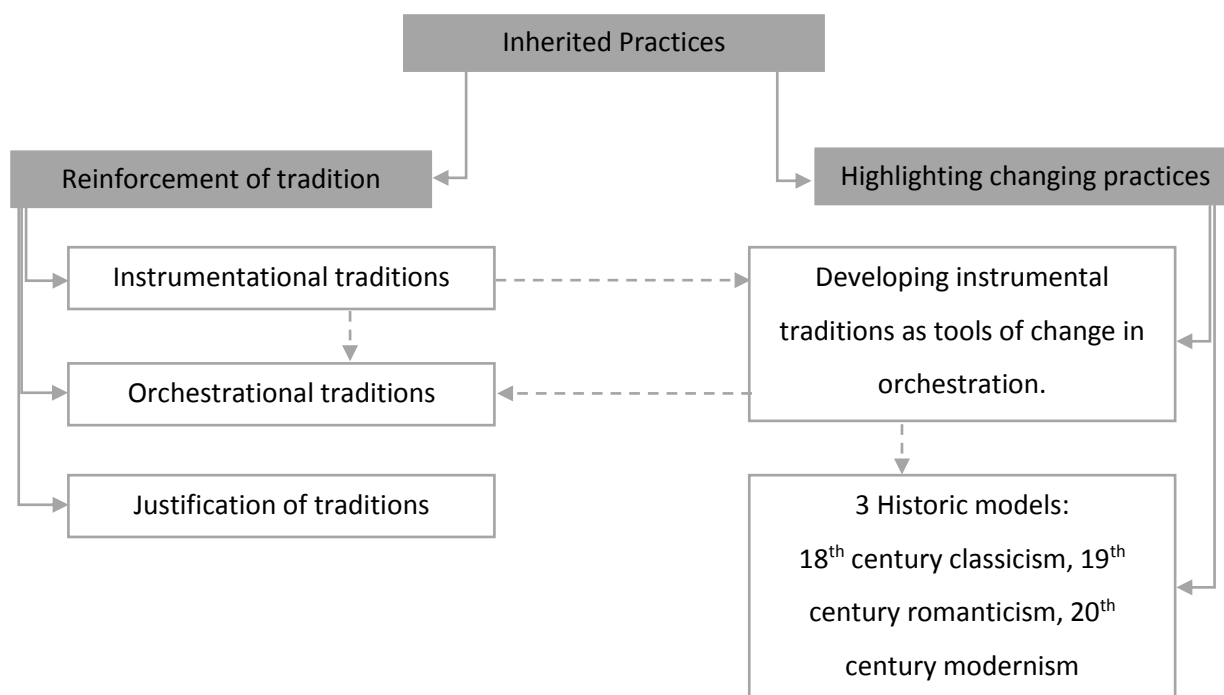


Diagram 6: A visual conceptual representation of inherited practices as a category of orchestration practice.

## 6.2 Reinforcement of tradition

As it was shown in the introduction to this chapter, three objects of focus reveal themselves through analysis and coding of text fragments with regards to how authors reinforce orchestral traditions in textbooks. The first focusses on instrumental practice, the second on orchestral practice, and the third on score evidence. Once these subcategories are identified and separated, closer investigation reveals subdivisions within these objects of focus. When discussing instrumental practice, for example, authors focus on three key terms or jargon: what is natural, what is the rule, and what is done most of the time.

Instrumental tradition or inherited instrumental practice is propagated firstly by stating that some instrumental practices are natural, “natural” being a word of jargon that is found throughout Piston (1961), Jacob (1956), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Sevsay (2013), and already as early as Berlioz (in Berlioz & Strauss, 1991) in order to indicate something that is found in many scores or texts over the previous three centuries. “Natural” is applied to instrumental range, placement, layout, technique and function. The “natural function” of the bassoon, for example, is to provide a bass to the woodwind group (Jacob, 1956); the “natural function” of the celesta is to provide a limpid sheen to an existing melody

(Parrott, 1957); the “natural function” of the timpani is to provide support for the orchestra in rhythmic figuration (Kennan & Grantham, 2002); and the “natural function” of the horn within the orchestra is either to carry a melodic line or to provide harmonic support (ibid.). The “natural layout” of the string orchestra is in four-part harmony with basses doubling cellos where needed (Berlioz & Strauss, 1991; Jacob, 1956). It would be “natural” to place a loud cymbal crash at a moment of excitement or climax (Kennan & Grantham, 2002); the bass drum can be versatile, but “naturally” it is well equipped to add volume and percussive accent to an orchestral tutti (Adler, 2002). The horn section, because of the “natural” divide in the physiology of players who specialise in carrying high and low material, can be divided into two pairs (Piston, 1961). A “natural” octave relationship can be found between the trumpets and trombones (ibid.). Without discussing the merits of these divergent statements, it is possible to draw a number of ideas from them.

Firstly, it is possible to draw a correlation between the ideas of natural and idiomatic; if an orchestrator uses the techniques and abilities of an instrument that come naturally to it, the resulting sound will be idiomatic. Idiomatic writing in music has long been held as a trait of good or effective composition (and by implication, orchestration)<sup>158</sup>, although instrumental idioms have often been expanded over time through the absorption of ideas that were at first perceived as extending beyond the scope of that which would be considered idiomatic at the time. The most often cited orchestral work in a collection of eight twentieth century orchestration textbooks, that is Stravinsky’s *Le Sacre du Printemps*, was at the time of its first performance received with mixed reviews due to the manner in which it challenged both the orchestra and the dancers. Imaginably, the colouristic effects employed by Ravel in his orchestration of Mussorgsky’s *Pictures at an Exhibition* 50 years after its composition might also have seemed disagreeable in 1874. Therefore, in my reading of the material, implied idiomatic qualities of natural writing serve to reinforce the importance of orchestration tradition by leading students towards writing for the orchestra in traditional ways. The orchestrator then functions in a state of tension between

---

<sup>158</sup> The link between idiomatic writing and effective orchestration is discussed to greater length in the next chapter titled *Perspective seven: The meaning of effective orchestration*, p.226, but was also mentioned in the previous chapter titled *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.

the technical expression of a musical idea and the boundaries of what is considered idiomatic; if the resulting musical work exceeds the bounds of idiomatic writing, the tension is transferred to the performing musicians who absorb the expanded idiom through performance and transfer the expanded idiom to younger composers through score study<sup>159</sup>.

The following examples from eight South African orchestral works show representative clarinet passages from each. These examples show some of the idiomatic uses of clarinets either in pairs or alone. Notably in Figure 80, Figure 81, Figure 84 and Figure 85, the clarinets feature as a pair and are used in harmonic intervals; Jacob (1956) praises such “natural” use of the clarinets. In Figure 86, the clarinets start with a fanfare motive that mimics the preceding trumpets, which is another commonly occurring function in orchestration. After that, Grové combines the clarinets with all woodwinds to create a single voice, which is a practice also employed by Zaidel-Rudolph in Figure 83. In Figure 82 and Figure 87, a third very common use of the clarinet is shown, namely to provide colour effects to a musical texture. Each of these examples can be studied to compare them with others in terms of how idiomatic or “natural” they appear to be, and other instruments could be compared in the same manner.



Figure 80: A representative example of Van Wyk's use of clarinets (transposed) in the final movement of *Primavera* (1960).



Figure 81: A representative example of Fagan's use of clarinets (transposed) in the first movement of *Karoosimfonie* (1976).

<sup>159</sup> Orchestration displays a trend of placing the orchestrator in a state of tension between a number of physical and musical factors. Various other states of tension involving the orchestrator are referred to and described throughout this thesis, but the reader can refer to footnote 133 for more about this.

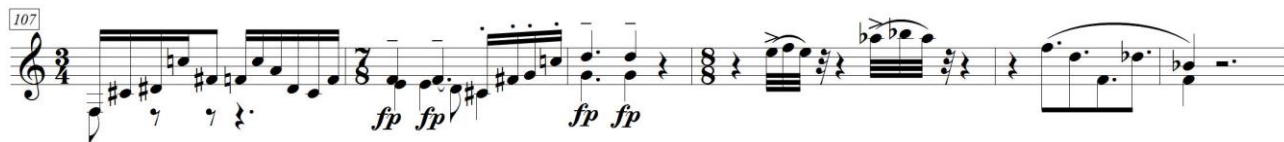


Figure 82: A representative example of Klatzow's use of clarinets (non-transposed) in *Incantations* (1984).



Figure 83: A representative example of Zaidel-Rudolph's use of clarinets (non-transposed) in *Tempus Fugit* (1986).

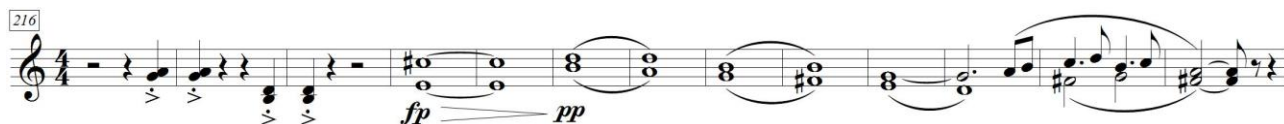


Figure 84: A representative example of Roosenschoon's use of clarinets (non-transposed) in the second movement of *The Magic Marimba* (1991).



Figure 85: A representative example of Temmingh's use of clarinets (transposed) in *tjellokonsert* (1992).



Figure 86: A representative example of Grové's use of clarinets (transposed) in *Raka* (1996).

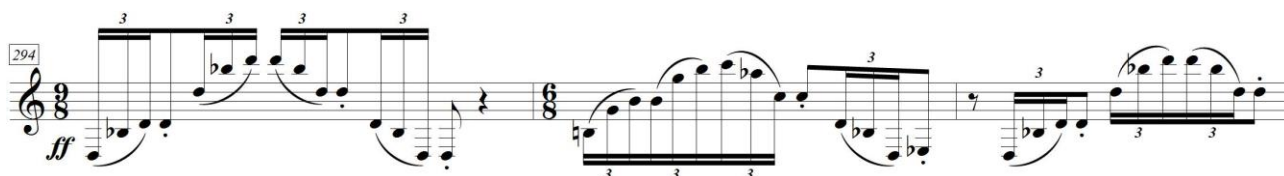


Figure 87: A representative example of Hofmeyr's use of clarinets (non-transposed) in *Sinfonia Africana* (2003).

Tradition is furthermore imposed on orchestral instrumental practice via the promotion of traditional techniques and customs in textbooks about orchestral writing. Earlier in the thesis, orchestrational constraints were discussed as rules relating to what a composer should not do; here a counterpart exists for that category in the form of what a composer should do based on what historical standard has been provided. It is important to note that because performance of works from the western canon makes up a substantial portion of orchestral concerts, and because orchestrators utilise the study of orchestral

performance as a tool for learning orchestration<sup>160</sup>, orchestration shows the tendency towards a reliance on traditional instrumental techniques for its proper functioning. For that reason, the idiomatic (or natural) instrumental techniques that were discussed earlier in this chapter have a counterpart in orchestral technique as well<sup>161</sup>. Perspective two, which described instrumental functions within the orchestra, showed how the unique characteristics of each orchestral section contributed to a hierarchical structuring of instrumental forces. Some examples can be shown to prove how instrumental traditions are propagated for the reason that they are traditions; perhaps, most strikingly, is the tradition of writing for transposing instruments, which is a practice that persists today partly because it is tradition to do so; to change the practice that is now so deeply rooted would likely be impossible (Jacob, 1956; Carse, 1964; Del Mar, 1983). Another layer of convolution is added to orchestration in this process, because orchestrators are required to compose in multiple transpositions simultaneously to produce the desired unified pitch outcome. It has been suggested that some instruments remain transposed, because it facilitates the ease with which players can switch between different instruments of the same family; however, the trombones, tubas and recorders are notable examples of instrument families that do not transpose, but play on various tunings (recorders, for instance, are tuned in C, D, F and G, in various octaves). The modern double or triple horn in F and B<sup>b</sup> also requires continuous internal transposition from the performer, but this is not the concern of the orchestrator who writes only in F.

Some interesting examples of tradition in orchestration are found in orchestration literature. The cornet for example, which Jacob (1956) explains has greater flexibility than the trumpet and articulates more easily as well, is conventionally found in the military or brass band and is not used in the symphony

---

<sup>160</sup> See the next two chapters titled *Perspective seven: The meaning of effective orchestration*, p.226, and *Perspective eight: Knowledge and orchestration*, p.260, for more about the importance of score study in orchestration.

<sup>161</sup> Within reason, the orchestrator's training as an instrumental performer should have a significant influence on his or her orchestration, but this factor is not discussed in orchestration textbooks. It is possible that the same way in which the orchestrator assumes the imaginary role as audience member in the orchestration process, the orchestrator can assume the imaginary role of instrumentalist to aid in conceptualising the technical and musical outcomes of a work. The imaginary role as listening is discussed in a foregoing chapter titled *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141.

orchestra. Composers are likewise discouraged from including the upright piano or bells other than tubular bells in their orchestrations, because tradition has shown that the 9-foot grand piano and tubular bells are the most effective and are therefore now in standard use in the orchestra (Parrott, 1957; Blatter, 1997; Kennan & Grantham, 2002). The timpanist, who is usually also a versatile percussionist (in a solo capacity), should traditionally not be required to perform on other percussion instruments as well; the timpani is assigned exclusively to one player, and where a composer has chosen to change the rule, orchestras have generally hired an additional performer to take either only the timpani or only the extra instruments (Adler, 2002). In the eight South African orchestral works referenced in this thesis, all of them employ a dedicated timpanist.

Textbooks also have some examples of how performance techniques are restricted by tradition: the harp part of an orchestration should consist, as is traditional, only of strategic chords and arpeggio figures, with some glissando effects (Widor, 1906; Wagner, 1959; Jacob, 1956); the timpani should only be used on notes that fit with members of the harmony, as is the tradition (Kennan & Grantham, 2002); trumpet parts should consist mostly of rhythmic figuring, which would traditionally constitute the bulk of their content (Blatter, 1997); the horns have always had a place with both the woodwinds and the brass, and so orchestrators should consider them as belonging to both groups (Jacob, 1956; Adler, 2002). It has always been the case that composers have at times expanded on these traditions and continue doing so in contemporary practice – the jargon referred to here (“tradition”, “should”, “mostly”, “constitute the bulk”) therefore describes the point of departure rather than the outermost limits. A number of early examples exist to show how orchestrators’ disregard for rules of the time has led to the expansion of accepted performance technique. Monteverdi’s use of string tremolo in his operas was a decided break with the instrumental technique of the time and was met with fierce resistance at first (Carse, 1964; Del Mar, 1983). In Beethoven, the expansion of the horns was necessitated by the tonal requirements set by his music, as was his shifting away from tuning timpani in the tonic and dominant. What was at those times considered a break with tradition, became absorbed into standard practice in the following decades so that later they were considered standard practices.

In the following examples from South African orchestral works, the use of harp is shown even in contemporary scores to adhere mostly to traditional patterns and modes of performance. In the first two figures, the harp fills in arpeggio figures with the left and right hands in an octave. The second example from Fagan (1976) is somewhat unidiomatic because of the uneven spacing of intervals and the regular changing of pedals throughout. In the last example from Hofmeyr (2003), the extended arpeggio figure has been worked out for each hand in order to facilitate with performance; this figure is sustained throughout nearly the entire movement. Grové takes the most experimental approach with a *bisbigliando* effect in the right hand and *glissando* plucked by the nails of the left hand; Grové uses this single figure throughout the entire first movement of his composition. In Klatzow (1984), the harp player's part is restricted to simple chords and repeated figures throughout:

Figure 88: Representative example of Van Wyk's use of harp in the first movement of Primavera (1960).

Figure 89: Representative example of Fagan's use of harp in the second movement of Karoosimfonie (1976).

Figure 90: Representative example of Klatzow's use of harp in Incantations (1984).



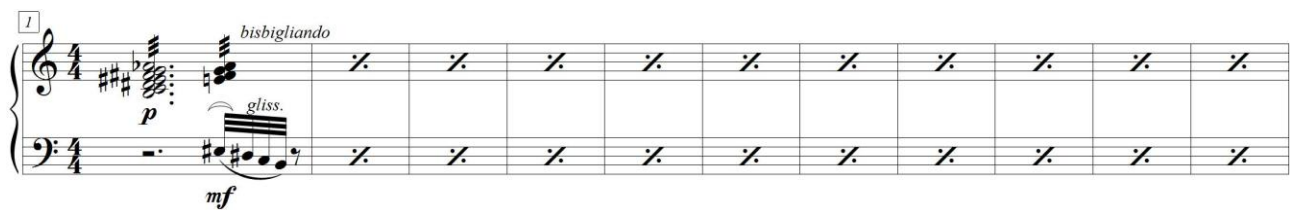


Figure 91: Representative example of Grové's use of harp in the first movement of *Raka* (1996).

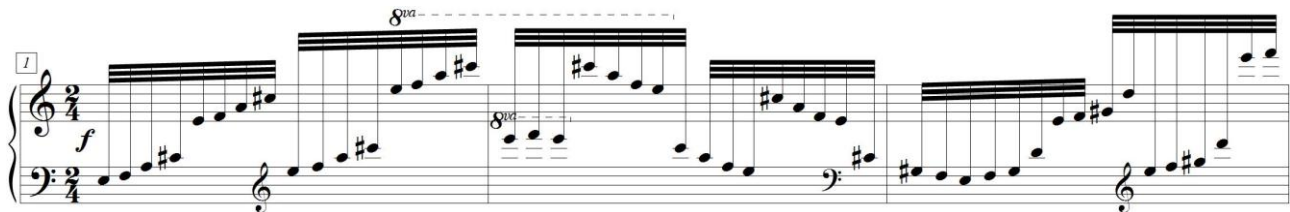


Figure 92: Representative example of Hofmeyr's use of harp in the third movement of *Sinfonia Africana* (2003).

Lastly, instrumental tradition is reinforced in orchestration literature by calling on score examples of master composers as examples of ideal practices. By promoting firstly an attitude that students should study scores to gain knowledge about good orchestration, and secondly that score examples show an abundance of established and successful instrumental techniques, the idea that traditional techniques are superior is more firmly secured in the practice of orchestration. Score examples focus mainly on pointing out ideas in three conceptual areas: instrument range, musical placement of an instrument, and instrument use. As was previously the case, the boundaries are described to differentiate between the traditional and the non-traditional areas of orchestration, which colloquially often translates to the safe and the dangerous realms of orchestration. A number of examples follow from textbooks.

According to a number of authors, for example, it is usual for some instruments to be considered as the bass voice of their group: these sources quote score examples from different styles and periods to show that the cellos constitute the bass voice of the string group most of the time, with double basses merely reinforcing the function of the cellos (Piston, 1961; Adler, 2002; Kennan & Grantham, 2002); the trombones are shown in scores from classical, romantic and modern composers to take the bass of the brass group, while the tuba is mostly employed when the addition of greater weight to the sound is required or when the trombones cannot reach sufficiently low tones (Jacob, 1956; Blatter, 1997). When looking at examples from all periods and times in orchestration literature, one can notice that extreme

registers are utilised very infrequently, and that textbooks voice it as a warning to avoid writing for instruments outside of their normal ranges without precaution. Score examples of solos for some instruments like the triangle or cymbal are very rarely found, and the orchestrator should therefore take caution in assigning solo material to such members of the orchestra (Parrott, 1957; Kennan & Grantham, 2002). Scores from the last 100 years have shown that interlocking woodwinds provide the most uniform and homogeneous chord texture possible; students today should therefore also use it (Jacob, 1956)<sup>162</sup>. The horn, which can be seen from scores is used frequently with groups other than the brass, should be considered a good option to blend with textures in the woodwinds or strings (Parrott, 1957)<sup>163</sup>. The strings, as scores from both earlier and modern times will show, take much more material than the woodwinds or brass, especially where melody and accompaniment is concerned, or where the composer wishes to decorate an existing melody with an unimposing instrument (Piston, 1961; Sevsay, 2013)<sup>164</sup>. Use of traditional patterns, like quadruple stops in the strings, is still found in many contemporary scores such as Ligeti's *Melodien* and should not be abandoned by the student who wishes to sound more modern (Blatter, 1997; Kennan & Grantham, 2002).

There are a number of fragments from Piston (1961), Jacob (1956), Adler (2002) and Sevsay (2013) that point towards a perception of orchestration specifically (as opposed to instrumentation that was discussed before) as a subject that is steeped in traditions or inherited practices that span centuries, but especially point to the practices and techniques of Haydn, Mozart and Beethoven<sup>165</sup>. Piston (1961), for example, refers to orchestration throughout his textbook as the process of writing music for the orchestra using principles of instrumentation that operate in scores of Haydn, Mozart and Beethoven. Adler (2002)

---

<sup>162</sup> Vertical balance is a contributing factor of effective orchestration, as is described in the next chapter titled *Perspective seven: The meaning of effective orchestration*, p.226.

<sup>163</sup> More about the duplicitous role of the horns in the orchestra is discussed in an earlier chapter of the thesis titled *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

<sup>164</sup> This is discussed to greater length in an earlier chapter of this thesis titled *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

<sup>165</sup> Of the nearly 1800 examples listed from various orchestration textbooks in addendum B, over 15% of examples are contributed by Haydn, Mozart and Beethoven (~5% each), which is well above the average contribution of 0.8% per composer.

and others echo the same idea, but expand it to say that the orchestra as an accompanying instrument (especially of the voice) is considerably older than the orchestra as an independent body, and therefore we find that where a musical texture consists of three parts, those will usually be melody, countermelody and accompaniment; orchestral accompaniment can and should only be learnt through study of score examples, such as the operas of Mozart. Blatter (1997) and Piston (1961) both describe orchestration as a technique that is applied now much the same way as it was in the classical period. Sevsay (2013) states that despite the differences between various schools of orchestration and composition, the basic scoring principles remain similar through different periods and composers; comparing scores of Mozart and Debussy, or Haydn and Mahler, will show these basic similarities. However, the only orchestration author among the various sources consulted in this study who overtly acknowledges his adherence to tradition in writing about orchestration, or states explicitly that teaching orchestration is also about teaching tradition, is Jacob (1956) – in various points of his book he acknowledges the prominence of tradition in his teaching and writing. Other authors, including those who are published after Jacob, show a decreased awareness of the significance of tradition in their teaching of the techniques and structures of symphonic orchestration.

Rules about orchestration that stem from traditional use or inheritance are less stringent than those about the instrumental practices that were discussed previously. This is perhaps because orchestration has always promoted an element of experimentation, a tendency which is a prominent feature even of early texts like that of Berlioz (1843)<sup>166</sup>. Piston (1961) acknowledges that, although there are natural rules<sup>167</sup> that govern the combining of instruments in the orchestra, almost every score will show exceptions or violations of the rule (he uses as an example the rule that instruments should be combined in their natural order of pitch, that is flute above oboe, oboe above clarinet, clarinet above bassoon and so forth). As Parrott (1957: 27) also states, master composers of the past were frequently “whimsical disregards of the conventions

---

<sup>166</sup> The first category of this study, which describes the practice of mystifying orchestration (see *Perspective one: The mystification of orchestration (also an introduction)*, p.23), shows how orchestrators are preoccupied firstly with maintaining a flexible approach to orchestration, and show secondly that orchestrators are not always willing to commit to fixed and rigid systems.

<sup>167</sup> “Natural” is reminiscent of the references to idiomatic writing that are made previously in this chapter.

of their time". Many of the rules of orchestration can perceivably not be corroborated as universally accepted systems by teachers of orchestration, except in very general contexts – Piston (1961) and Kennan & Grantham (2002) state as an example the principles that govern the construction of chords for orchestra, noting how rules can only be provided in a very elementary sense as an imitation of what composers have done in the past. There is no established system that determines how orchestration takes place on every conceptual level, although guidelines do exist<sup>168</sup>. It is therefore noteworthy that within that framework of flexibility, there are three rules of orchestration that appear to be definitive and irrevocable:

The first such an irrevocable orchestrational rule found in twentieth century textbooks, which has been inherited from earlier practice, is the rule that an orchestral score must be organised logically – this is an aspect of orchestration that all textbooks describe and for which there is an almost universal standard in orchestral writing, printing and engraving. Inherited practice dictates that woodwinds are placed at the top of each page, followed by brass, followed by percussion, and lastly with strings placed at the bottom; additional instruments such as the piano, harp, or choir, are placed above the strings and below the percussion. The order of instruments that is presented on the first page of a score must be adhered to throughout the work. Traditional engraving rules which determine the placement of expressions, time and key signatures, and clefs, are always adhered to. Consistent and systematically designed scores that adhere to established systems of presentation are essential for performers and conductors, who have become accustomed to a system of notation and are custodians of a centuries-old system of scoring. Composers who have deviated from these norms in the past have generally been criticised for making changes to the layout of a score; changes to the systems of score presentation are met with more criticism than other musical changes<sup>169</sup>. Score presentation is one of only a few aspects of orchestration that shows clear and

---

<sup>168</sup> Meyer's (2012) distinction between principles of orchestration and rules-of-thumb come to mind here.

<sup>169</sup> The various types of short hand scores that were produced by innovative twentieth century composers, especially the cut out score originally brought into practice by Stravinsky, have been criticised by some contemporary orchestrators and conductors as making a score more complicated and difficult to understand, when they were originally intended to achieve the opposite.

universally accepted systematisation. As a simple example, the following table shows the basic instrument order on the front page of each of the scores of eight South African orchestral scores:

Table 11 -- Basic instrument order in eight South African orchestral works in order to show a high level of systematisation (exceptions are shown in bold):

<b>Van Wyk <i>Primavera</i> (1960)</b>	<b>Fagan <i>Karoosimfonie</i> (1976)</b>	<b>Klatzow <i>Incantations</i> (1984)</b>	<b>Zaidel-Rudolph <i>Tempus Fugit</i> (1986)</b>	<b>Roosenschoon <i>The Magic Marimba</i> (1991)</b>	<b>Temmingh <i>tjellokonsert</i> (1992)</b>	<b>Grové <i>Raka</i> (1996)</b>	<b>Hofmeyr <i>Sinfonia Africana</i> (2003)</b>
Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons	Flutes Oboes Clarinets Bassoons
Horns Trumpets Trombones Tuba	Horns Trumpets Trombones Tuba	Horns Trumpets Trombones Tuba	Horns Trumpets Trombones Tuba	<b>Trumpets</b> Horns Trombones Tuba	Horns Trumpets Trombones Tuba	Horns Trumpets Trombones Tuba	Horns Trumpets Trombones Tuba
<b>Percussion</b> Timpani	Timpani Percussion	Timpani Percussion	Timpani Percussion	Timpani Percussion	Timpani Percussion	Timpani Percussion	Timpani Percussion
Keyboard Harp	Keyboards Harp	Keyboard Harp	Keyboard	Keyboards	Soloist	Keyboard Harp Soloist	Keyboard Harp Soloist Choir
Strings	Strings	Strings	Strings	Strings	Strings	Strings	Strings

The second definitive rule of orchestration, which originates from its use as an accompanying instrument (discussed earlier), is a compound rule based on sound perception. Historic use of the orchestra has dictated that if there is only one texture or idea in the orchestra, then it is a melody; if there are two, then they are considered as melody and accompaniment/counter melody; and if there are three, then they are considered as primary melody, secondary melody and accompaniment (Piston, 1961; Adler, 2002; Sevsay, 2013). In contemporary orchestration, which might not contain anything resembling melody, Adler's categorisation of orchestral musical material into foreground, middleground and background is perhaps more appropriate, although it communicates the same hierarchical structuring of orchestral sound into those that are meant to be heard more prominently and those that are not. This hierarchical categorisation results in an important orchestrational law, namely that the melody should never be overwhelmed by the accompaniment. Clarity of orchestral design, which is discussed in another section of the thesis<sup>170</sup>, is a central prerogative of orchestration that, historically speaking, stems from this ideal that

<sup>170</sup> See the section titled 7.3 *Clarity of effective orchestration*, p.242.

orchestra as accompanying body should only support and not overwhelm the primary material which is the melody (Carse, 1964; Del Mar, 1983). It is conceivable that a melody might be overwhelmed by its accompaniment as a planned effect by the orchestrator, but if that is the case then it must be orchestrated and executed in such a manner that it seems convincing<sup>171</sup>.

The following three examples from Temmingh (1992), Grové (1996) and Hofmeyr (2003), show how these orchestrators compensate for the presence of a solo instrument in the orchestral accompaniment. The first example from Temmingh shows the solo cello in the top staff, timpani below that and followed by the full orchestra. The soloist is firstly placed in a very high register on the instrument in order to give the soloist more saliency of sound, but the orchestra is also restricted to strategically placed chords in order to allow the soloist to be heard. The second example, from Grové's *Raka*, contrasts the solo piano and orchestra by giving them juxtaposing rhythms. In order to engender a sense of homogeneity between piano and orchestra, the orchestrator synchronises the instruments at specific moments, after which their roles divide and the orchestra sustains a vertical structure over which the piano projects a rhythmic figure. In the final example, the extreme delicacy of the solo soprano in her low tessitura is aided by the complete silence of the orchestra excepting the double bass pedal tone. When the oboe enters, it enters into a dialogue with the soprano in a higher octave, while the rest of the orchestra maintains a very low dynamic level; the orchestra does, however, not occupy the same registral space as the soprano.

---

<sup>171</sup> The criteria by which an orchestrational device is considered convincing are discussed in the next chapter. See *Perspective seven: The meaning of effective orchestration*, p.226.

Figure 93: The final measures ( $\downarrow = c.138$  molto ritardando) of Temmingh's *tjellokonsert* (1992), showing the solo cello (top), timpani (top-middle) and followed by the full orchestra (bottom).

Figure 94: The final measures (Presto  $\downarrow = 80$ ) of Grové's *Raka* (1996), showing solo piano at the top and full orchestra below.

Figure 95: The first entry (Largo desolato  $\downarrow = c.76-84$ ) of the solo soprano in the second movement of Hofmeyr's *Sinfonia Africana* (2003).

The third definitive rule of orchestration (within the realm of inherited practice) is that when stationary and moving voices are combined, it is accepted practice to give one colour to the moving part and another colour to the stationary part (Parrott, 1957; Piston, 1961; Kennan & Grantham, 2002). Historic practice has shown orchestrators through teaching and score examples that the colour of stationary material should contrast with that of moving material, or more traditionally that melody and accompaniment should contrast each other sufficiently (Adler, 2002; Sevsay, 2013). There are physiological reasons for the necessity of the distinction that are discussed in a previous chapter<sup>172</sup>. That is presumably why Mozart, in composing his flute concerto in G major, omitted the orchestral flutes altogether: so that timbral confusion would not transpire if solo flute and orchestral flutes were employed at the same time<sup>173</sup>. This idea of categorising orchestral sound as foreground and background, as primary and secondary, as stationary and moving, or as vertical and horizontal, is the whole premise behind Ian Parrott's textbook of 1957. In his *Method of Orchestration*, Parrott does not deal with orchestration in the normal order of first describing instruments, then instrument combinations and finally orchestral combinations, but in terms of the development of sound on a horizontal and a vertical level. Adler's textbook (2002), which attempts to teach orchestration in terms of different layers of musical functions and perception, relies on the premise that the student will realise the need to differentiate sound layers from one another by differentiating the colours of each from one another. (The reader is referred to a previous chapter about sound perception and saliency on page 141, that can be referred to for more information on the aural quality of timbre).

The following examples taken from the eight South African orchestral scores referenced in this thesis show how static and moving lines are colouristically separated from each other. Noticeable in all the examples is the fact that strings constitute the static line in six of the eight examples, while in Zaidel-Rudolph (1986) a timpano and a bassoon carry a pedal, and in Temmingh (1992) the horns are used in an octave pedal point. In all eight examples, the moving line is differentiated from the static line by means of

---

<sup>172</sup> See the chapter titled *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141.

<sup>173</sup> The majority of composers, however, still make use of the same instruments in a solo and orchestral capacity and make use of other orchestrational devices to prevent aural confusion.



contrasting primary colours. Addendum C, which shows the relative saliency of many orchestral instruments in different registers, can be consulted to see how these instrument pairings could be expected to interact normally; in Klatzow (1984), for example, the harp in its low register displays very low saliency, but against the static *pianissimo* strings background it becomes more pronounced. See Figure 96 to Figure 103:

Figure 96: Colouristic separation of static and dynamic textures in the first movement (Poco lento, teneramente  $\downarrow = c.60$ ) of Van Wyk's *Primavera* (1960); violas tremolo, flute ordinario.

Figure 97: Colouristic separation of static and dynamic textures in the first movement (Molto lento  $\downarrow = 30$ ) of Fagan's *Karoosimfonie* (1976).

Figure 98: (Meno mosso  $\downarrow = 54$ ) Colouristic separation of static and dynamic textures in Klatzow's *Incantations* (1984).

Figure 99 is a musical score for Zaidel-Rudolph's *Tempus Fugit* (1986). It features four staves. The top two staves are for Timp. (Tympani) and Bsns. (Bassoons), both in 6/4 time. The Timp. part starts at measure 21 with a *mp* dynamic. The Bsns. part starts at measure 21 with a *p* dynamic. The bottom two staves are for Vcls. (Violoncello) and Dbs. (Double Bass), both in 6/4 time. The Vcls. part starts at measure 21 with a *ff* dynamic. The Dbs. part starts at measure 21 with a *p* dynamic. The score shows a clear separation of textures and dynamics across the instruments.

Figure 99: (♩ = c.152) Colouristic separation of static and dynamic textures in Zaidel-Rudolph's *Tempus Fugit* (1986).

Figure 100 is a musical score for Roosenschoon's *The Magic Marimba* (1991). It features four staves. The top staff is for Organ, starting at measure 146 with a *mf* dynamic. The second staff is for Vlns. (Violins), Vlas. (Violas), and Vcls. (Violoncellos), starting at measure 152 with a *mp* dynamic. The third staff is for Organ and Dbs. (Double Bass), starting at measure 152 with a *mf* dynamic. The bottom staff is for Dbs. (Double Bass), starting at measure 152 with a *mf* dynamic. The score shows a clear separation of textures and dynamics across the instruments.

Figure 100: Colouristic separation of static and dynamic textures in the first movement of Roosenschoon's *The Magic Marimba* (1991).

Figure 101 is a musical score for Temmingh's *tjellokonsert* (1992). It features two staves. The top staff is for solo Cello, starting at measure 371 with a *f* dynamic. The bottom staff is for Hns. (Horn), starting at measure 371 with a *p* dynamic. The score shows a clear separation of textures and dynamics across the instruments.

Figure 101: Colouristic separation of static and dynamic textures in Temmingh's *tjellokonsert* (1992).

Figure 102: Colouristic separation of static and dynamic textures in the opening (Andante  $\downarrow = 72$ ) of Grové's *Raka* (1996).

Figure 103: Colouristic separation of static and dynamic textures in the first movement ( $\downarrow = c.69-76$ ) of Hofmeyr's *Sinfonia Africana* (2003).

Other than these three relatively rigid rules, an additional set of guidelines can be provided from various orchestration authors to help the student orchestrate with better use of colour – they are really an expansion of the third rule stated above, but are not worded as absolutely as that. These guidelines appear here, because where they are stated or provided they are done so within a context of tradition, and therefore call on a historic practice as evidence for their significance. They should, however, not be seen as definitive: numerous other orchestration guidelines and rules about colour and timbre are discussed elsewhere in this thesis because the contexts in which they are stated are different. The first guideline warns the orchestrator against the use of extreme registers (this has been mentioned previously in this chapter, as well as in other chapters), which has traditionally been avoided by orchestrators for the danger

inherent in their execution; also that melodic material in extreme registers has historically been avoided for sounding strange or unusual (Jacob, 1956; Piston, 1961; Kennan & Grantham, 2002). Secondly, wide spacing in the lower registers of the orchestra is desirable in all cases, as historic use has shown (Jacob, 1956; Parrott, 1957)<sup>174</sup>. Lastly, the more colourful the sound of an instrument is, the less effective it becomes when used for extended periods, especially when the instrument is used in a prominent position like that of primary melody (described earlier). Instruments that are very highly coloured should therefore be used with extreme discretion, as has always been the case in the best orchestrations (Wagner, 1959; Casella & Mortari, 2004)<sup>175</sup>. Furthermore, the unique sound effect of the true orchestral tutti in unison or octaves should not be over-utilised; an examination of a large number of scores undertaken by Piston (1961), Adler (2002) and Kennan & Grantham (2002) show that tuttis make up a very small portion of those scores<sup>176</sup>. In the eight South African orchestral scores referenced in this thesis, there are no unison tutti sections.

### 6.3 Changing traditions

Orchestration authors show less awareness of the developments and changes of tradition than they do of tradition itself. Whereas many text fragments were found in a substantial collection of texts that indicate an awareness of the impact of inherited instrumental and orchestrational practice on modern techniques and design of orchestration, relatively few were discovered that give an indication of how changing practices and traditions have impacted contemporary orchestration practice. Those fragments that were found deal with orchestration practice in general or of instrumental techniques in particular.

---

<sup>174</sup> This is also discussed with regards to sound perception (page 153) and musical aspects of orchestral transcription from piano literature (page 180).

<sup>175</sup> Aural fatigue, which results from extended use of instruments with a high saliency, is discussed in an earlier chapter titled *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141.

<sup>176</sup> Out of the nearly 1800 orchestral examples listed from textbooks in Addendum B, fewer than 10 refer to unison tuttis in the orchestra.

Those fragments that describe changes in instrumental practices do so in two categories. There are firstly those effects and techniques that have been utilised so much that they are now considered clichéd or hackneyed, best to be avoided. As was also mentioned earlier, some instruments, like the tenor drum and alto clarinet, have lost their place (however precarious their place was to start) in the orchestra since the Second World War, due to economic pressure on the one side and because of becoming obsolete on the other<sup>177</sup>. In terms of effects, many of the ones that are now considered clichéd were first utilised in late romantic and impressionist works for colouristic nuances, but were quickly copied by other composers because of their efficacy, before becoming overused. Jacob (1956) and Kennan & Grantham (2002) mention these effects throughout their textbooks. The harp glissando, which is now considered one of its most effective, idiomatic and intriguing effects, has been used so much in works like Respighi's *Fountains of Rome* that authors suggest it be used very sparingly in contemporary work. A muted brass instrument, especially the trombone, that is blown forcefully, produces a snarling and metallic sound of a highly individual and expressive quality; the effect has been absorbed into various dance music styles of Latin America, but has also been over-exploited in orchestral music of the twentieth century. Already in Jacob (1956), the effect is described as bizarre and grotesque and he writes that it should rather be avoided for having been exploited too much. What was argued in the first Perspective, namely that instrumental colours and effects bring with them associations from outside of the musical work, has an impact here: the harp glissando, for example, which has developed a lush romantic connection through its use in film and in well-known works like Tchaikovsky's *Roméo et Juliette*, could give a contemporary work an unintended air of Romanticism. It is likely for this reason that the use of highly distinguishable and overused techniques and effects are discouraged.

There are secondly those effects and techniques that have been borrowed from other genres in recent times that became absorbed into contemporary orchestration practice. Kennan & Grantham (2002)

---

<sup>177</sup> It is difficult to separate these two factors however: economic pressure decreases the availability of an instrument, which encourages composers to find other more viable alternatives, which decreases the demand for the instrument. Instruments that retain their position in the orchestra are those that are most versatile, robust and economically viable.

acknowledge alone of all contemporary authors a simple yet fundamental principle of instrumental performance, namely that effects that are now seen as extended techniques will likely be absorbed into mainstream orchestral usage in the future and will not be a novelty then anymore<sup>178</sup>. As Carse (1964) recalls and which was previously referenced in this thesis, the first time Monteverdi called on violinists to perform *arco tremolo* in performance, they were reported to refuse out of hand such an unusual request; yet now, the tremolo is considered one of the most basic effects of the strings family. The fluttertongue technique of the woodwinds and brass, similar to the tremolo of the strings, became a common technique in the twentieth century after being avoided almost completely before then. The earliest prominent use of *frulato* can be found in the opening of the final act of Tchaikovsky's *The Nutcracker* of 1892. After that, in the music of Mahler, Strauss, Shostakovich, Schoenberg and Britten, the effect is found more often. Today, flutter tonguing is a standard component of writing for winds. The vibraphone, which after its invention in 1921 was readily absorbed into Jazz and commercial genres, is now finding general acceptance in the symphonic orchestra as a useful and versatile addition to the percussion family. Other effects and instruments from popular styles, like the electric guitar and drum kit, have also found a tentative place in the symphony orchestra, although it will likely be a number of years before they can be considered a standard addition. Other instruments show the potential to contribute in new and interesting ways to symphonic music, but have not yet been incorporated into the orchestra due to practical or economic reasons. The musical saw and Theremin, for example, both have a flexible tone and unique timbre that have shown themselves to be useful in orchestral music<sup>179</sup>. Yet, because they are challenging to perform on and require dedicated players (on the score these instruments appear in the percussion section, but special players are generally hired), they cannot normally be utilised to their fullest extent.

---

<sup>178</sup> John Corigliano, an American composer born in 1937, regularly explores contemporary pop and dance styles of music in his own film and art music scores, which he applies to convincing effect. Another composer who displays a varied application of style is Louis Andriessen (born 1939).

<sup>179</sup> Two well-known examples of works that make use of musical saw and/or Theremin are Khachaturian's *Piano Concerto* and Corigliano's *Mannheim Rocket*.

In terms of awareness of changing orchestration practices, authors have constructed a simple trajectory following the practices of the classical (eighteenth century), then romantic (nineteenth century), then modern (twentieth century to the present) eras. Pre-classical practices like that of Handel and Bach are not placed in the primary trajectory of orchestrational development, and only a minimal number of examples are quoted from that time (see Addendum B). Rimsky-Korsakov (1964) and later Sevsay (2013) see the classical school that is represented by Haydn and Mozart as a kind of foundation upon which later composers like Berlioz, Weber, Mendelssohn, Tchaikovsky, Wagner, Strauss, Dvorak, Verdi, Puccini, Debussy, Ravel and Stravinsky built their individual styles. This school of orchestration is characterised by clearly distinguished textural layers, minimal use of inter-sectional doubling, and carefully designed colour combinations that accentuate structural aspects of the work. Romantic orchestration practices of the nineteenth century is described from the perspective of modern authors like Kennan & Grantham (2002), Adler (2002) and Sevsay (2013) as being generally unfavourable because their opaque, blended, over-doubled, cluttered and thick sounding qualities (especially in the middle registers). These instrumental characteristics are in contrast with both the classical period before and contemporary practices after. Parrott (1957) and Kennan & Grantham (2002) describe a reaction in the twentieth century to the sumptuous scoring characteristics of late nineteenth century orchestral music; modern scores that make use of a full orchestra rather use instruments consecutively than simultaneously. The primary colours of individual instruments are given preference over the blended sounds of doubling in scores of Wagner and Brahms. Instruments of the orchestra tend to function more like soloists in moderns scores, and the orchestra is often perceived to be divided up into a collection of chamber ensembles. Some styles of twentieth century composition, such as serialism, provide further motivation to avoid doubling and strive for clarity of the orchestral sound. This trajectory is reflected in the eight South African works referenced in this study, at least as far and until Roosenschoon (1991) is concerned: whereas Van Wyk (1960) displays a distinctly romantic approach to orchestration, with frequent doubling and a lush harmonic framework, Roosenschoon (1991) displays a lean and geometric approach to orchestration with a predilection for primary colours. Temmingh (1992) and Grové (1996) display less involved approaches to orchestration,

with fewer lines and simpler mechanical procedures. Hofmeyr (2003) returns to a lush and thickly layered romantic orchestration.

The admiration that orchestration authors hold for the model of Viennese classicism means that books published in the last twenty years tend to favour score examples from the classical period, especially those by Haydn and Mozart, as models for good orchestration practice<sup>180</sup>. The pluralism that hallmarks the musical practices of the previous century is also reflected in orchestration practices, which as a number of authors explain, gives rise to the many interesting effects of contemporary scores that deviate from traditional patterns, especially traditions of spacing and doubling. It is very likely that some of these deviations will survive long enough and be popular enough to become new orchestration traditions. As an example, the characteristic sound colours of minimalism and its scoring styles have already made a widespread and long lasting impact. The use of so-called C-scores and notational anomalies like Stravinsky's cut-out scoring are other twentieth century inventions that have found acceptance and absorption in contemporary orchestration practice.

It is clear from orchestration textbooks that authors living and working today are hesitant to proclaim the bounds of a contemporary orchestration practice, and are equally hesitant to acknowledge the impact of commercial genres on the orchestration practices of serious music. It is equally clear, however, that orchestration practice of the classical period (that is generally praised for its clarity of design and simplicity of execution) is seen today as a superior model to romantic orchestration by orchestration sources of the last 50 years.

## 6.4 A statistical view of tradition in orchestration

Orchestration textbooks, which form the basis of this study, contain more types of data than only written text. Musical fragments, for example, are found in the majority of textbooks, and contain

---

<sup>180</sup> This preoccupation with the composers and techniques of the Viennese classicism was also referenced earlier in the chapter in reference to establishing tradition in orchestration.



information about authors' views about which works are important, which styles and style periods are worthy of study, and which composers are the best ones to turn towards for orchestrational guidance. In Addendum B, which is attached to this thesis, the referenced examples of eight textbooks have been compiled into a tabulated list arranged according to the instrument and the technique to which the examples refer. The textbooks that were included in the list were chosen because they contain examples from a variety of composers, style periods and nationalities. These sources are: Widor (1906), Wagner (1959), Piston (1961), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004) and Sevsay (2013). Sources that were excluded either contained too few examples to be useful (such as Parrott, 1957) or only referenced a limited number of composers (such as Rimsky-Korsakov, 1964; or Jacob, 1956). To a large extent, the compiled list is the most significant piece of evidence to show that orchestration is steeped in tradition and inherited practice.

Table 12 -- Total number of examples counted, per nationality, in eight orchestration textbooks (see Addendum B):

Nationality	No. of examples	Most cited work	Nationality	No. of examples	Most cited work
American	148	Harris, Roy (1939): Symphony no.3	Hungarian	52	Bartók, Béla (1943): Concerto for Orchestra
Argentinian	1	Cobián, Juan Carlos (1936): Nostalgias	Israeli	1	Haubenstock-Ramati, Roman (1971): Tableau III
Armenian	2	Khachaturian, Aram (1936): Piano concerto	Italian	92	Respighi, Ottorino (1924): The Pines of Rome
Austrian	232	Mahler, Gustav (1901): Symphony no.4	Japanese	1	Takemitsu, Toru (1967): Green
Belgian	4	Hasselmans, Alphonse (1887): Ballade	Mexican	2	Chávez, Carlos (1935): Chapultepec
British	42	Holst, Gustav (1916):  The Planets	Norwegian	2	Grieg, Edvard (1875): Peer Gynt Suite no.1
Catalan	1	Gerhard, Roberto (1959): Symphony no.2	Polish	18	Penderecki, Krzysztof (1961): Threnody to the Victims of Hiroshima
Czech	6	Husa, Karel (1971): Two Sonnets	Romanian	3	Enescu, George (1901): Roumanian Rhapsodie
Finnish	14	Sibelius, Jean (1899): Symphony no.1	Russian	314	Stravinsky, Igor (1913): Le Sacre du Printemps
French	377	Ravel, Maurice (1912): Daphnis et Chloé	Scottish	1	Musgrave, Thea (1969): Night Music
German	474	Brahms, Johannes (1883): Symphony no.3	Spanish	5	De Falla, Manuel (1926): Concerto for Harpsichord and 5 Instruments

In the table above, the compiled list is subdivided into the different nationalities that are represented in the eight textbooks, showing the number of examples originating from each nationality as well as the most cited work of each. The table shows that textbooks favour the traditional centres of music in the Old World (Austria, Germany, France and Russia) for procuring examples of effective orchestration techniques. The United States shows an increase of referenced examples in the twentieth century. In total, 1792 examples were counted and documented in Addendum B; out of that total, ten works reveal themselves to be the most referenced throughout the body of literature consulted. These ten works corroborate the findings of the previous table, namely that textbooks favour significant centres of music in the Old World.

Table 13 -- A table showing the ten musical works that are cited most often in eight orchestration textbooks (see Addendum B):

Composer	Nationality	Composition	Year	No. of entries
Stravinsky, Igor	Russian	Le Sacre du Printemps	1913	41
Mahler, Gustav	Austrian	Symphony no.4	1901	23
Ravel, Maurice	French	Daphnis et Chloé	1912	22
Stravinsky, Igor	Russian	Petrouchka	1911	21
Debussy, Claude	French	La Mer	1905	20
Tchaikovsky, Pyotr	Russian	Symphony no.4	1877	19
Brahms, Johannes	German	Symphony no.3	1883	19
Stravinsky, Igor	Russian	L'Oiseau de Feu	1910	18
Ravel, Maurice	French	Pictures at an Exhibition (Mussorgsky)	1922	18
Debussy, Claude	French	Prélude à l'Après-midi d'un Faune	1894	18

The following table lists the ten most cited composers in Addendum B; again, the findings of the previous two tables are corroborated in the sense that traditional centres of music are favoured:

Table 14 -- The ten most cited works in eight orchestration textbooks of the twentieth century (see Addendum B):

Composer	Period	No. of entries	Nationality	Most cited composition
Stravinsky, Igor	1882-1971	130	Russian	Le Sacre du Printemps
Ravel, Maurice	1875-1937	109	French	Daphnis et Chloé
Beethoven, Ludwig van	1770-1827	98	German	Symphony no.3
Strauss, Richard	1864-1949	88	German	Also Sprach Zarathustra/ Don Juan
Debussy, Claude	1862-1918	81	French	La Mer
Tchaikovsky, Pyotr	1840-1893	76	Russian	Symphony no.4
Wagner, Richard	1813-1883	74	German	Die Meistersinger
Brahms, Johannes	1833-1897	72	German	Symphony no.3
Mahler, Gustav	1860-1911	68	Austrian	Symphony no.4
Mozart, Amadeus	1756-1791	65	Austrian	Le Nozze di Figaro

The following table lists the number of examples cited per decade between the years 1680 and 2000 across all nationalities. The table shows a gradual increase in examples throughout the nineteenth century,

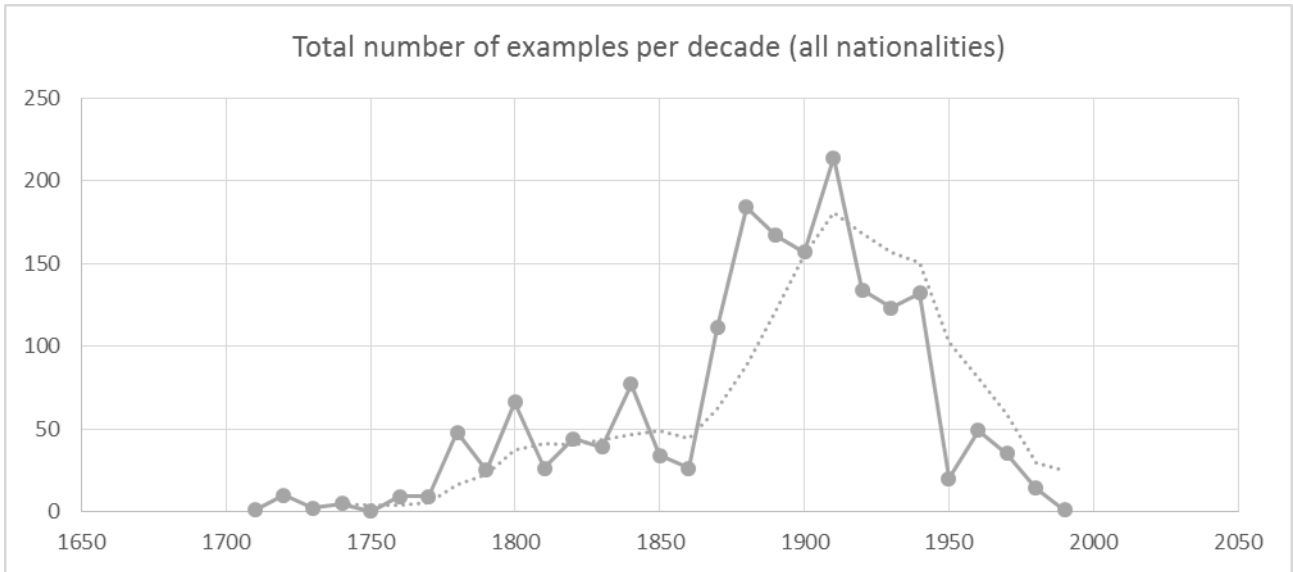
until there is a peak around 1910 (*Le Sacre du Printemps* was completed in 1913). Even though a number of significant sources that were consulted in Addendum B date from after 1990, there are significantly fewer examples that date from after 1950.

Table 15 -- The number of examples per decade cited in Addendum B across all nationalities (see Addendum B):

Decade	No. of entries	Decade	No. of entries	Decade	No. of entries
1680-1689	1	1810-1819	26	1910-1919	215
1710-1719	1	1820-1829	44	1920-1929	136
1720-1729	10	1830-1839	39	1930-1939	127
1730-1739	2	1840-1849	77	1940-1949	135
1740-1749	5	1850-1859	34	1950-1959	21
1760-1769	9	1860-1869	28	1960-1969	52
1770-1779	9	1870-1879	113	1970-1979	38
1780-1789	48	1880-1889	186	1980-1989	17
1790-1799	25	1890-1899	169	1990-1999	1
1800-1809	66	1900-1909	158		

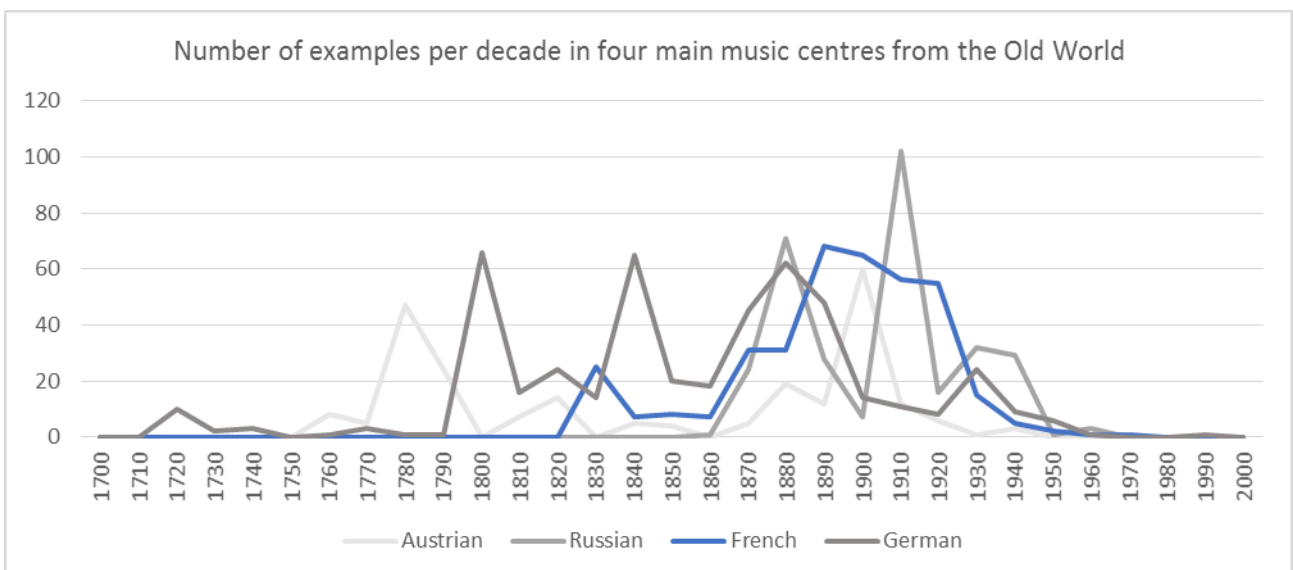
The following three tables give a graphical overview of 1) the number of examples per decade across all nationalities, 2) the number of examples per decade across the main traditional music centres of the Old World (Austria, Germany, France and Russia), and 3) the number of examples per decade in other music centres.

Graph 3 -- Total number of examples per decade (all nationalities) from eight orchestration textbooks (see Addendum B):



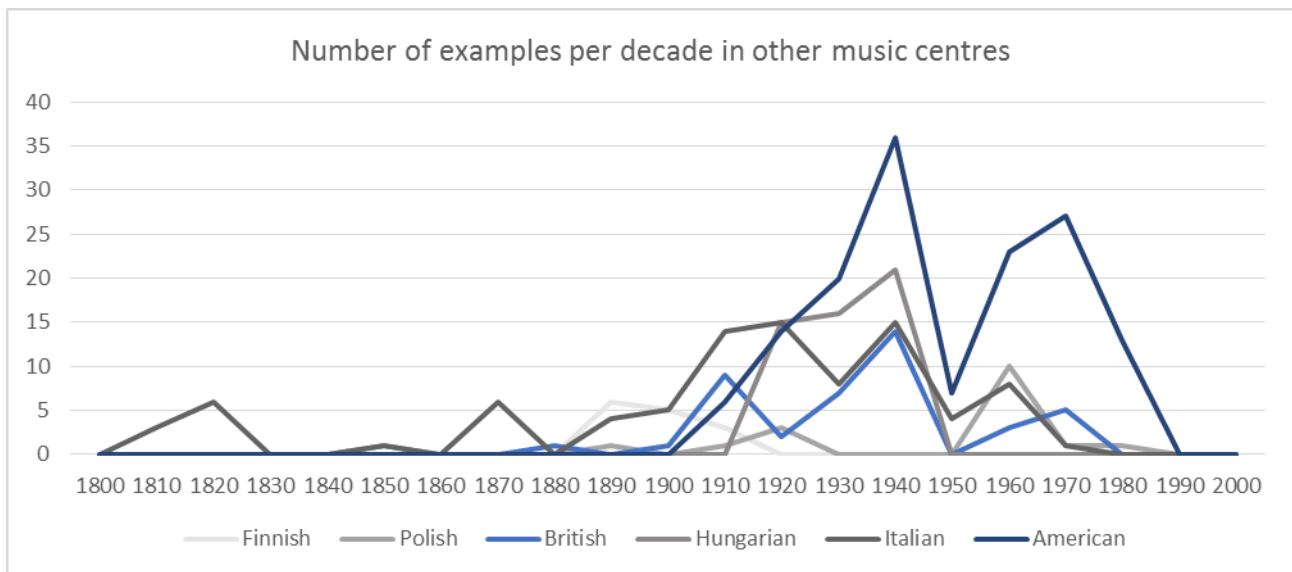
The table above also shows a period-4 mean average trend line across all counts on the x-axis, in order to give a clearer representation of the increase and decrease of examples per decade. In earlier decades, a relatively large number of examples from Mozart (ca. 1780) and Beethoven (ca. 1800) cause local peaks, while examples from Wagner cause another peak around 1840. Stravinsky's *Le Sacre du Printemps* creates a significant peak around 1910. After World War II (around 1950), a significant decrease in cited examples is noticeable.

Graph 4 -- Number of examples per decade in four old-world music centres from eight orchestration textbooks (see Addendum B):



Graph 4 displays the same trends as Graph 3; local peaks are caused by an increased number of examples cited from notable composers. After 1950, nearly no new works are cited, which indicates a shift of focus to other music centres.

Graph 5 -- Number of examples per decade in secondary and in new-world music centres from eight orchestration textbooks (see Addendum B):



In contrast to the previous graphs, Graph 5 shows a comparatively greater number of entries after 1950, although a clearly discernible trough is visible directly after World War II. American works become the subject of greater focus in more recent times, although not to the extent of earlier works from traditional music centres. These decentralised originators of new musical works appear to receive some attention in the twentieth century and especially after 1950 (compared to the previous graphs). More information about the specific breakdown of musical references per author is provided in the first chapter of this thesis, in order to show that authors generally show a predilection towards referencing composers from their own country or institutional affiliations. The findings in this section serve to show, however, that orchestration authors generally favour referencing well-established works from orchestrators that worked within the influential traditional music centres of Europe and Russia.

## 6.5 Concluding remarks

In this chapter, the important contributions of inherited practices and traditions to orchestration were described in terms of their perceptions by orchestration authors. Most importantly, the frequent referencing of existing orchestral works (see Addendum B) was shown to help reinforce inherited practices and highlight concepts such as idiomatic scoring and natural techniques. Referencing many examples over a considerable period of time helps to show how certain practices have developed throughout their history. There are, therefore, two main aspects of orchestrational tradition: firstly there are those practices that are referenced in order to reinforce traditions, and secondly there are those practices that show how traditions have developed over time and help orchestrators to predict how practices might develop in the future.

In terms of reinforcement of tradition, three main components revealed themselves in text analysis. The first component is a description of those techniques and traditions that have become a twenty-first century inheritance. The second component highlights the impact of traditional practices on orchestration. The third component is the justification of tradition by referencing a large number of existing score examples. Furthermore, some techniques and instrumental practices that have been used over a long period of time are shown to constitute a central body that is referred to as being idiomatic or natural. In this regard, the concepts of tradition and constraints are brought into conversation with each other. Expanding on this idea, an adherence to idiomatic techniques and constraints of idiomatic writing then result in idiomatic orchestration.

Changing traditions were described firstly according to the effects of mechanical developments of instruments: as instruments become able to perform a greater variety of techniques and pitches with greater ease, orchestrational traditions surrounding those instruments are able to expand. On the other hand, overused or clichéd traditions become ejected from orchestral practice over time and so cause changes to orchestrational traditions. In the twentieth century, the development of popular and dance genres have contributed to an expanding orchestrational tradition. Lastly, contemporary orchestration authors construct a simple trajectory of developing orchestrational traditions that follow the eighteenth,





## Perspective seven: The meaning of effective orchestration

### 7.1 Introduction

Orchestration should be effective. This is the single most important idea regarding orchestration in this study, so that this category constitutes nearly 25% of all coded material derived from text analysis. It presents itself in my interpretation of the data as the core function of orchestration: the quality of an orchestrator's work can be judged by how effective it is. There is, however, little attempt made in orchestration literature to delineate the qualities or characteristics of orchestrational efficacy, so that even with a very large number of references to this ideal outcome of orchestration, it appears to be fluid and context sensitive. This chapter will attempt to give a better understanding of the characteristics of effectiveness as a denominator of orchestrational quality by studying these text fragments, whether they make use of the term "effective" specifically or by implication (for example: greatest effect, effectiveness, or quality of effect).

Clarity of structure, which is a major contributing factor to orchestration, will be contextualised within the broader principles of effectiveness. The ideal of clarity, which has been mentioned in a number of previous chapters of this thesis, is closely tied in with the efficacy of orchestration. Then, because effective orchestration is often described in terms of what is *not* effective, a number of factors will be grouped and described that result in the opposite of effective orchestration. The relationship between these opposing factors will help in determining whether there is a link between those practices which are considered effective and those which are considered ineffective. After that, the important contribution of colour to effective orchestration will be discussed, followed by a section describing the contextual sensitivity of effectiveness (colloquially one could describe this contextual sensitivity as the right thing happening at the right time). Score study, especially of such passages that orchestration authors deem as representative of effective orchestration, are mentioned throughout the chapter as a mechanism by which to gain information about orchestrational efficacy.

## 7.2 Effectiveness in orchestration

In texts by Piston (1961), Jacob (1956), Kennan & Grantham (2002), Adler (2002) and Sevsay (2013), orchestration and effectiveness are drawn into a relationship with each other in four general ways: firstly, orchestration is perceived as effective when instruments are utilised in an idiomatic manner<sup>181</sup>; secondly, orchestration is effective when the vertical relationships between instruments create the aural illusion of an even pane of sound<sup>182</sup>; thirdly, orchestration is effective when it displays accurate workmanship and attention to detail<sup>183</sup>; and lastly, orchestration is perceived as effective when the orchestration of a passage contributes positively to the perceived musical outcomes of a passage<sup>184</sup>. Piston (1961) takes these ideas together, in a way, when advising the student orchestrator to seek in orchestration the qualities of clarity, naturalness<sup>185</sup>, beauty of sound, fidelity to the original musical thought<sup>186</sup>, and an imaginative scoring of renewing interest without writing unnecessary material. The last point is echoed by Jacob (1956) when he writes that effective orchestration displays itself as a colouristic and decorative art that intrigues the ear without distracting it; also that monotony and boredom should never occur in orchestration and that it can

---

<sup>181</sup> Jacob (1956) gives the example that passages for two clarinets in thirds or in sixths are a standard tool of orchestration and are always of excellent effect. This would therefore be an example of idiomatic use of clarinets. Idiomatic writing is discussed at greater length in an earlier chapter of this thesis titled *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.

<sup>182</sup> Piston (1961) gives as an example of well-structured woodwind chord writing a passage from Tchaikovsky's *Roméo et Juliette*, stating that because it was written with an ear to balance, it will be very effective in its organlike sonority.

<sup>183</sup> This is a point stressed most often by Kennan & Grantham (2002) and Adler (2002); the former states that good workmanship, attention to detail and a practical approach cannot be stressed too strongly if orchestration is to be effective.

<sup>184</sup> Piston (1961) recalls an example from Mahler's Symphony no.2 where the double basses feature prominently in their lower octaves, noting that the deep and ponderous bass, which he states is surely an intended effect, is very effective. If the passage was not perceived as intending to sound deep and ponderous, it might have been labelled as ineffective.

<sup>185</sup> Naturalness is an important precursor to idiomatic writing, which is discussed in an earlier chapter titled *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.

<sup>186</sup> An earlier chapter (*Perspective three: Changing and interchanging of material in orchestration*, p.122) explores the relationship between musical thought and musical material and highlights the importance of preserving musical ideas.

never be effective if boredom occurs<sup>187</sup>. These four factors agree with the qualities that orchestration authors regularly refer to in orchestrational passages within their textbooks. In Piston (1961), for example, orchestration examples are described in terms of the quality of vertical balance achieved, how orchestral colours create unity or variety, whether the quality of clarity is present, whether the orchestration displays brilliance of timbre, and whether it is expressive. In Kennan & Grantham (2002), examples are studied in terms of effective doubling and balance, how different musical ideas are vertically distributed, and in terms of the use of primary and blended colours as well as stylistic traits. In Adler (2002), examples are studied in terms of placement or assignment of colour, proper voice leading, vertical balance and distinction between foreground, middleground and background textures. These four main elements of effective orchestration are each discussed in the following paragraphs:

1. Idiomatic writing is described in two different ways; some instrumental techniques are seen as always being effective, while others are effective because of their contextual placement in the musical material<sup>188</sup>. In this regard, the opposite is also described in literature, namely that certain techniques are seen as always being ineffective, while some techniques become ineffective when they are applied in an improper context. It appears that whereas each instrument or instrument group of the orchestra possesses the ability to produce a number of highly effective techniques in isolation, the eventual perceived efficacy of those techniques is dependent on the musical context within which they are applied. There are a number of examples to demonstrate this: Piston (1961) describes the strings as effective in any utilisation of techniques in both open or in closed spacing, because string tone is rich in overtones<sup>189</sup>; the snare drum's roll, which can create an uncanny sense of anticipation, is its most effective device (Kennan & Grantham, 2002); one should always endeavour to use the violas in their most effective register, namely on their C string (Jacob, 1956);

---

<sup>187</sup> An earlier chapter of the thesis (*Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141) also discuss the importance of maintaining listener interesting without creating aural confusion.

<sup>188</sup> (As in footnote 185.) Idiomatic writing is an essential aspect of orchestra; see the chapter titled *Perspective five: Instrumental constraints and orchestrational creativity*, p.165, for more about idiomatic writing.

<sup>189</sup> This is discussed in *Perspective two: An instrumental-hierarchical view of the orchestra*, p.54.

the lower register of the horn is most effective for sustained tones (Adler, 2002), while melodic passages at this tessitura are awkward and ineffective (Kennan & Grantham, 2002); the harp is most effective in the orchestra if only one is used, therefore make use of two only if there is something really helpful and effective for the second harp to do (Jacob, 1956)<sup>190</sup>; the timpani, although used for much longer and much more than the rest of the percussion family, are still similar to other percussion instruments in that they are most effective at the moment of their entry (Widor, 1906); It can be said of all percussion instruments that their effectiveness depends mostly on how sparingly they are utilised (Jacob, 1956); the timpani, which are generally not very effective with extended solos in the orchestra, can be highly effective when asked to perform two or three notes in isolation, and such figures are found often in orchestral literature (Kennan & Grantham, 2002); some of the most effective uses of crash cymbals occur at the end of Debussy's *Fêtes* from his orchestral nocturnes, where the cymbals are merely brushed together to produce a single, soft note; the tone of the tam-tam, which is of a colour unlike any other instrument, should be allowed to vibrate a moment if it is to sound most effective (Parrott, 1957). These examples provide a representative idea of how authors describe the most effective sounds, techniques and uses of the orchestra's instruments, but there are many more that exist in orchestration literature.

Idiomatic writing extends to the orchestra as well, if one perceives the orchestra as an instrument in and of itself. There are different ways in which to write for the orchestra and it is possible to argue that effective writing for the orchestra is, the same as idiomatic writing for the orchestra. In terms of idiomatic orchestration, Adler (2002) argues that modern tendencies to treat a large orchestra more like a collection of chamber ensembles is a trend that steps away from effective orchestration. This could be because the full sound potential of the orchestra is not realised when it is constantly subdivided into smaller sections, or because (as some authors say) it is economically

---

<sup>190</sup> There was a time, however, when a number of harps had to be used to compete with the sound of a very large orchestra. The orchestra of the late Romantic was shown earlier in the thesis generally to make use of more than one harp (Table 3, p.47).

and musically wasteful to let instrumentalists wait in silence for the majority of an orchestral performance (Jacob, 1956; Blatter, 1997; Kennan & Grantham, 2002)<sup>191</sup>.

Hofmeyr's *Sinfonia Africana* (2003) displays the best example of a repetition of techniques that loses its efficacy when it is placed in a different sound context. In the following figure, the harpist and pianist are instructed to pluck the required strings with their fingernails, while the suspended cymbal is struck with a wire brush. All three techniques are relatively delicate, but especially on the piano and harp the eventual sound is fragile and not very resonant; this is likely why Hofmeyr instructs the musicians to perform the techniques with so much force (*sfz*). In the first measure, when the effect is applied for the first time against a backdrop of static *pianissimo* strings, it is effective firstly because it is used for the first time, secondly because it creates timbral contrast with the colour of the background material, and thirdly because the delicate qualities of the effect's sound can be heard distinctly against the very soft background of strings. In the second example, the effect will likely lose most of its distinctive qualities, firstly because the strings are now at a much higher dynamic level, and secondly because the mode of sound production (plucking of strings) is now equal in all instruments so that timbral contrast is lost. In the third example, the high dynamic level in all instruments together with the high degree of instrumental activity throughout a number of octaves will render the effect lost completely. Whereas the effect would be highly effective at the moment it is first utilised, it will be completely ineffective in the last example:

---

<sup>191</sup> Economic forces have to be reckoned with in orchestration, as it is seen by orchestration authors as a constraint that orchestrators need necessarily contend with. See an earlier chapter titled *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.

The image shows a musical score for Hofmeyr's *Sinfonia Africana* (2003). The score is written for a full orchestra and includes the following parts: Piccolo (Picc.), 2 Flutes (2 Fls.), 2 Clarinets (2 Cls.), 2 Oboes (2 Obs.), 2 Bassoons (2 Bsns.), Suspended Cymbal (Sus. cymb.), Piano, Harp, and Strings. The music is in 4/4 time and features a key signature of one flat (B-flat). The score is divided into three measures, with measure numbers 36, 42, and 48 indicated. The dynamics range from *mf* (mezzo-forte) to *sfz* (sforzando) and *ff* (fortissimo). The strings are marked *pp* (pianissimo) and *pizz.* (pizzicato). The woodwinds and strings play a complex, rhythmic pattern that repeats, creating a 'colour effect' that is described as effective at first but becoming ineffective later.

Figure 104: Repetition of a colour effect in Hofmeyr's *Sinfonia Africana* (2003), which is at first effective, but becomes ineffective later.

2. Verticality is the second consideration that was mentioned earlier of what constitutes effective orchestration. Application of vertical textures, which occurs in all orchestral music where instruments are applied simultaneously to different pitches, is only described as a component of effective orchestration in Piston (1961), Kennan & Grantham (2002) and Adler (2002), but chord writing is a standard component of orchestration literature in all sources since Berlioz (1843) (it is, however, noticeably absent from Forsyth, 1914). Verticality is measurable in four ways, namely by balance, unity, spacing and density. A perfectly balanced chord (and one which is most effective) is one where an even plane of sound has been secured and in which there are no perceivable breaks between the points where one instrumental colour joins another (Piston, 1961; Adler, 2002). Therefore, the first measurement of effective vertical application is to create the perception that a flat vertical plane of sound has been orchestrated. Unity of effect, the second measurement, is described by Jacob (1956) and Kennan & Grantham (1956) as being desirable in creating vertical

textures within the orchestra; as an example Kennan & Grantham (ibid.) advises that when woodwinds and strings are used together in a *marcato* passage for example, separate bows in the strings should be used next to separate tonguing in the woodwinds. Spacing is the third measurement of effective application of verticality; trombones, for example, sound at their best in wide spaced triads at a low dynamic level (Jacob, 1956; Kennan & Grantham, 2002), while the upper woodwinds are most effective in narrow spacing (Kennan & Grantham, 2002; Adler, 2002). Vertical spacing in the orchestra is most effective when it follows the model set by the overtone series (Piston, 1961; Jacob, 1956; Parrott, 1957; Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002; Casella & Mortari, 2004; Sevsay, 2013), although the model only serves orchestrators well when a chord is written in root position (Piston, 1961; Kennan & Grantham, 2002). Many modern scores deviate from the traditional use of harmony and here it is difficult to predict a model (Adler, 2002). On the last point, namely that of density, Adler (2002) states that orchestration is highly dependent on density<sup>192</sup>: the correct amount of density can add immeasurably to the effective presentation of solo material, but too little can give a sense of thinness and too much can overshadow the clarity of the orchestral design (Jacob, 1956; Adler, 2002). It will be shown later how clarity of design is considered to be central to the effectiveness of orchestration.

The problems posed by an ideal outcome of a flat vertical pane of sound are solved in various different ways by orchestrators. The following examples from eight South African orchestral works aim to show how some of these composers dealt with vertical spacing and the ideals of verticality in mostly chordal passages. Basically, all vertical positioning of instruments can be said to follow one or more of the four basic methods of combination, which are displayed in the figure below: juxtaposition [A]<sup>193</sup>, overlapping [B], interlocking [C]<sup>193</sup> or enclosure [D]. These patterns were first described in Rimsky-Korsakov

---

<sup>192</sup> Density of musical texture in this context should not be confused with sound energy density, which is a physical property of sound. In this case, as with sound weight (see the section titled *4.4 Some last notes about the perception of sound*, p.153), musical density is a psychophysical perception of sound that relates to a combination of factors including pitch frequency combination, volume, spectral content and registral locality.

<sup>193</sup> In Rimsky-Korsakov (1964), terms used are overlaying instead of juxtaposition, and crossing instead of interlocking. However, other textbooks do not favour this terminology, because it presents some ambiguity.

(1964, originally published 1913), but have since been adopted by nearly every textbook on orchestration. Each of the methods of combination has advantages and disadvantages, which cannot be described exhaustively in this thesis, but about which the reader can find out more in several of the orchestration textbooks. Juxtaposition allows the orchestrator to keep instrument groups in close proximity within the same register, thereby minimising issues of saliency, but sacrificing blend. Overlapping improves blend, but doubling of chord tones limits possibilities of range and sacrifices primary tone colours. Interlocking improves the homogeneity of a chord, but balance is sacrificed because instrument pairs are placed further apart. Enclosure is only rarely found in orchestration, and usually serves to accentuate the tone colour of one instrument pair by placing it around another pair.

The image displays a musical score for four instruments: 2 Flutes (2 Fls), 2 Oboes (2 Obs), 2 Clarinets (2 Cls), and 2 Bassoons (2 Bsns). The score is written in 4/4 time and consists of four measures, labeled A, B, C, and D. Each measure shows a different pattern of chord tone distribution across the four instrument staves. In measure A, the instruments are grouped into two pairs: Flutes and Oboes on the top two staves, and Clarinets and Bassoons on the bottom two staves. In measure B, the instruments are arranged in a staggered fashion, with Flutes and Clarinets on the top two staves, and Oboes and Bassoons on the bottom two staves. In measure C, the instruments are arranged in a staggered fashion, with Flutes and Oboes on the top two staves, and Clarinets and Bassoons on the bottom two staves. In measure D, the instruments are arranged in a staggered fashion, with Flutes and Bassoons on the top two staves, and Oboes and Clarinets on the bottom two staves. The chord tones are represented by black dots on the staves, and the patterns are labeled A, B, C, and D in boxes below the staves.

Figure 105: Four basic patterns of chord tone distribution.



Figure 106 shows a musical score for the first movement of Fagan's *Karoosimfonie* (1976). The score is in 4/4 time and consists of several staves for different instruments: 2 Oboes (2 Obs), English Horn (Eng. horn), 2 Clarinets (2 Cls), Bass Clarinet (B.cl.), 2 Bassoons (2 Bsns), Contrabassoon (C.bsn), 2 Trombones (2 Tpbs), and 4 Horns (4 Hns). The score includes various musical notations such as rests, notes, and dynamic markings. Circled letters A, B, and C are placed at specific points in the score to indicate vertical elements.

Figure 106: Spacing of vertical elements in the first movement of Fagan's *Karoosimfonie* (1976).

Figure 107 shows a musical score for the fourth movement of Grové's *Raka* (1996). The score is in 4/4 time and consists of several staves for different instruments: 2 Flutes (2 Fls), 2 Oboes (2 Obs), 2 Clarinets (2 Cls), 2 Trumpets (2 Tpts), 2 Horns (2 Hns), Bassoon (Bsn), and Contrabassoon (C.bsn). The score includes various musical notations such as rests, notes, and dynamic markings. Circled letters A, B, and D are placed at specific points in the score to indicate vertical elements.

Figure 107: Spacing of vertical elements in the fourth movement of Grové's *Raka* (1996).

Figure 108: Spacing of vertical elements in Temmingh's *tjellokonsert* (1992).

In the previous three figures, each type of chord tone distribution is marked in order to show which types are used most often. Generally, different kinds of distribution are combined within one passage, so that local distribution is shown between, below or above a group of voices. Within one instrument group, instruments are often placed in juxtaposition, but then there is usually some doubling between different instrument groups. In Figure 108 for example, Temmingh mostly uses juxtaposition within a single instrument group, with some overlapping or interlocking in the upper woodwinds and brass to secure balance and blend. Between different instrument groups, however, there is a large measure of overlapping, interlocking or enclosure within each register: see for instance how the bassoons and clarinets fit neatly into the strings in the last three measures.

3. The third factor of effective orchestration regarding excellent workmanship has been described throughout this thesis already and attests to the important contributions it makes to

orchestration<sup>194</sup>. According to Jacob (1956), good workmanship in orchestration is achieved when idiomatic writing, clear and understandable penmanship, and clarity of design and purpose are brought together (the latter is described later in this section) within the score. He advises the student orchestrator to show practical common sense by making one's intentions clear in the score by means of well-considered dynamic markings, bowings of string parts and phrasing of wind parts (and by extension, of percussion and other instruments' parts as well), by writing comfortably for players and avoiding the strain and irritation induced by constantly writing in high registers, by avoiding awkward passages, by providing frequent rests for the wind instruments, and by avoiding some remote keys that instrumentalists struggle to tune and perform in. Many modern scores of composers such as Stockhausen, Boulez and Ligeti achieve a characteristic sound by moving away from almost all these points mentioned by Jacob<sup>195</sup>, although other composers like Penderecki manage to achieve a completely individual sound idiom without compromising these traditions. It is, therefore, not possible to fully refute or support Jacobs advice. All the various points raised by Jacob do occur in Parrott (1957), Rimsky-Korsakov (1964), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004) and Sevsay (2013), so that there is a level of corroboration between authors and schools. Feder (2015, personal correspondence) views a careful consideration of every articulation, dynamic indication and phrasing marks as a core principle of orchestration. It is commonplace in orchestration textbooks to find sections on score preparation and correct notation, and good workmanship is frequently mentioned in all these sources.

The following section shows page examples from two South African orchestrations. On these pages, differing kinds of detail and technical workmanship are displayed. The first score (Figure 109), from the

---

<sup>194</sup> In the previous chapter, score presentation and adherence to a number of notational principles were shown to be fundamentally important in orchestration.

<sup>195</sup> As Roosenschoon rightly pointed out (2015, personal correspondence), these composers were at the same time founding new and eclectic ensembles better to express the experimental idioms of their compositions. At the time of these instrumentational shifts, the orchestra was sometimes viewed as an elitist foundation tied down by institutional conservatism and dogma. However, many composers have found new modes of expression in the orchestra of the last three decades.

handwritten first movement of Fagan's *Karoosimfonie* (1976), shows a lack of instrument names and articulation, but phrasing and bowing are indicated. After hairpins, new dynamic markings are not indicated. Interestingly, the first page of Fagan's score does not show all the instruments either, so that some are newly introduced during the score. The score does not indicate whether instruments are notated in transposed or concert pitch, which complicates the performance of the score considerably<sup>196</sup>. There are considerable enharmonic misspellings in the example as well. It can be said that although the score is of a high artistic standard, it lacks in technical workmanship. In the second example (Figure 110) from Roosenschoon's *The Magic Marimba* (1991), instrument names are indicated on every page and grouping of instruments are clearly shown. The layout of instrumentalists is also clearly shown on the first page. Dynamic markings are regularly included after dynamic changes, and articulation is shown in detail. It can be said that a high level of technical workmanship informs Roosenschoon's score and contributes to the efficacy of the orchestration.

---

<sup>196</sup> The score (*Karoosimfonie, 1976*) which is referenced in this study contains notes made by a conductor at some point. In many places, the conductor has made notes about the possible transposition of material in the score, and also shows a large amount of insecurity about the specific instrument required at certain points in the score. The orchestrator that fails to indicate this type of information in a score runs a very high risk of an unsuccessful performance.

The image displays a musical score excerpt from the first movement of Fagan's *Karoosimfonie* (1976). The score is written for a large ensemble, including strings, woodwinds, and brass. The tempo is marked as *acc. poco a poco e piu urgentemente*. The score begins at measure 60, marked with a first ending bracket (1°). The tempo is indicated as  $\text{♩} = 104$ . The score is characterized by several technical issues, including:

- Overlapping and cluttered notation, particularly in the string and woodwind parts.
- Excessive use of slurs and ties, which obscure individual notes and phrasing.
- Complex rhythmic patterns and accidentals that are difficult to read.
- Repetitive and convoluted melodic lines in several instruments.
- Unconventional or unclear articulation markings, such as the 'V' marks used in the lower strings.
- Overlapping dynamics and crescendo markings, making it difficult to determine the intended volume.

Figure 109: A score excerpt from the first movement (*acc. poco a poco e piu urgentemente*) of Fagan's *Karoosimfonie* (1976), showing poor technical workmanship.

The image displays a page of a musical score for an orchestral work, likely from the second movement of Roosenschoon's 'The Magic Marimba' (1991). The score is arranged in a standard orchestral format, with staves for various instruments and a grand staff for piano and organ. The instruments listed on the left include Piccolo (Picc.), Flute 1 & 2 (Fl. 1.2), Oboe 1 & 2 (Oboi 1.2), Clarinet in G (C. Ingl.), Clarinet in Bb (Clar. 1.2), Bassoon (Cl. basso), Saxophone (Sas.), Flute in C (Flg. 1.2), Cymbal (C'fg.), Trumpet 1, 2, and 3 (Trbe.), Cornet 1, 2, 3, and 4 (Corni), Trombone 1, 2, and 3 (Tbne.), Tuba, Timpani (Timp.), Cymbal (Crt.), Xylophone (Xif), Marimba 2 (Mbf 2), Piano (Piano), Organ, Violin I and II (Vln.), Viola (Viole), Violoncello (Vcelli), and Double Bass (Cbassi). The score features complex rhythmic patterns, including triplets and sixteenth-note runs. Dynamic markings such as *ff* (fortissimo) and *sim.* (sforzando) are used throughout. There are also articulation marks like accents and slurs. The bottom of the page has a Roman numeral III in a box, indicating the end of a section.

Figure 110: A score excerpt from the second movement ( $\downarrow = 168$ ) of Roosenschoon's *The Magic Marimba* (1991), showing a high level of technical workmanship.

4. The last factor of effective orchestration relates to the link between the outcomes of musical ideas and the outcomes of the orchestration ideas, and that they should be in accord if the aim is towards effective orchestration<sup>197</sup>. Hofmeyr (2015, personal correspondence), for instance, assesses an orchestral score according to how effective it is, but the criteria for effectiveness are self-devised by him as assessor and cannot be said to represent the outcomes of the orchestrator. Piston (1961) writes that orchestration should have its origin in the musical material and should not be copied from other orchestrators or only consist of attractive sound effects. Jacob (1956) goes on to say that orchestration should emphasise and enhance the mood and musical qualities of the score in order to be truly effective. Sevsay (2013) shows us in his guide to orchestration how a large number of poorly orchestrated good compositions exist and recalls examples by Schumann, Mussorgsky and Brahms, but Adler (2002) argues that the end result will always be good if the music is good. This last point by Adler could explain why many works that are badly orchestrated (a generally accepted example is Schumann's piano concerto) are still often performed centuries after their conception; it could be argued *in lieu* of this fact that audiences are able to perceive or are more interested in perceiving the musical qualities of a work so that the orchestration of a work only performs a secondary function. But as South African-born composer Kevin Volans (2015, personal correspondence) pointed out, it seems impossible to compose any music without orchestrating it as well (in the sense that orchestration is the study of instrumental technique and combination and is not necessarily only applicable in the context of the full symphony orchestra), so that there remains an intrinsic link between the musical material and the way in which it is orchestrated. Following on this, one can notice that orchestration authors perceive a link between abstract musical outcomes and instrumental design, and that the most effective orchestration will marry these two aspects of the musical material. As one example, in music that shows a tendency towards a programmatic sound or

---

<sup>197</sup> In previous chapters, the musical outcomes and the orchestrational outcomes of a work have been placed in a relationship of tension. Here, that tension is contextualised as another factor of effective orchestration. See the chapters titled *Perspective one: The mystification of orchestration (also an introduction)*, p.23; *Perspective three: Changing and interchanging of material in orchestration*, p.122; and *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.

in music of a pictorial nature, Jacob (1956) argues that above all orchestrators must aim towards realism of the highest fidelity (provided that the musical outline is preserved) in order to achieve the most effective result. As another example, in a musical texture where there is a clearly perceivable difference between foreground and background material (in other words, where melody and accompaniment are present), it would be best and most effective to give one colour to the melody and another to the accompaniment (Kennan & Grantham, 2002; Adler, 2002).

What is noticeable in the four points above is that, in reality, there exists no concrete or fixed rule for effective orchestration: effective orchestration is determined above all by context. Although effective orchestration is often described as if it was written to be effective, it is only effective when perceived so by the listener. In other words, it is not the intention of the orchestrator that directly contributes to the efficacy of a passage, but the imagined intentions of the orchestrator as they are perceived by the listener. Often it is not even a real listener by whose judgment the efficacy of an orchestration is measured, but by the standards of a fictitious listener as engendered by the imagination of the orchestrator or the critic<sup>198</sup>. In some examples, an orchestrational idea is deemed effective in an orchestration textbook, because the author has experienced it as such within the context of the musical material in which it appears. At other times, an orchestrational idea is estimated to be effective before it has been performed, because in writing it displays a musical or technical quality that can reasonably be predicted to sound effective in performance. In a previous footnote (no. 184), for example, a scoring which leaned heavily towards the bass was judged as effective because it was perceived that the intended effect was to orchestrate a ponderous, bass-heavy texture. In another example earlier in this chapter, the ideal qualities of an effective and balanced, hypothetical vertical texture was described. Effective orchestration can therefore be perceived in theory when studying an orchestral score, or in practice when listening to an orchestral performance. One could argue that in many cases, an orchestral score already represents an embodiment of orchestration practice, so that although a studier of the scores perceives the work in a different way than

---

<sup>198</sup> The hypothetical listener for whom the composer or orchestrator writes is also discussed to some length in a previous chapter titled *Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141. See also footnote 199.



the listener, it is on an equal footing. When an orchestrator attempts to orchestrate effectively, he or she does so with the intention of having the work perceived as effective; in other words, the work is orchestrated with the aim that a hypothetical listener or researcher of the orchestration will perceive it as effective. It is hypothetical, because the orchestrator can never fully understand or attempt to predict the different ways in which any listener would perceive the orchestration<sup>199</sup>. The unknown contributions of the listener to the perception of the music was also discussed in the first Perspective of this thesis.

### 7.3 Clarity of effective orchestration

Analysis of text fragments shows that orchestrators perceive a co-dependency between effective orchestration and orchestrational clarity; it is possible to speculate that effective orchestration becomes far more difficult to achieve if clarity is absent from the orchestration. Sevsay (2013) defines clarity in orchestration by referring to it throughout his source as the balance of contrasts between different voices playing at the same time or different sections of musical material that are performed consecutively. In McKay (1969), the author dedicates an entire chapter to the principle of clarity, which he subdivides into sections focussing on: unit organisation, textural definition and differentiation, textural combination, distribution of pitch, timbral definition, melodic control, harmonic control, and dynamic control. Clarity can therefore be seen as a characteristic of both the musical texture and of the orchestrational design. A number of examples exist that demonstrate the use of clarity to describe different aspects of orchestration: Jacob (1956) writes that the objective of orchestration should not be to demonstrate displays of skill and ingenuity, but to present the music and the orchestral form with clarity; Kennan & Grantham (2002) write that one of the main objectives of scoring music should be to do so with clarity; Adler (2002) views clarity as the main focus of the orchestrator, and that lack of clarity generally indicates a lack of comprehension of

---

<sup>199</sup> The hypothetical listener or audience member, as well as the perceptions of the real listener or audience member, is a subject that cannot be explored fully in this thesis, although some ideas about it has been shared here and in previous chapters. For that reason, the reader is referred to Small (1998). Another interesting voice on this subject is Witold Lutosławski, who speaks about the relationship between composer and imagined listener in a documentary-style interview with Krzysztof Zanussi titled *Witold Lutosławski in Conversation with Krzysztof Zanussi* (1990).

the true implications of the music. In these three authors one finds, for example, that if an orchestrator is composing a passage for full orchestra, less prominent instruments that are not heard clearly would not contribute constructively to the musical texture in a perceivable manner, but could still mask or weaken the clarity of design in that section and make it less effective. Jacob (1956) therefore sees clarity as a unit of measurement by which the skill and quality of an orchestrator can be judged. If the orchestration is used to clarify one's musical ideas, Adler (2002) shows that the orchestrator will always achieve the desired result. We can see how clarity can be achieved by studying orchestration textbooks for information about both what should be done and what should rather be avoided (according to their authors).

Adler (2002) is especially preoccupied with clarity in orchestration; in his guide to orchestration there are many instances where the student is advised on how to achieve clarity. Clarity is firstly achieved by utilising orchestration to distinguish between foreground, middleground and background; then, the orchestration will be effective. Clarity is also achieved when orchestral colours are carefully balanced and musical elements are well-defined – this will provide a clearly articulated idea of the orchestrator's intentions and help to clarify the form of the entire work<sup>200</sup>. Using varied articulations and colours for each of the thematic or textural elements will help the listener to distinguish between different elements of a complex orchestral texture and will contribute to a clear perception of the orchestrator's intentions; when these techniques are effectively brought together in the orchestration, they will help to strengthen the formal structures of the work. Jacob (1956), like Adler, displays a preoccupation with clarity, but in his case focusses not on what should be done, but rather on what should not. For instance, he writes that clarity of musical thought can be destroyed when a melodic line is obscured by its accompaniment. In a point related to this, Jacob voices his concern regarding conductors of the last century who take it upon themselves to bring out secondary voices in the performance of a work, thereby working against the original design of the

---

<sup>200</sup> The intentions of the orchestrator and the listener's perception of those intentions are always in a state of tension; however, as will later be shown, clarity presents itself in orchestration textbooks as the mechanism by which the orchestration can attempt to exert a certain amount of control over those perceptions.

composer or orchestrator<sup>201</sup>. Therefore, a composer should be especially wary of waste notes in the music: nothing should be written into the score if it does not contribute to the music in its entirety. If, for example, the timpani cannot be called on to perform a roll on a chord tone at a specific moment (students are strongly discouraged to use the timpani on a non-chord tone), the timpani should rather be left out; it would do more harm to the clarity of the orchestrator's design to use the timpani on the "wrong" note than it would do not to have timpani at all<sup>202</sup>. Lastly, orchestration authors point out (Rimsky-Korsakov, 1964; Piston, 1961; Adler, 2002) that inexperienced orchestrators tend to use so many effects and colours in a work that the structure and clarity of a work are put in danger.

It was said earlier that effectiveness of an orchestral work was dependent to a large degree on the perception of the score reader or listener: it was shown that orchestration is described as effective when it is perceived that the musical outcomes of a work are in line the orchestrational outcomes of a work. Those outcomes, in turn, are also determined by the perception more so of those who receive the music than those who create it. I would like to argue that clarity of design is the mechanism by which the orchestrator can attempt to control the musical outcomes as they are perceived by performers, listeners and researchers of the music. That is why clarity is such a central component of the efficacy of an orchestration: it is through clearly designed and controlled structures, textures and colours that the composer can lessen the ambiguity of intention inherent in musical performance and ensure that what is perceived by the receiver of the music is also what was intended by the creator. If this principle is true, however, then it can be argued that perfect clarity can never be achieved: even in the absolute serialism of some of Stockhausen's work (e.g. *Kontakte*) there are still contextual influences that skew the receiver's perception of the music and create perceived ambiguities *vis-à-vis* the composer's intentions.

---

<sup>201</sup> Leonard Bernstein's recording with the Vienna Philharmonic of Mozart's Symphonies (specifically nos. 40 KV550 and 41 KV551 released by Deutsche Grammophon in 1984/1985) is an example of a musical production which sought to place the music in a new perspective by focussing on secondary melodies and hidden material within the scoring. This point was also discussed in *Perspective one: The mystification of orchestration (also an introduction)*, p.23.

<sup>202</sup> There are, of course, a number of examples where composers/orchestrators have used the timpani on non-chord tones, but these examples in the absolute minority. In Fagan (1976) and Klatzow (1984), the timpani are sometimes used on non-chord tones.

The following examples show how a number of composers achieve the quality of clarity in their orchestrations by applying some of the procedures that were described above. In the first excerpt (Figure 111) from Zaidel-Rudolph's *Tempus Fugit* (1986), the composer achieves clarity primarily by applying three dynamic layers (*mezzo piano*, *piano*, and *pianissimo*) to differentiate between layers of musical material. Furthermore, the composer makes use mostly of primary colours in order to engender maximum timbral contrast. Lastly, different parts are placed in different octaves so that there is a measure of registral segregation between instrumental voices.

The musical score for Figure 111 is written in 8/8 time and consists of several staves. The first staff is for the first flute (1. Fl.), marked *pp*. The second staff is for the second flute (2. Fl.) and first oboe (1. Ob.), marked *mp*. The third staff is for the first bassoon (1. Bsn), marked *pp*. The fourth staff is for the second bassoon (2. Bsn), marked *pp*. The fifth staff is for the timpani (Timps), marked *mp*. The sixth staff is for the vibraphone (Vibes), marked *pp sempre*. The seventh staff is for the first violin (Vlns I sul pont.), marked *pp*. The eighth staff is for the first violin (Vlns I), marked *p*. The ninth staff is for the first violin (Vlns I), marked *p*. The tenth staff is for the first violin (Vlns I), marked *p*. The score shows a complex layering of textures with dynamic markings used to differentiate foreground, middleground, and background material.

Figure 111: (♩. = ♩ = 132) Use of dynamic markings to differentiate foreground, middleground and background material in Zaidel-Rudolph's *Tempus Fugit* (1986).

In Klatzow's *Incantations* (1984, Figure 112), clarity is maintained in a complex layering of textures mainly by rhythmic separation of timbres. The phrase has been constructed as a complex musical unit following the 4-phase model of attack-decay-sustain-release (ADSR), of which the first three phases are displayed in the figure. The attack phase combines the timbres of all instruments at once in order to achieve homogeneity of effect, after which instruments are divided into separate functions. Trumpets and strings provide sustain, which Klatzow thins out and reduces in volume over time. As the trumpets fade out,

their sound is replaced by English horn and bassoon, whilst the sound of the piano is replaced by harp and vibraphone. The pure sinus tone of flutes enter as a secondary musical force, which then develops into a melodic component of its own. The flute line still stands out above the rest of the ensemble (although it is marked *pianissimo*), because it is assigned material that is faster than the other instruments and is placed registerally above them.

Figure 112: (Meno Mosso ♩ = 54) Use of rhythm, timbre and dynamics to differentiate musical textures in Klatzow's *Incantations* (1984).

In Grové's *Raka* (1996, Figure 113), a complex of three melodic components in flutes/piccolo, horns and bassoons/violas are differentiated by contrasting rhythmic profiles and registral separation. By comparison, the strings sustain clusters of tones at variegated dynamic levels, in order to provide a shifting background texture. The string clusters are enhanced by the harp, which maintains a constant background vibration of sound with a *bisbigliando* effect. Together, these considerations allow the orchestrator to maintain clarity in a complex combination of two textural ideas.

Figure 113: Separation of musical elements by rhythmic, timbre and registral contrast in the first movement (Andante  $\downarrow = 72$ ) of Grové's *Raka* (1996).

The final example below shows how an overburdening of the score with textural layers can harm the resulting clarity of the orchestration and obscure the primary melodic material. Although Hofmeyr has marked the solo voice (top line) at a dynamic level higher than the accompaniment, the intensely involved rhythmic activity of strings, winds, percussion and choir in various octaves overwhelms the text of the soloist. The balancing problem is compounded by the fact that the passage for soprano is composed in her lowest and least resonant tessitura. The problem could have been reduced by silencing any instrumental sounds occurring in the same octave as the voice, or by removing the comparatively salient sounds of the flute and clarinet trills. The problem is here not so much the octave in which the soprano is singing is overburdened, but that the overtones created by the many different instruments will absorb the diction-determining overtones of the singer; therefore, although the singer might still be heard as a musical element, her diction will be muffled by the surrounding instrumental activity. The audience, who might perceive the music as being dependent on the diction, might in turn perceive the passage as being ineffectively scored.

The musical score for Hofmeyr's *Sinfonia Africana* (2003) is presented in a multi-staff format. At the top, a solo voice part is marked 'Solo' and 'mp', with lyrics in Afrikaans: 'nag wind, diep, diep en donker, en in ons roep 'n'. The orchestral accompaniment includes a piano (p) and a double bass (Dbs) part, both marked 'ppp'. The string section (Vlns, Vla, Vcl) is marked 'ppp' and features a dense texture of triplets. The woodwind section (Fls, Cl, B.cl) is marked 'p' and 'pp' and includes trills and triplets. The percussion section (Hrp, Bsn, Dbs) is marked 'mp' and 'p'. The score is in 3/4 time and features a complex arrangement of instruments with various dynamics and articulations.

Figure 114: Overpowering of the solo voice by the orchestra in the last movement (*Più mosso* ♩ = c.66-72) of Hofmeyr's *Sinfonia Africana* (2003).

## 7.4 Other factors that contribute to effective orchestration

### 7.4.1 The contribution of tone colour

There are a number of secondary factors related to effective orchestration that also warrant discussion; the application of colour in orchestration has been mentioned a number of times already so that it should be clear by now that effective use of colour contributes directly towards effective orchestration. There are a number of examples that show how colour is perceived by orchestrators as a central aspect of effective orchestration: Sevsay (2013) writes that orchestration has developed over the previous three centuries so that today it deals not only with the isolated production of tone colour or with unconventional use of instruments, but with the combination of these factors to produce an effective composition. Adler (2002), when discussing the contribution of colour to orchestration, borrows a well-

known quote by the painter Jacques Maroger, who is known to have said that “the greatest colourists have always obtained the maximum brilliance and vibration with a minimum of colour”<sup>203</sup>. In terms of the ideals of clarity that were discussed earlier, this statement reinforces the idea that a focused application of fewer elements holds more value than an untidy application of many different elements. Colour is arguably one of the greatest contributors to subjectivity in orchestration, because the perceived efficacy of a colour is a) highly context dependent and b) highly dependent on personal taste. A harp glissando that sounds very effective to one listener might sound hackneyed and unattractive to another; the same harp glissando that might be perceived as adding an appropriate wash of colour to Respighi’s *Fountains of Rome*, might seem out of place in a Baroque-style fugue. It is not surprising then that while Jacob (1956) discourages the use of violin pizzicato in the extreme upper range for being dry and lacking in resonance, Kennan & Grantham (2002) advocate their use in a context where their brittle sound can add to the atmosphere of the musical material. Likewise, whereas Kennan & Grantham (ibid.) write that the English horn loses its characteristic colour in its highest register and should therefore be replaced by the oboe in those sections, Parrott (1957) on the other hand writes that the double reeds gain a more highly coloured and uniquely pinched quality of tone in their upper ranges that can add considerably to the overall mood of a musical texture if used appropriately. Blatter (1997), Kennan & Grantham (2002), Adler (2002) and Sevsay (2013) are somewhat opposed in their writing to the blended scoring techniques of the Romantic era, which as a practice they consider to be counterproductive to the goal of clarity and, by implication, of effectiveness<sup>204</sup>. Primary or near-primary colours (that is, using the colour of only one or two instruments) have the most characteristic sound quality, and should always be applied to thematic material so that it can be easily distinguished when it returns (Kennan & Grantham, 2002; Adler, 2002). In other sections of the music, secondary or blended colours could be applied to reduce the vibrancy and transparency of those textures and in so doing accentuate the sections that do make use of primary colours; if used in this way colour can add to the clarity of an orchestrator’s design and reinforce the structure of the music (Kennan & Grantham, 2002;

---

<sup>203</sup> Maroger, J. (1942). *The secret formulas of and techniques of the masters*. New York: Studio Publications.

<sup>204</sup> The reader is referred to an earlier chapter of this thesis, where the matter of scoring traditions is more thoroughly explained. See the *Perspective six: Inherited practices and orchestration traditions*, p.193.



Sevsay, 2013). Lastly, predetermined, well-designed application of colour is a crucial element of effective chord writing if Piston's (1955) ideal of a flat vertical plane of sound is to be achieved.

#### 7.4.2 Doing the right thing at the right time

The contextual sensitivity of the attribute of effectiveness in orchestration has been mentioned a number of times in this chapter and it was shown in the previous paragraph how the efficacy of colour is also dependent on how and when it is perceived in a musical texture. As Meyer (2012: 4) writes, an orchestrational effect might be effective in one context, but not in another, depending on a number of situational characteristics. There is a kind of serendipity to orchestration that determines that an effect applied at the right time can add much value to the orchestration at hand, but that it is not always possible to predict what will work and where<sup>205</sup>. To state it in colloquial terms, it is a case of having the right thing at the right time. There are, however, a number of routes that an orchestrator can follow to maximise the chances of such a serendipitous occurrence and they link well with the principles of effective orchestration that have been discussed so far. (It is therefore not entirely a matter of chance, but also of knowledge, experience and personal preference.) As Parrott (1957) states, the choice of an instrument or how or when it is used is not a simple matter, but one in which knowledge and loving care are joined to expediency<sup>206</sup>. In considering Parrott's statement, one could think of the difference in tone colour when strings are used with or without mutes; as Kennan & Grantham (2002) state, the decision should not rely on volume or colour production alone, but on musical intent, character and the colours already provided by other instruments. Jacob (1956) also states that it is not enough to choose an instrument according to the compass or register

---

<sup>205</sup> The unpredictable outcome of orchestrational devices in performance was discussed in Perspective 1, p.23. Here I feel that two opposing factors exist in a kind of tension: there is on one hand the acknowledgement by orchestrators that some techniques and instrumental devices are always idiomatic and effective, which to me is proof of an underlying predictability within orchestration; on the other hand there is the tendency to make of orchestration a mystical endeavour that resists classification and systemisation, which is also a valid notion when one considers the tremendous number of factors that influence the eventual performance of an orchestration. It seems that when these two opposing factors work in favour of each other, the serendipity to which is referred is then realised.

<sup>206</sup> Loving care seems here to refer to personal taste, and also seems to infer that when personal preferences and knowledge are combined to good effect, personal taste becomes good taste. See under the previous chapter the section titled 5.3 *The effect of musical constraints*, p.180, for more about the good taste and orchestration.

that is needed, but that many other considerations like musical outcomes and structural effect should be considered simultaneously.

The most compelling advice given for attaining the expediency that Parrott refers to comes from Piston (1961), Jacob (1956), Blatter (1997), Kennan & Grantham (2002) and Sevsay (2013) and is to write for instruments in the ways and in the situations that have already been described and classified as very effective in orchestration literature<sup>207</sup>. The piccolo is widely described as being most effective in adding a brilliant quality to a melodic line (Berlioz & Strauss, 1991; Piston, 1961; Rimsky-Korsakov, 1964; Jacob, 1956; Blatter, 1997; Kennan & Grantham, 2002); logically then, in a situation where an orchestrator wishes to enhance the brilliance of an orchestral passage, the piccolo could be the first and safest choice. The oboe, which is universally admired for its ability to perform expressive phrases and melodies in the correct register, could likewise be a safe and trusted choice for expressive or poignant melodic material. The process can also be reversed: if one wishes to use an instrument or instrument group, one could study scores and texts to find out what material is written for them most often and suits them well<sup>208</sup> – it is for example, as has been stated before, commonly understood that the trombones work best if thought of as a three-part harmonic unit (Jacob, 1956; Blatter, 1997). It would be possible to compile a list of the most-used instrumental effects and devices in orchestral literature to provide a kind of encyclopaedia for students to consult when orchestrating<sup>209</sup>, and a number of composers such as Karl Jenkins can be cited for using almost exclusively such commonplace techniques to good and replicable effect. What one might gain

---

<sup>207</sup> As was previously the case, there is an argument to be made here for the idea of idiomatic orchestration that transcends writing idiomatically for each individual instrument.

<sup>208</sup> Jacob (1956) writes, for example, that the trombones should only be used for such parts as suit them well. Such a statement might at first seem vacuous in the sense that it is not really teaching the student anything, but it touches on the core principle of idiomatic writing that underpins Jacob's text: if instruments are used in a way that is idiomatic (in other words, that suits them well), the resulting orchestration is far more likely to be effective.

<sup>209</sup> Something vaguely of this sort does exist, but not to serve the purpose that is described here. Gardener Read's *Orchestral combinations: the science and art of instrumental tone-colour* provides an encyclopaedic overview of a wide range of instrumental and interval combinations found in orchestral literature; in his book the aim is not to give examples of the most common uses in orchestration, however, but to give orchestral examples of the widest range possible of octave doublings and instrument combinations that the author could imagine. Read does provide a description of the efficacy and technical demand of each example, which could be of help to an orchestrator.

in scores that are easily performed and listened to, however, one might lose in originality of expression; composers throughout time have been characterised by their tendencies to innovate or preserve tradition partly because of this. Meyer's thesis (2012) mentions that authors see a dichotomy between technical and creative orchestration, noting that a technically perfect orchestration could be bland and uncreative while a creative orchestration might be technically unfeasible. A composer like Ravel managed to utilise greatly innovative and striking techniques in his orchestration, but with the result that his music is generally perceived as more challenging to perform effectively. In contrast, the subdued and minimal orchestrations of other composers (such as Rodrigo's concerto for guitar, or Rautavaara's concerto for harp) might also display an innovative and original approach.

Figure 115: ( $\downarrow$  = c.88) Expedient use of standard techniques and registers to create effective textural layers in Temmingh's *tjellokonsert* (1992).

In the example above from Temmingh's *tjellokonsert* (1992), which is also referenced previously in the chapter regarding vertical balance, a number of observations can be made about the composer's use of varying levels of expedient instrumental techniques and registers. Firstly, the composer makes use

exclusively of standard (perhaps even common) techniques, which as Jacob (1956) and Parrott (1957) showed are more likely to be successful in performance. The different instrument groups (strings, woodwinds and brass) have been treated as musical units, so that within each group there is a high measure of technical unity; aspects of ensemble performance such as intonation and synchronicity are more likely to be successful because of this. Furthermore, Temmingh avoids placing instruments in extreme registers, which decreases the likelihood of problems with intonation and timbral balance. As a general comment, one could classify Temmingh's orchestration practice in this extract as conservative, or "safe" as Jacob (1956), Parrott (1957) or Meyer (2012) refer to this style in their texts. There are some problems in the extract as well, however, especially in the first two measures of the woodwinds: once the clarinets and flutes enter their respective lowest octaves, the dynamic of *fortissimo* combined with the articulation of *staccato* seems less likely to succeed; the clarinets, which have been placed squarely in their throat registers in the last three measures, will also need compensation by the players in order to succeed at a dynamic level of *fortissimo*.

#### 7.4.3 Avoiding that which is not effective

The last note about effective orchestration is that the concept can also be approached or achieved from the opposite side; by this is meant that effective orchestration can be achieved by avoiding the habits, techniques and devices that would reduce the characteristics of effective orchestration that were described earlier. It is worth describing some of these characteristics even if they are only shown in Jacob (1956) and Kennan & Grantham (2002) (and to some extent in Rimsky-Korsakov, 1964), because they aid in our understanding of what *does* make orchestration effective. A number of examples will be shown to display four categories that comprise the pitfalls or mistakes that prohibit effective orchestration; these four categories form a complement to the four categories of effective orchestration that were described earlier. A table provides the best means to show the comparison:

Table 16 -- Four categories of effective and ineffective orchestration displayed in a table for comparison:

	Effective orchestration:	Ineffective orchestration:
1	Instruments are utilised in an idiomatic and original manner.	Instruments are utilised in an unidiomatic or a hackneyed manner.  Jacob (1956) writes, for example, that the dry and sometimes humorous staccato effect that the bassoon is capable of producing has been exploited so much in orchestration that it has been rendered ineffective (in the twentieth century, composers have sought other sound idioms for the bassoon; this was discussed somewhat in <i>Perspective one</i> , p.24). The overuse of percussion in the orchestra is described by both Jacob (ibid.) and Kennan & Grantham (2002) as ineffective in the orchestra today, because it is both uneconomical and clichéd <sup>210</sup> .
2	Even vertical balance is achieved.	Vertical textures are unsatisfactory in the sense that chords are unbalanced, or instruments are utilised in such a way that they do not blend well with each other.  Jacob (1956) and Rimsky-Korsakov (1964) mention thinness and thickness as two textural opposites that should be avoided. The former (thinness) is symptomatic of instruments that are spaced so far apart that blending is not possible anymore, and leads to what Adler (2002) describes as an anaemic sound. The latter (thickness) is generally caused by chord tones spaced too closely in the lowest octaves, or what Jacob refers to as a too grumpy placement of the harmony. Kennan & Grantham (2002) warn against having a wide gap in the scoring in the middle register, because balancing and blending will become much more difficult and the sound will likely be unsatisfactory <sup>211</sup> . These are, however, very relative concepts in contemporary scoring (Stravinsky's <i>Le Sacre du Printemps</i> is an obvious exception), because musical aesthetics of present-day works could imaginably call for a very thick or grumpy sound, or necessarily an anaemic spacing of the instruments. Therefore, although these warnings do provide a sense of the general

<sup>210</sup> Kennan & Grantham (2002) show an example from Respighi's *Roman Festivals*, which lists a total of fourteen percussion instruments of which ten are used together at one point. Although the effect in performance is staggering, it places financial and logistical limits on the performance possibilities of the work. The authors seem to imply that the ability to perform a work easily and universally can be seen as a contributing factor to effective orchestration, or rather that a lack of those characteristics can reduce the efficacy of an orchestration.

<sup>211</sup> More on this in a previous chapter titled *Perspective three: Changing and interchanging of material in orchestration*, p.122.

		<p>listener's perspective (if such a thing can be shown to exist today), they carry more authority in music of a tonal or more traditional nature. Both authors acknowledge this point to some extent when they describe the fluidity of aesthetics in music composed after World War II.</p>
3	The score shows accurate workmanship and attention to detail.	<p>Insufficient knowledge about instruments and little attention to detail are visible in the orchestration.</p> <p>Piston (1961) states that insufficient knowledge about the strengths and weaknesses of instruments, as well as a lack of experience with the techniques and sounds of instruments, are the most prominent defects to be found in the scores of inexperienced orchestrators. Jacob (1956) writes for example that it is pointless to give the trombones long sustained chords at a dynamic strength above <i>mezzo forte</i>, because the instrumentalists will be incapable of sustaining such a chord for long (see Figure 49); in his experience, students often forget how much air instrumentalists require to perform at a certain dynamic level and in the process orchestrate ineffectively. Some effects that were traditionally performed on one instrument, will today often be performed on another instrument that can produce the same sounds more effectively: the two-plate roll, which is when crash cymbals are rubbed together in a circular motion, produces much the same effect as a roll on a suspended cymbal, although the latter is more convincing than the former because of improved resonance. Kennan &amp; Grantham (2002) find that students who study scores will often copy outdated effects, because they lack the knowledge and experience to know of more effective modern equivalents. Lastly, some instrumental combinations have been tested by orchestrators throughout time and have been found to be ineffective; many of these denounced combinations are anecdotal, however, so that the exact characteristics of their incompatibilities have not been studied enough to produce a predictable model. The oboe should not, for example, be doubled in unison with the violins, if there are fewer than six violins in the orchestra (Jacob, 1956), because the sounds will not produce a satisfactory blend. As another common example, the oboe and clarinet in unison are also considered ineffective, because the instruments differ enough in sound quality that they become difficult to tune.</p> <p>Jacob (1956) and Rimsky-Korsakov (1964) articulate a common misconception about art that, somehow, technique and creativity are opposing forces and that an abundance of one facet in music indicates a deficit of the other. These two components are not mutually exclusive,</p>

		<p>however: to musicians, music is not only an art, but also a complex and difficult craft. Therefore, when a composer ignores the practical details of writing for the instruments of the orchestra, the eventual sound product is far more likely to fail and be incapable of effective delivery. Piston (1961) states the same, that if parts are well written both in terms of the individual instruments and in terms of their roles in the orchestra, the performance product is almost guaranteed to sound well; in contrast, if the parts are poorly conceived or ill-suited to the instruments and the orchestra, the total effect is bound to be unsatisfactory.</p>
4	<p>The perceived musical outcomes are enhanced by the orchestration.</p>	<p>The orchestration does not match or enhance the perceived musical outcomes of the work. Instruments are used in a manner that seems contradictory to their normal use.</p> <p>It might, for example, be ineffective to use the xylophone to carry music of a lyric or <i>espressivo</i> nature, because the instrument is so dry and lacking in sustained resonance that even when rolling, it would not be able to produce a lyrical sound. It could be imagined that in some situations, the addition of a xylophone to a lyrical passage could provide an ironic edge to the sound that could be exploited to good effect, but only if the addition of xylophone is perceived as a planned effect. The piccolo, being the brightest member of the orchestra, would also likely seem out of place in a dark and sombre chord; again though, one well-placed piercing note from the piccolo can provide a darker chord with a sense of radiance. Notwithstanding, if it is used improperly it could sound out of place and then become ineffective. If clarity is perceived as the ideal marriage between musical and orchestrational thinking, then the lack of clarity will obviate effective orchestration. Jacob (1956) is especially verbal about this, and discourages the orchestrator strongly from having instruments present in the score without a clear goal in mind, going on to say that it is unproductive to overload a score with decorations simply for the sake of giving an instrument something to do; the resulting sound in performance will be a jumble of sound and a blurring of the design of the music.</p>

## 7.5 Concluding remarks

In this chapter, the concept of effective orchestration was shown to be the greatest concern of orchestration authors (see Graph 6, p.281). Although it is often referenced in textbooks, the concept has not been adequately delineated, so that this chapter attempted to provide a meaningful description of effective orchestration by comparing a large number of codes from several textbooks. It was discovered that effective orchestration centres mainly on colour, clarity, balance, blend, sound perception and conceptual perception of orchestrational outcomes.

Effective orchestration itself was described under four subcategories that include 1) idiomatic techniques, 2) vertical blend and balance, 3) workmanship, and 4) a perception of orchestrational outcomes as effective. However, it was shown that the last subcategory often contradicts the requirements of the first three, because an orchestration that appears to “break the rules” can be perceived to do so very effectively. The hypothetical listener was reintroduced as an entity for the orchestrator to contend with when mentally testing ideas and effects. Clarity was identified as a major contributing factor to effective orchestration, and focussed on the differentiation of colours, ideas and textures. Clarity aids in communicating musical ideas and outcomes more unambiguously, and was identified as a mechanism with which the orchestrator could control the perceived outcomes of a work, thus ensuring efficacy of orchestrational effects.

Clarity was described in terms of both those techniques that should be used and those that should not, so that the earlier *Perspective five* regarding constraints was brought into consideration. Colour, which was discussed thereafter, was shown to be another major contributor to effective orchestration, and referred the reader back to *Perspective three* that dealt with change and interchange of colour as a central orchestrational concern. It was shown that because colour can reinforce structure in music (*Perspective four*), that clarity is closely related to colour. The contextual dependency of these various factors were considered and it was shown that a number of approaches could aid the orchestrator in achieving the desired effect with greater surety. These included making use of trusted idiomatic techniques that are



found in existing orchestral scores, and avoiding a number of dangerous orchestrational practices. A number of these practices, which are described by orchestration authors as reducing the likelihood of achieving an effective orchestration, were then listed. As Belkin (2008) writes, it is important to develop a set of general principles that orchestrators can follow reliably, because orchestration is a challenging endeavour to undertake.

Although the concept of effective orchestration appears to be a highly abstract idea that encompasses a complex array of factors, I attempted in this chapter to provide a structured layout of a number of its constituent factors in order to delineate it more clearly. The following concept map shows how a number of concepts in this chapter are linked to other Perspectives in this thesis, as was also the case in previous chapters:

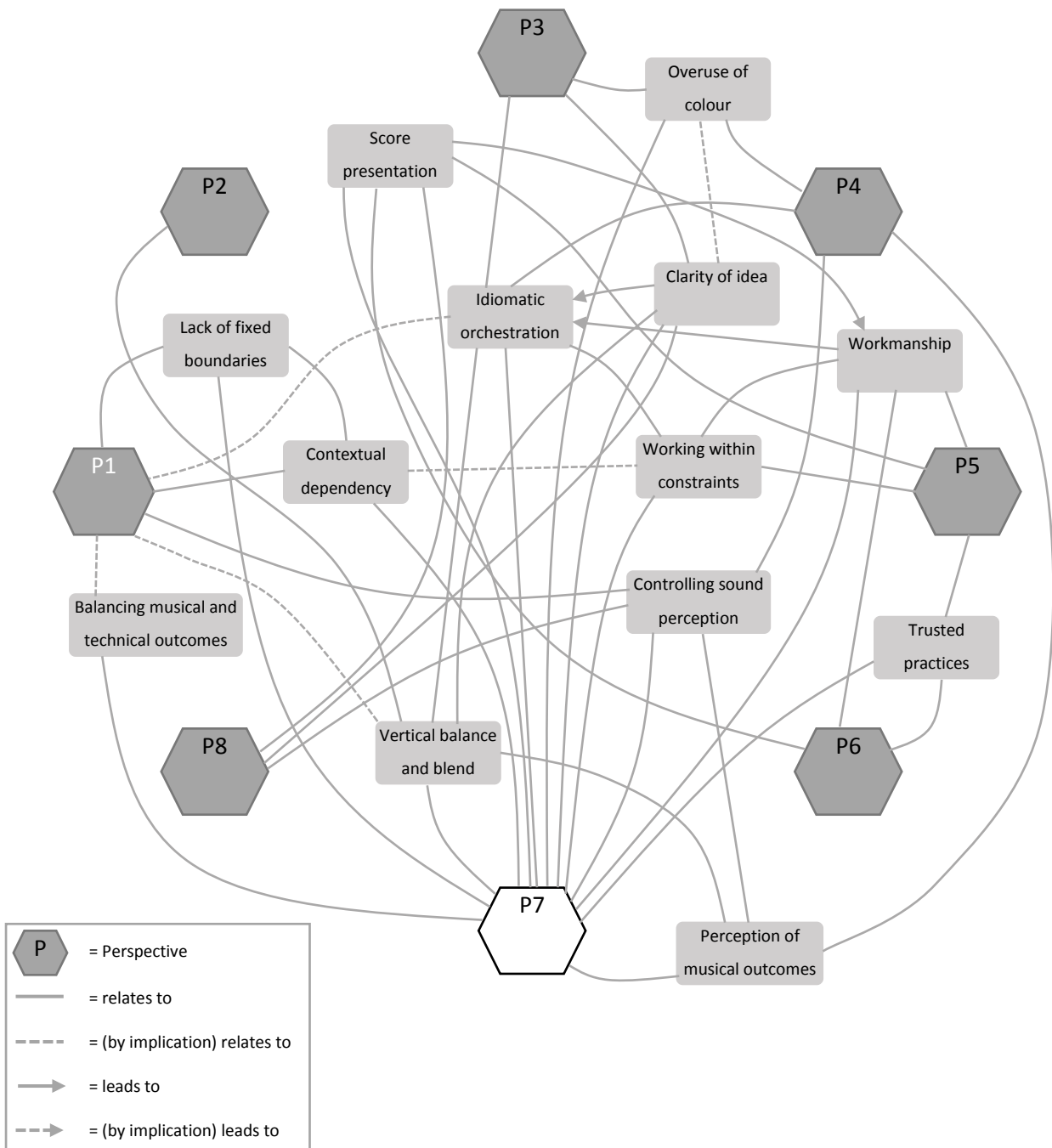


Diagram 8: Concept web showing interrelatedness of concepts in Perspective 7 with other Perspectives.

## Perspective eight: Knowledge and orchestration

(also in conclusion of a grounded approach to orchestration)

### 8.1 Introduction

Orchestration, as experienced by orchestrators through the texts studied in this project, seems to present itself as deeply concerned with knowledge in various ways. We have already seen that symphonic orchestration in almost any form is dependent on a wide and divergent body of prerequisite knowledge in the theory, performance, perception and history of music both in terms of the orchestra and in terms of what is being orchestrated. These same forms of knowledge were seen to place constraints on the practice of orchestration. Orchestration routinely calls on the abilities of an orchestrator to compose, analyse, harmonise and choreograph music in order for it to take place effectively. Furthermore, a number of scientific principles in the fields of psychoacoustics, sound propagation and acoustics are brought into play when the musical design of the orchestration meets physical expression of the sound. The manner in which these principles are expressed in orchestration are often reliant on inherited practices, whether it is in agreement with them or whether it attempts to negate them. Centuries of orchestration practice based on the study of existing score material have led to a number of slowly evolving intra-orchestral hierarchies that the orchestrator must contend with as well if orchestration is to be effective. Lastly, orchestrators show a tendency to resist a systematic approach to some aspects of orchestration, so that a full understanding of the subject is further convoluted by a sense of instinct or mysticism. These various points were described in the foregoing seven categories (Perspectives) of orchestration. It is not surprising then that Piston (1961) and Parrott (1957) both describe the orchestra as a complex machine and orchestration as a complex set of mechanics, when it draws on such a complex set of knowledge systems in order to operate well. It is because of the central position of knowledge in all aspects of orchestration that this Perspective was chosen also to be a conclusion to this grounded study.

In the analysis and coding of text fragments of this project, a significant number of fragments presented themselves as directly concerned with knowledge. Although this thesis cannot undertake a full epistemological account of orchestration, which would be too lengthy and not be in line with the main

objectives of a Grounded Theory approach to the research, it is worth calling on some epistemological terminology in order to describe the functioning of knowledge within orchestration more accurately. Therefore, knowledge is viewed here as an awareness or understanding of something like a fact, or like information, or like a skill which is acquired through either experience or education by the process of perceiving, discovery or learning<sup>212</sup>. The practical skills and understanding referred to in orchestration are seen as implicit knowledge, whereas theoretical understanding is seen as explicit knowledge. It will be shown that implicit knowledge acquired in orchestration is sometimes described in an abstract (or even mystical) sense, calling on notions of inspiration, wisdom, intuition or genius<sup>213</sup>. Furthermore, orchestration authors also reveal the tendency to relegate very complex kinds of knowledge to this mystical realm by stating that some complex things simply cannot be learnt from textbooks. Although one might agree that some aspects are better learnt from experience and personal discovery, it is also possible that some of the concepts described in this way, however complex and resistant to documentation they are, could be formalised in order to become explicit knowledge. Inversely, prerequisite knowledge such as harmony, voice leading, balance, aurality and organology are sometimes designated to the realm of explicit knowledge to be studied from books with little sensitivity to the unique ways in which these forms of knowledge are embodied in orchestration: although many aspects of these subjects can be studied from textbooks, they are as reliant on implicit forms of knowledge gained through experience as orchestration itself is. This exchange of knowledge between implicit and explicit paradigms is the main mechanism by which the technique of orchestration is taught and documented. This exchange takes place in a cycle that can be illustrated simply as follows:

---

<sup>212</sup> It is not possible to describe knowledge in this manner without acknowledging that the exact definition of knowledge is an ongoing philosophical debate. The concern here, however, is not with whether something is actually knowledge, which could form a study on its own: if the state of knowing is called upon in a text fragment by an author, it is seen as describing knowledge of some sort. Such a view is reminiscent in a basic sense of Ludwig Wittgenstein's observation in *On Certainty* (1969) that what is *known* by a person is fundamentally different from what is *believed* by a person, and that the state of knowing engenders the state of knowledge.

<sup>213</sup> This draws us back to the second chapter of this thesis: *Perspective one: The mystification of orchestration (also an introduction)* p.23, in which these aspects of orchestration are discussed in more detail.

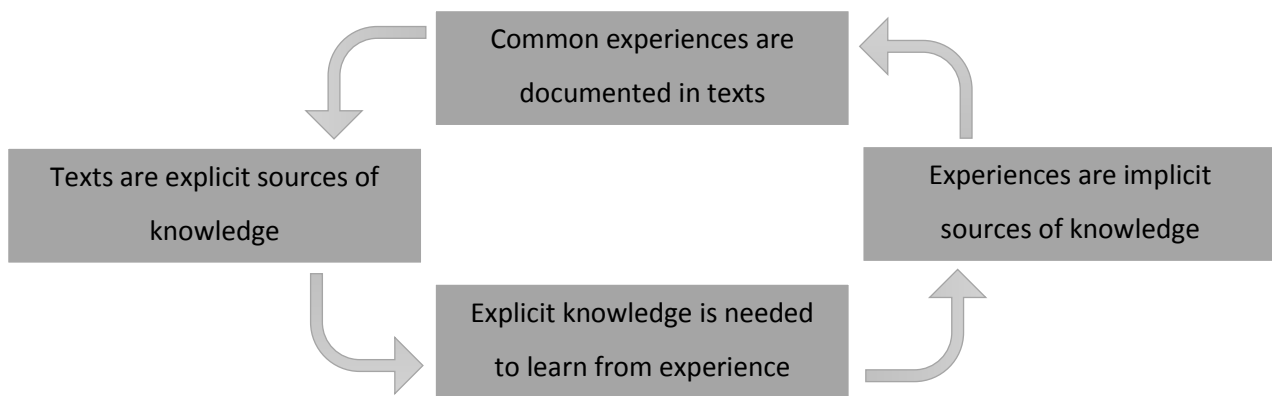


Diagram 9: The cyclical process of knowledge transfer between explicit and implicit spheres in orchestration.

One could argue that because of the cyclical nature of knowledge generation/discovery and preservation in orchestration, there is a sense of situatedness imbued into the skills and knowledge required for and acquired by orchestration; the ways in which skills and knowledge are known in orchestration specifically are different than the ways in which they are known in a general sense because of the ways with they have been perceived, experienced and documented over centuries in the process of orchestrational tradition-formation. This embeddedness in tradition is one of the key components of situated knowledge, according to Haraway (1988)<sup>214</sup>. In the following sections, I have attempted to capture the four-phase cycle shown above in order to describe orchestration knowledge in two main subcategories: explicit knowledge and implicit knowledge. The transitional areas between these two paradigms are difficult to assign to either one of the areas, but at the same time are so intertwined with them that it seems impossible to assign them to separate subheadings or sections. In analysing and coding text fragments, these two main subcategories seemed to emerge naturally from the text fragments so that in Grounded Theory terms they were a good fit to the data.

<sup>214</sup> Situated knowledge is knowledge specific to a particular situation and is grounded in the traditions, language and community in and by which the knowledge is generated. Although Haraway originally created the term to describe the characteristics of her perceptions of scientific knowledge from a feminist perspective, the term is now generally used in knowledge studies.

## 8.2 Explicit knowledge

It is only in post-millennial orchestration books that authors display the tendency to reveal or acknowledge their roles as knowledge preservers and carriers, and attempt to define or situate the position of their writing in the knowledge spheres of orchestration<sup>215</sup>. Orchestration books from earlier tend to describe knowledge in an infallible tone that makes it difficult to distinguish between knowledge that was gained from the author's own experience and that which has been documented enough times over to constitute a kind of situated common knowledge<sup>216</sup>. Orchestration authors do, however, acknowledge the important contribution of knowledge to orchestration: Virgilio Mortari (in Casella & Mortari, 2004: 5) states in his preface to *The Technique of Contemporary Orchestration* that the true art of orchestration can only be gained through diligent work and much knowledge. Kennan & Grantham (2002), Adler (2002) and Sevsay (2013) explicitly state that their books place an emphasis on the practical fundamentals of orchestration, focussing on organology and basic instrumentation techniques; whereas Kennan & Grantham and Sevsay place a stronger emphasis on instrument knowledge, Adler states as his final goal a systematic description of the techniques of orchestration (his textbook is divided into two main sections: instrumentation, then orchestration). Sevsay furthermore delineates his approach to focus on examples of the techniques of Viennese classicism as a model for refined orchestration. In Piston (1961), to show an example of an older generation writer, the purpose of the book is not explained in terms of the author's

---

<sup>215</sup> This role as preserver of knowledge is tied in intimately with the role of preserving tradition, which is described more fully in a preceding chapter of this thesis titled *Perspective six: Inherited practices and orchestration traditions*, p.193.

<sup>216</sup> In epistemological terms, one could here differentiate between *a priori* knowledge, which is justified independent of experience (for instance, that the clarinet never has to play in more than three sharps or flats if the choice is between a B<sup>b</sup> or an A instrument) and *a posteriori* knowledge, which can only be justified through experience (for instance, that it is uncomfortable to play the clarinet in keys with more than three sharps or three flats). Whereas it remains the prerogative of the orchestration author to explicate the differences between these two kinds of knowledge or not, I believe that *a posteriori* knowledge requires greater explanation in order for the reader to understand fully the implications and substance of its truth. To make use of the previous example of the clarinet, the author could explain to the reader what the exact mechanical or sound production reasons are the difficulty of playing in more than three sharps or flats; then the student orchestrator would be better-equipped to write for the clarinet in a difficult key should the necessity arise.

position or outcomes, but as a source of the essential skills and techniques required by every orchestrator. This would be described by Haraway (1988) as a “god trick”: Piston places his knowledge in a position where it can escape representation and be in a sense infallible. Rather than writing, for example, that there are certain basic principles of orchestration that he believes in and will attempt to describe, Piston rather states that it is an essential necessity for the orchestration student to become familiar with the processes of handling large instrumental forces that are described in his book.

Orchestrational knowledge transfer in explicitly documented ways is possible because of what Kennan & Grantham (2002: 2) write: that orchestration is not “nebulous” or purely informed by artistic inspiration, but is mostly a grounded and tangible craft. This statement brings to the foreground a significant dichotomy, namely that orchestration seems largely concerned with the tension between what kinds of knowledge are transferable and what are not; this is largely also reminiscent of the tension between knowledge contained in theory (in general) as opposed to skills acquired by experience in practice. Later on it will be shown how the latter, namely the experience-based and practice-taught aspects of orchestration, becomes the mechanism by which orchestrators appear to elevate their craft to an art. The tension between orchestration as a craft and as an art (if one does not perceive these two views as equal) is therefore directly embodied in the implicit/explicit knowledge dichotomy. From Piston (1961), Jacob (1956), Parrott (1957), Blatter (1997), Kennan & Grantham (2002), Adler (2002) and Sevsay (2013), a considerable list of prerequisite factual knowledge and skills can be constructed. These various kinds of knowledge are, to paraphrase Adler, necessary in order to master the art of orchestration. One can discover a general logical assumption in an analysis of text fragments in this category, that the degree of accuracy to which these forms of knowledge are internalised and expressed in orchestration also determine the level of mastery expressed in an orchestration. There is, therefore, a strong correlation perceived between mastery of orchestration and mastery of knowledge about orchestration. These kinds of knowledge include:

1. A thorough knowledge of instruments and organology<sup>217</sup>, which includes:
  - a. The names of all instruments in various languages like German, Italian and French<sup>218</sup>;
  - b. The technical functioning of each of the instruments and instrument families<sup>219</sup>;
  - c. The full range of each instrument (see Addendum A)<sup>220</sup>;
  - d. The comfortable, safe, or novice range of each instrument<sup>221</sup>;
  - e. The dynamic strength of each instrument at any specific place in its various registers when performing in any style or technique, in comparison to all other instruments being used at the same time (see Addendum C);
  - f. Any and every possible articulation, technique and effect possible on every orchestral instrument, as well as the various mechanical, technical and musical difficulties of each;
  - g. An understanding of each instrument's performance practice, both current and historical<sup>222</sup>;

---

<sup>217</sup> Piston (1961) states that a thorough knowledge of instruments, which leads to good writing for instruments, is indisputably the most important factor in good orchestration. It is part of the technical equipment of both composer and orchestrator to have a deep understanding of individual instruments in terms of their capabilities and characteristics.

<sup>218</sup> It is a standard feature in orchestration textbooks to find lists of instruments in various languages, both for use in scores by orchestrators and as a reference for score study.

<sup>219</sup> In order to understand how to write for brass instruments, for example, it is necessary to know the basic technical sonic principles on which they operate. Understanding how the overtone series and use of valves/pistons impact the technique of brass playing, the orchestrator is able to compose better for any of the brass instruments.

<sup>220</sup> This is closely linked to an understanding of the overtone series and how instruments utilise it. Brass instruments are most often linked to the overtone series because it is expressed most directly through them, but all instruments utilise the overtone series in some manner and its utilisation impacts the possible range of any instrument.

<sup>221</sup> Orchestration textbooks generally differentiate between the maximum range of an instrument and the range that is generally used in orchestral literature; some (like Blatter, 1997) go further to differentiate between ranges appropriate for high school, college, semi-professional and professional orchestras. In some instruments, like the strings, these ranges can differ substantially. See Addendum A.

<sup>222</sup> Textbooks such as Forsyth (1914) and Kennan & Grantham (2002) provide substantial historical overview about the use of instruments such as the French horn, timpani, English horn and harp, in order to get to a deeper understanding of the functioning of the instrument within the orchestra. In this regard, Kennan & Grantham seem to promote a rooted knowledge about instruments (especially those like the French horn and harp that have a complex history and



- h. An awareness of what techniques and musical ideas are idiomatic on an instrument, and by extension which ones are not<sup>223</sup>;
- i. The economic implications of utilising an instrument as part of an orchestration<sup>224</sup>;
- j. The tone colour of each instrument and an awareness of its saliency when combining it with any of the other instruments<sup>225</sup>; and
- k. by extension, an awareness of the overtone composition of an instrument's tone at any given point in its range when performing any possible technique or articulation<sup>226</sup>.

---

are less forgiving of unidiomatic writing) that connects their contemporary use with their historical use in a bid to make idiomatic writing more feasible to student orchestrators.

<sup>223</sup> For example, Kennan & Grantham (2002: 249) state that knowledge about the use of standard rudimentary drum strokes (like the flam, drag, ruff and roll) is a basic requirement of writing well for the drum. Conversely, Jacob (1956) notes that when double bassoon parts fail to speak idiomatically, it is almost always because the orchestrator has neglected to bear in mind that the instrument is incapable of much agility.

<sup>224</sup> This point has been touched on before, especially where percussionists are concerned. Some percussion instruments are very expensive and not generally available, so that it is necessary to rent them for performances at additional cost and potential damage to the instrument.

<sup>225</sup> Some orchestral combinations are very common, while others are very unusual. Kennan & Grantham (2002) describe an inverse correlation between the regularity of instrumental combination and the technical-musical effort required to perform them effectively. The more unusual a doubling is, the more skill is required from the orchestrator (and the performers) in order to use it in a manner that is effective and technically feasible. Inversely, those combinations that have been shown to work easily and work well are found quite often.

<sup>226</sup> Some sources (Parrott, 1957; Blatter, 1997) argue that it is, for example, difficult for the oboe and clarinet to tune in unison because the overtone composition of each differs so strongly from the other. Oboe tone contains much more of the even overtones, while clarinet tone favours uneven overtones. If instrumentalists tune their shared pitches according to coinciding overtones, then it becomes understandable that two instruments with very few coinciding overtones would be difficult to tune. There seems to be little evidence to support such a theory, however. The reader is referred to Matei (2009) on instrumental tuning in orchestral practice, which makes reference to overtone composition of instrumental sound and its effect on tuning. Adler (2002), when making reference to the capacity for instruments to blend, refers to their acoustically sympathetic registers – those are the registers where two instruments are most congruent in overtone construction. Lastly, Jacob (1956) shows examples in which he notes how Schubert instinctively placed the clarinets high above the brass in agreement with their overtones (thus reinforcing them) in order to increase the overall brightness of the brass tone.

2. If an existing work is being transcribed for another combination of instruments, then the points above are applicable both to the instruments used in the original instrumentation and the combination that is being arranged for.
3. A knowledge and understanding is required of harmonic, melodic, rhythmic and structural principles of the entire orchestral canon<sup>227</sup>.
4. An understanding of the principles and characteristics of various schools of orchestration are necessary if one wishes to compose or arrange for the orchestra in a stylistically idiomatic manner.
5. Principles of notation and engraving must be understood<sup>228</sup>, including:
  - a. Score layout for orchestras of various combinations;
  - b. Transpositions of various instruments and how they are presented on the score;
  - c. Grouping of instruments;
  - d. The correct use and placement of expression and technique texts in various languages;
  - e. An understanding of how to combine various articulation symbols, phrasing marks and expression texts to communicate effectively a desired technical execution;

---

<sup>227</sup> Many basic tenets of orchestral writing rely on a well-developed understanding of the principles of theory and harmony of Western art music. In orchestration text books, however, the necessity of these underpinnings are generally neglected. An example that references such an underpinning is found in Jacob (1956), who writes that it should be obvious that a dissonance sounded by one instrument must be resolved by that instrument: in fact, it does not seem obvious, because it would to me depend on the function of the dissonance within the orchestral texture and whether it is a matter of voice leading or of colour. The same can be observed of the doubling of notes in a chord, which calls on a consideration of voice leading, harmonic tension and chord function. In non-tonal or free-tonal music, these considerations become more complex and more important. Orchestration textbooks, however, take for granted a wide and complex knowledge foundation required for orchestration to take place effectively. In Rimsky-Korsakov (1964), Del Mar (1983), Adler (2002) and Sevsay (2013), there is a connection made between the expansion of harmonic and melodic capabilities of western art music and the expansion of the orchestra, so that this is further evidence of the intrinsic link between knowledge about harmony and voice-leading, and knowledge about orchestration.

<sup>228</sup> This was mentioned earlier in the thesis (*Perspective five: Instrumental constraints and orchestration creativity*, p.165) as one of the basic systems of orchestration that is relatively inflexible compared to other systems.

- f. A technical understanding of how a score will be read by a conductor and how a part will be read by an instrumentalist, so that the presentation of both can be streamlined to accommodate the orchestra.
6. An understanding is necessary of the physical interaction between the orchestra, the space it will be performing in, and the listener, in order for the orchestrator to be able to exert more control over how the communication process occurs between orchestrator, orchestra and listener<sup>229</sup>. This translates to an awareness primarily in three areas:
- a. Sound propagation (how sound is created and transmitted)<sup>230</sup>;
  - b. Acoustics (how sound reacts to its physical environment, especially that of an enclosed space like a concert hall);
  - c. Psychoacoustics (how sound is transmitted through the human ear, and how it is processed by the human brain).
7. Transcription for orchestra requires additional considerations in order to take place most effectively (these are found in Rimsky-Korsakov, 1964; Adler, 2002; Kennan & Grantham, 2002; and Blatter, 1997), but because they can readily be applied to orchestrating in general, or composing for orchestra as well, they are listed here:
- a. A knowledge of the structure and formal aspects of the piece that is to be orchestrated;
  - b. An insight into the orchestral style of the composer whose work is going to be orchestrated;

---

<sup>229</sup> Chapters two (*Perspective one: The mystification of orchestration (also an introduction)*, p.23) and five (*Perspective four: An orchestrator's view on hearing and sound perception in orchestration and the orchestra*, p.141) expand on this notion of the relationship between orchestrator, orchestra and listener.

<sup>230</sup> The physical properties of sound and its propagation are described in Casella & Mortari (2004) to some detail before instrumental technique is engaged with. Their discussion of sound in general is made more relevant to the orchestrator by showing how its properties are embodied in string vibration as well as hollow-tube vibration. This provides the orchestrator with valuable insight into the physical production of sound by various instruments (but not by the idiophones or membranophones). It is not usual for orchestration text books to discuss sound propagation in this manner.

- c. Knowledge about the orchestrational practices of the era in which the original piece was composed;
- d. A valid reason to transcribe the work; and/or
- e. A personal attachment to the work that is going to be transcribed.

Hofmeyr (2015, personal correspondence) for instance wrote that for an orchestrator to make informed discoveries and exploration in the field of orchestration, it is important to understand the characteristics, limitations and possibilities of the instruments at their disposal, as well as a thorough knowledge of what has been achieved by other composers in terms of instrumental effects and combinations. It is interesting to note that the prerequisite knowledge described here by orchestration authors basically constitutes the technique of orchestration; texts books on orchestration generally accede this point but remind the reader often that it is only through regular execution of orchestration and careful observation of orchestral performance that these knowledge sets gain an internalised depth of understanding. In other words, everything that can be learnt about orchestration from books is only the first phase of knowledge acquisition about orchestration. Practice, observation and experience provide further development and enrichment to these knowledge and skill sets that are required for excellent orchestration to take place. Kennan & Grantham (2002) propose that the real artistic choices involved in orchestration can only be made once this factual knowledge is acquired<sup>231</sup>. It is also interesting that, although all these points and subpoints are considered vitally important for effective orchestration to take place, the majority of books focus almost exclusively on point 1, with only a lesser focus on points 4 and 5. The other points are mostly referred to by inference or as side notes to the matter of instrumentation and organology. Lastly, these various points constitute to a large degree everything that has been written in the

---

<sup>231</sup> This sentiment is echoed in a way by Sevsay (2013) who writes that the teaching of orchestration can only start after the student has studied organology. In his differentiation between instrumentation (organology) and orchestration, the former deals with technical knowledge and its application while the latter is concerned with aesthetic ideals and choices. Jacob (1956) writes in the same line of thought that the knowledge that is contained in books or that is carried over by teachers can only describe the technique of the subject and not the art.

foregoing seven chapters, so that the central role of knowledge in every facet of orchestration becomes evident.

From Piston (1961) we see that the points described here and the way in which they are taught in orchestration books only constitutes a relatively small portion of the entire subject: he states his intention as only presenting the first stages of study in each chapter with the anticipation that the orchestrator will continue with personal investigation. In practice, this primarily translates to a transition from explicit sources to implicit sources of knowledge (which is discussed in the next section). For instance, an orchestrator can learn much about string technique from textbook study and from study of many examples, but in the end a true knowledge of the technique and all the subtleties that accompany string bowing can only be gained from actually playing the instrument and engaging directly with those techniques that come to it idiomatically (Piston, 1961; Kennan & Grantham, 2002; Casella & Mortari, 2004). Percussion instruments, to name another example, are normally far removed in performance practice from other orchestral instrument families (in the orchestra, instruments from the string, woodwind and brass families have developed in such a way as to carry melody and harmony primarily, whereas percussion has developed primarily as rhythm carriers), so that this group is generally perceived as the most difficult to write for in the orchestra (Carse, 1964; Blatter, 1997; Kennan & Grantham, 2002; Adler, 2002). Much of this perceived shortcoming can be improved upon by critically studying score examples and textbooks for ideas about idiomatic percussion writing, but the subtleties of sounds available from percussion instruments are generally only open to those who have played the instruments themselves or who have observed demonstrations of them first-hand.

To a large extent, the musical score is an extant source of knowledge to those who are well-versed in the language of music notation and performance, and a number of previous chapters of this thesis have made reference to the importance of score study in orchestration. The score is also the most tangible link between explicit and implicit knowledge spheres in orchestration, because it represents at once a detailed account of an orchestrator's knowledge about orchestration, as well as experience of and personal taste about the subject within the context of a specific musical work. Through score study, development of style

and practice can be traced over many years, allowing the student to see how the same techniques and procedures are applied in different styles and genres. Score analysis can take different forms, but essentially the orchestrator is examining music in relation to the complex machine that is the orchestra in order to learn how the latter can be used to create the former (Parrott, 1957). Studying orchestral literature provides the student with various useful types of data such as knowledge about how it was used to present musical thought (Piston, 1961). Studying orchestral literature from a specific viewpoint can provide more useful and specific guidelines about certain procedures than a textbook can achieve: studying concerto literature, for example, can provide better guidelines about the use of the orchestra as accompaniment (Adler, 2002)<sup>232</sup>. Piston warns the student, however, that a pedantic approach to score study and analysis could be unproductive, because whereas many procedures can be studied in their application by master orchestrators in a score, the reasons for them doing so in a specific way will seldom be discovered<sup>233</sup>. Kennan & Grantham (2002) also warn the student against mimicking anything that is found in a score, because scores can carry ineffective practices: some techniques, like using soft mallets on the timpani, are described as generally ineffective by Kennan & Grantham (*ibid.*), although they are transmitted from score to score via study and incorrect understanding of the effect over many years.

---

<sup>232</sup> Piston (1961), contradicts this statement by advocating the idea that accompaniment is a matter of composition and not of orchestration. Orchestration procedures cannot remedy a defectively composed accompaniment, for example, and the relative weight of the accompaniment compared to the melody is firstly a musical choice before it is an instrumentational choice.

<sup>233</sup> Here, Piston (1961) makes reference to the dichotomy of orchestration as an art and a science: because orchestration is a science (or perhaps more accurately, a technique or craft), the techniques and methods out of which it consists can be discovered and documented, but because it is also an art, the reasons behind those decisions cannot necessarily be traced forensically. Casella & Mortari (2004) echo this sentiment by stating that the presence of an expert teacher is a prerequisite for learning the art of orchestration, because scores can by themselves not reveal that information to the student. The authors leave one with the impression that knowledge about the artistic side of orchestration is somewhat closed off from the reader. These points are explained in more detail in three foregoing chapters: *Perspective one: The mystification of orchestration (also an introduction)*, p.54; *Perspective five: Instrumental constraints and orchestration creativity*, p.165; *Perspective six: Inherited practices and orchestration traditions*, p.193.

With the eventual goal of transcribing an existing work for orchestra, it can be useful to analyse both the score of the work being transcribed and a few representative examples of orchestral works by the same composer. In this way one can gain information in three main areas: firstly, knowledge can be gained about the structure, character and musical qualities of the work to be transcribed; secondly, insight can be developed about the orchestrational style of the composer in question; lastly, one can develop ideas about how to deal with certain style-specific elements of the composer's music within an orchestrational context<sup>234</sup>. In the end, as Piston (1961), Kennan & Grantham (2002) and Adler (2002) state, the goal is only to discover ideas and possibilities and not definitive answers, because the entire process of orchestration is highly subject to external and uncontrollable influences<sup>235</sup>.

### 8.3 Implicit knowledge

It was inferred in the previous section that explicit knowledge is seen by orchestrators as a tool with which better to gain implicit knowledge about orchestration; conversely, implicit knowledge appears to be perceived by orchestrators as the primary contributor to the quality of an orchestration. Implicit knowledge here refers to concepts like experience, aural imagination, understanding, wisdom, instinct and sense – in other words it refers to abstract kinds of knowledge that cannot readily be documented and therefore transferred explicitly. As Hofmeyr (2015, personal correspondence) wrote, textbooks on their own are never sufficient to learn all of orchestration, and most of the knowledge gained about orchestration happens via score study, listening to music and attending rehearsals. There is evidence in every textbook to show that orchestrators perceive a divide between explicit and implicit knowledge, and that implicit knowledge is highly favoured in orchestration. Piston (1961) for instance writes that his textbook can only achieve a rudimentary description of orchestration, and that further study of scores and orchestral performance will in the end be the best method of learning about the complex instrument. Jacob (1956)

---

<sup>234</sup> Orchestral transcription, which is the focus here, is discussed in the foregoing chapter titled *Perspective three: Changing and interchanging of material in orchestration*, p.122.

<sup>235</sup> See the chapter titled *Perspective one: The mystification of orchestration (also an introduction)* (p.23) for more about this.

writes that whereas textbooks can provide a certain amount of factual knowledge, the true application of the technique will depend almost entirely on the musicianship, inventiveness, experience and general good taste of the orchestrator; the whole technique of orchestration can never be learnt from books alone. Rimsky-Korsakov (1964), Del Mar (1983) and Carse (1964) corroborate these ideas. In the most recent textbook source about orchestration, Sevsay (2013) points out that a score can show good instrumentation, but be poorly orchestrated<sup>236</sup>. What Sevsay explains is that a proper textbook knowledge of instrumentation can mean that there are no technical problems present in the score: the instruments are balanced and musical textures are clear and distinguishable. However, if the form and musical design of the piece are forgotten and the instrumentation does not serve to communicate the myriad underlying elements of the musical structure, then it is badly orchestrated<sup>237</sup>. Whereas good orchestration can only occur if good instrumentation has been employed, it cannot be certain that good instrumentation will translate into good orchestration. It seems that orchestrators are articulating a dual sense of knowledge about orchestration in that apart from the generalizable truths of the subject, the orchestrator also needs to bring knowledge about the work into engagement with a knowledge of general principles of orchestral music; only then can instrumentation effectively become orchestration.

Rimsky-Korsakov (1964), Kennan & Grantham (2002) and Adler (2002) start the orchestration process with a formal and harmonic analysis of the work, which they state will lead to intelligent scoring. It is also posited as a constraint of orchestration, that it cannot take place without first understanding a composition's structure both formal and harmonic<sup>238</sup>. This kind of analysis enables the orchestrator to access fields of knowledge that cannot be accessed via textbooks or instruction. Jacob (1956) and Rimsky-

---

<sup>236</sup> Sevsay (2013) distinguishes between organology, instrumentation and orchestration: organology is the study of instruments in terms of their design, history, technique and sound; instrumentation is the study of how instruments are combined in a musical composition; orchestration studies the aesthetic choices and design mechanisms by which instrumentation and organology are brought together in score to produce style and to communicate musical outcomes.

<sup>237</sup> This idea ties in closely with that of clarity and effective orchestration, which was discussed at length in the previous chapter of this thesis.

<sup>238</sup> See *Perspective five: Instrumental constraints and orchestrational creativity*, p.165.



Korsakov (1964) promote the teaching of orchestration via regular orchestral transcription, so that the student may develop not only the principles of balance, contrast and colour that is taught in a classroom environment, but also gain truer insight into the underlying structure of the music and how orchestration serves to enhance these features. Jacob seems to perceive the instrumentation of a work as a surface quality of the music, which when changed from one medium to another like the piano to the orchestra, forces the student to engage with the underlying mechanisms that make music and orchestration effective. If the aim of orchestral transcription as an educational tool is to look at the deeper processes of the music, then Piston's remark (1961) that orchestration as an art is inseparable from composition becomes more meaningful: orchestration is meant to engage on a deep level with the abstract musical ideas and mechanisms that define a composition. When an orchestrator has transcribed enough orchestral music and the processes of instrumentation have been performed many times over, those processes develop into instinct, intuition, common sense or wisdom, so that the orchestrator can make the best choice from a number of options that increase in complexity, originality and subtlety as the orchestrator gains more experience (Jacob, 1956; Parrott, 1957; Blatter, 1997; Adler, 2002). Then many different possibilities for the same passage will open themselves to the orchestrator, who will be in a position to choose the option that is personally most appropriate in a given context.

It is interesting to note that textbooks generally do not state the performance of orchestration as a requirement for gaining knowledge about it – in matter of fact a number of textbooks acquiesce to the rarity of orchestral performance and in its stead promote the evaluation of an orchestration by a more experienced orchestrator. It becomes logically plausible to deduce that enough experience in orchestration, even without performance, enables the orchestrator to predict with increased accuracy what the outcomes of an orchestral performance might be, but also that orchestration can become a kind of logic game that has no practical physical expression. There are many examples of works (a few are listed elsewhere in the thesis) which were originally composed for one instrument or collection of instruments and then transcribed for the orchestra (sometimes by the same composer). In studying these works, the processes that govern orchestral transcription can be learnt by way of example. Some works like J.S. Bach's *Kunst der*

*Fuge* or Modest Mussorgsky's *Pictures at an Exhibition* have been orchestrated many times over by composers of different nationalities and style periods and afford the student orchestrator the opportunity to learn from more experienced orchestrators<sup>239</sup>. Adler (2002) refers to the Brahms Quartet and Schoenberg's orchestration of it as an excellent example of such a collaboration that spans across multiple style periods; here the student orchestrator can learn about good taste and judgement, which are two qualities central to producing effective orchestration<sup>240</sup>. Score analysis in one form or another is described by Sevsay (2013) as a matter of importance; careful and conscientious score study and analysis is crucial to developing a deeper understanding of orchestration.

Another method of learning about orchestration that is propagated by textbooks is that of critical aural study of orchestral performances of other scores, especially if the manuscript is available for reference (in other words, as a kind of aural expansion of score study). This kind of study helps to show how the symbols and patterns are translated from their written form on the score to a real sound product in the auditorium. Through this kind of study, the orchestrator can learn about the characteristic sound quality of each instrument alone and in combination with other instruments in a more tangible way than can be described in textbooks (Kennan & Grantham, 2002; Adler, 2002). The latter, namely the characteristic qualities of different instruments alone or in combination, is promoted by Piston (1961) as the most important reason to study orchestral performances with a score at hand. Sevsay (2013) takes this approach to orchestration study even further with his suggestion that orchestrators can learn the most about orchestral practice and tradition by attending orchestral rehearsals, and sitting next to orchestral musicians in order to observe and experience the process from within the orchestra. Comparing the score of a work within its performance can give the orchestrator an idea of the how music was translated from text to sound; the processes and changes that occur in the translation (and the mistranslation) can be

---

<sup>239</sup> Studying orchestral transcriptions as a source of knowledge about orchestration was mentioned in two earlier chapters of this thesis titled *Perspective three: Changing and interchanging of material in orchestration*, p.122 and *Perspective six: Inherited practices and orchestrational traditions*, p.193.

<sup>240</sup> Good taste is discussed in three other chapters of the thesis: *Perspective three: Changing and interchanging of material in orchestration*, p.122; *Perspective five: Instrumental constraints and orchestrational creativity*, p.165; and *Perspective seven: The meaning of effective orchestration*, p.226.

studied in this way. Textbooks can only document the most common of these occurrences and can only do so in simplified terms, while each performance can provide unique insights into the process<sup>241</sup>.

With enough experience and careful listening, an orchestrator can develop an aural memory sufficiently capable of recalling instruments alone and in combination with great nuance (Adler, 2002). Special effects, which are prevalent in contemporary scores, are more easily absorbed through frequent aural contact than through textbook study. When a sufficient amount of such listening and critical aural study has been undertaken, then the timbre, strength and texture of every segment of an instrument's range becomes more easy to recall and to use effectively in orchestration (Kennan & Grantham, 2002; Adler, 2002). It also becomes more possible for the orchestrator to realise the dynamics, implied colours and emotional feel of the music that is being orchestrated when the reaction of the orchestrator to the score is understood with greater experience and internalised awareness (Adler, 2002). Sevsay (2013) promotes a large portion of his textbook to this kind of transcription practice, which he propagates as one of the most effective methods of learning to orchestrate. His scoring and rescoring practice focusses on three different approaches: the first is to score for orchestra a number of piano works of different lengths (he cites Ravel as an example of a composer who often orchestrated his piano works) in order to learn to think for orchestra; the second is to reorchestrate condensed scores or *particelli* in order to gain a greater understanding of the orchestral language; and the third is to reduce orchestral works for piano or two pianos, from which the student can gain insight into the abstract musical mechanics that function within an orchestral work by stripping away the various layers of instrumental layering. These are methods that are all described to some extent in other orchestration textbooks of the twentieth and twenty-first century as central components of learning orchestration.

There appears to be a mechanism or a transitional moment in orchestration whereby observation or experience, clearly understood over many occurrences, can be documented as a form of explicit knowledge. In orchestration textbooks, this mechanism is captured in the form of advice-giving and

---

<sup>241</sup> This is once more reminiscent of the first and fourth Perspectives discussed in this thesis, where the written orchestration was placed in opposition to or in tension with the eventual performance thereof.

personal observations by the authors, or remarks about a composer's music or a general music example, which are generally based on many years of personal experience and teachings gained from previous masters. Meyer's (2012) discussion of rules-of-thumb corroborates this idea. In Kennan & Grantham (2002), for example, a statement such as that the harp is more a harmonic than a melodic instrument in feeling captures a long period of observation and experience by the author about the practices of harp performance and presents it to the reader as a fact to absorb and remember. Another such a statement from the same textbook would be that the role of the contrabassoon at the bottom of a chord must be obvious – it is possible that such an unspoken rule might not be obvious to the student orchestrator, who would only understand such a principle after an extended period of observation and experience in orchestration<sup>242</sup>. In textbooks, this mechanism often takes on prosopopoeic qualities (giving the object of discussion the qualities of human speech and thinking) as a way possibly to emphasise the implicit origin of the knowledge and to imbue it with a sense of mysticism. In Jacob (1956) the celesta itself suggests to the orchestrator how it should be used, or in Parrott (1957) a stroke on the triangle at one point in the music implores of the orchestrator to use it again further on in the music to balance the structure. In Kennan & Grantham (2002) the second occurrence of an eight-bar theme seems to demand a fresh application of colour and more weight in its orchestration, while in Adler (2002) the music to be scored seems to suggest a specific combination of instruments. Through these kinds of description, orchestration authors appear to struggle with articulating the exact qualities of the ideas which they are attempting to document, and it is likely that a general and reliable description of the concepts is only attainable after numerous idiosyncratic descriptions by a number of authors. In a certain sense, the outlook and approach of this study, which draws on the myriad individual descriptions of many authors to arrive at a general truth, is captured by this

---

<sup>242</sup> Such a statement is interesting for another reason. If it is obvious that the contrabassoon must be placed at the bottom of the chord, one could question why it is not penned down as a rule to be abided. Two opposing forces seem to be working against each other here: on the one side is a tendency to systematise orchestration and provide consistent mechanisms by which orchestrators can write with surety, but on the other side there is the tendency to mystify orchestration and make of it a relativised subject in which anything is possible if done correctly. It appears to reinforce Piston (1961) and others' views of orchestration as both an art and a science that exists in a state of tension between the two seemingly opposing paradigms. This is described at greater length in the first Perspective of this thesis, p.23.

process. As Meyer (2012) writes, the development of a set of principles of orchestration could enable a composer to make decisions about different musical elements with systematic consideration.

## 8.4 Concluding remarks

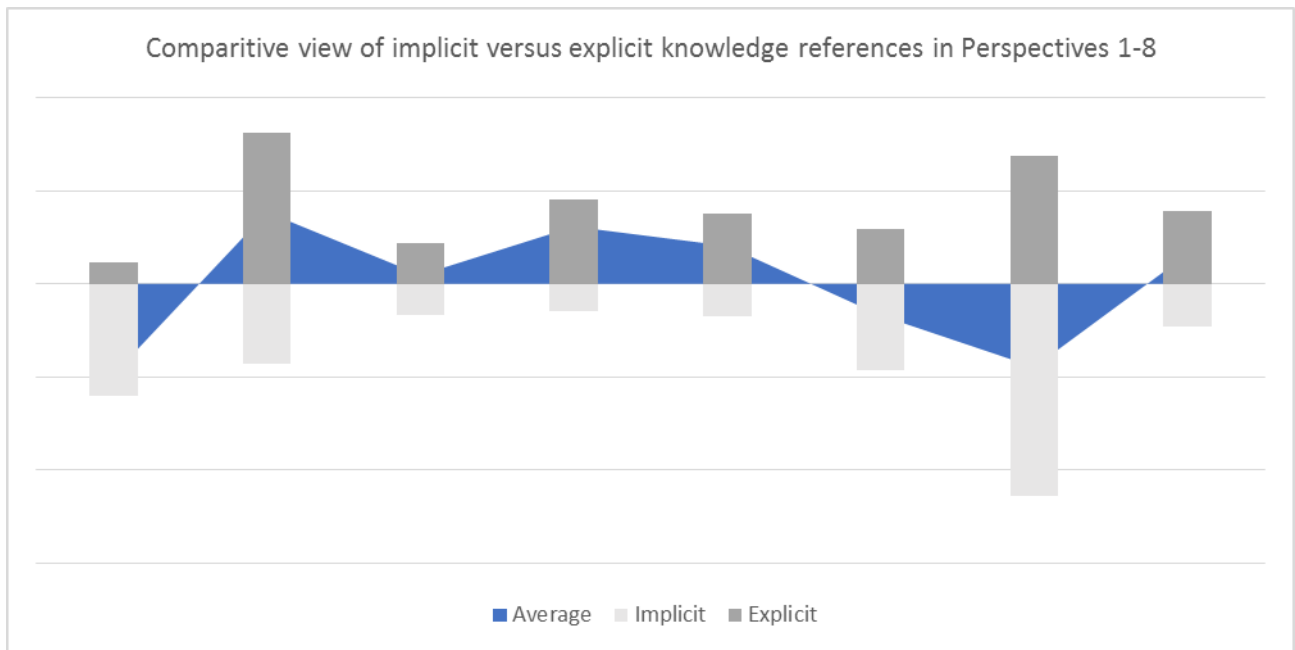
Taking into account what is shown in this chapter as well as in other sections of the thesis, and looking further at Jacob (1956), Parrott (1957), Kechley (1959), Piston (1961), Rauscher (1963), Rimsky-Korsakov (1964), McKay (1969), Berlioz & Strauss (1991), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004), Read (1979; 2004), Belkin (2008), Meyer (2012), and Sevsay (2013), a number of methods by which knowledge transfer takes place in orchestration can be shown:

1. Orchestrating music originally composed for a medium other than the orchestra;
2. Reorchestrating piano transcriptions of existing orchestral works, in order to compare different versions;
3. Transcribing orchestral music for other instruments, such as the piano;
4. Orchestrating works that have already been orchestrated by other composers, in order to compare different versions;
5. Extensive score study, with and without recordings or live performances;
6. Studying recordings and live performances without scores;
7. Studying orchestration resources such as text books and theses;
8. Working with an actual orchestra in preparation of a performance;
9. Working with an experienced orchestrator as a teacher; and
10. Regularly attending orchestral rehearsals;

Knowledge, it has been shown, is the central binding force of orchestration between all the various Perspectives that were discovered and described in this thesis. Each Perspective was described in relation to both the technical and the musical aspects of orchestration, and some authors were shown to refer to orchestration in this regard as existing in a state of tension between these seemingly contrasting aspects. In

this regard, explicit knowledge becomes the area in which the technical mechanics of orchestration are situated, whereas implicit knowledge becomes the area in which artistic or aesthetic aspects of orchestration are situated. Each chapter of the thesis can be studied from the Perspective of knowledge to see that, in the end, every aspect of orchestration is saturated by a preoccupation with knowing. This is likely both the strong point and the weak point of a grounded approach to studying orchestration textbooks, in that it becomes very obvious that knowledge is the central focus of textbooks (which is to be expected). What a Grounded Theory methodology aided in during this study was to bring into the focus the underlying concerns of orchestration authors, which has also provided through numerous score examples a number of new ways to study orchestral literature. This chapter does, however, not aim to draw all the various ideas together in a traditionally formulated conclusion, but through the Perspective of knowledge show that it can be seen as a binding force between all the other categories (to apply traditional Grounded Theory terminology), and therefore that a grounded approach has been successful in describing the practice of orchestration in a coherent manner. The relative position of each category as situated in either explicit or in implicit knowledge paradigms can be indicated visually by examining the number of codes that were allocated to each category that refer either directly or indirectly to implicit or explicit forms of knowledge. The graph only provides an approximate visual reference in order to show that, generally, explicit forms of knowledge are favoured in textbooks.

Graph 6 -- An approximation of the number of codes per category that refer either directly or by implication to implicit or explicit types of knowledge:



Lastly and as a final visual aid, a concept map that combines the previous seven helps to provide a more detailed representation of conceptual links throughout this grounded theory of orchestration:

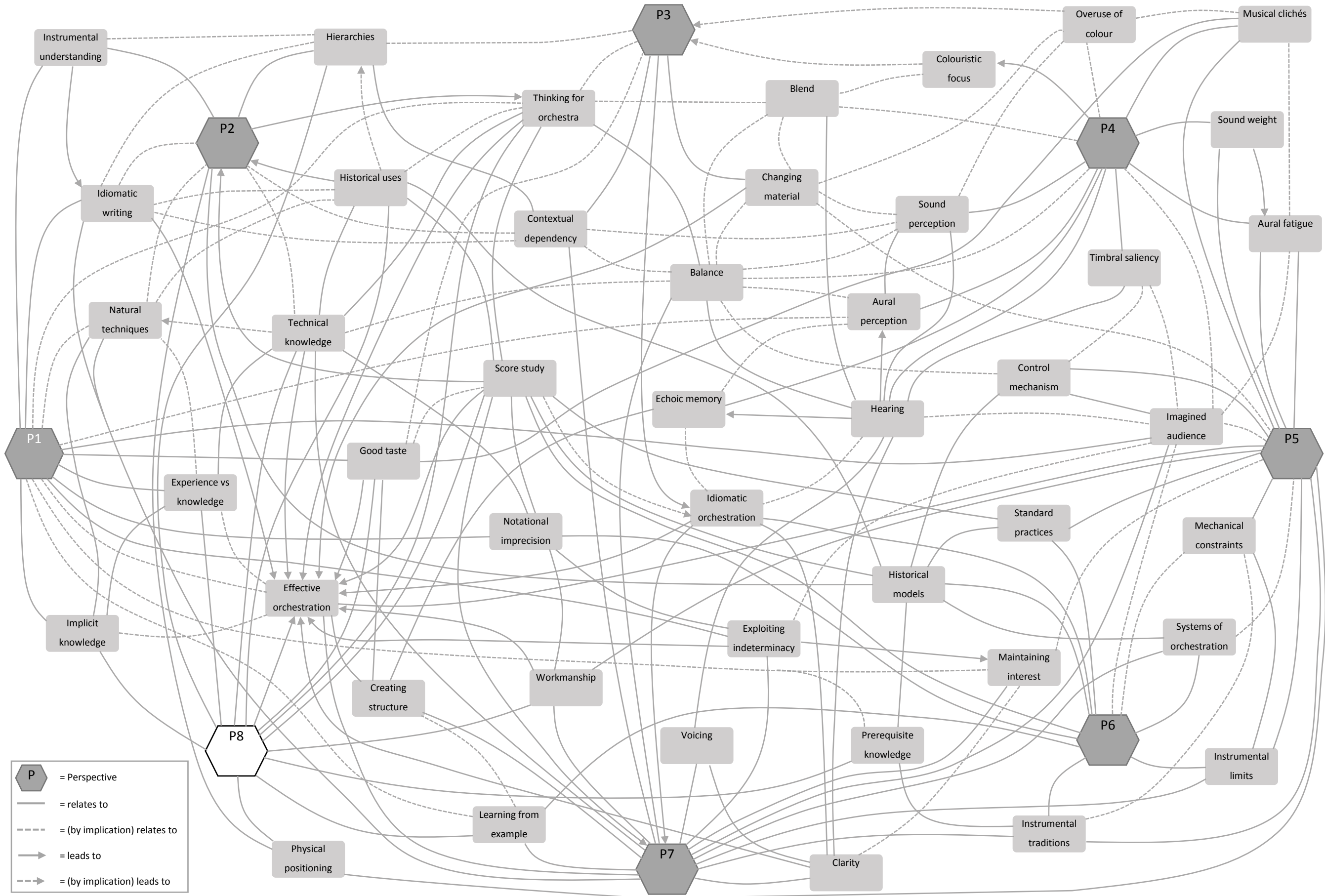


Diagram 10: Concept web showing interrelatedness of concepts in Perspective 8 with other Perspectives.



## Reference list and bibliography

(Referenced sources shown in **bold**)

**Adler, S. (2002). *The study of orchestration* (3rd ed.). New York: W.W. Norton & Company, Inc.**

**Åge, L. (2011). Grounded Theory methodology: Positivism, hermeneutics and pragmatism. *The Qualitative Report*, 16(6), 1599-1615.**

**Akira, I., Tanaka, M., Iwamae, M., Kim, C., Yamano, E., & Watanabe, Y. (2013). Fatigue sensation induced by the sounds associated with mental fatigue and its related neural activities: revealed by magnetoencephalography. *Behavioral and brain functions*, 9(24).**

Anderson, A. (1924). *Practical orchestration*. Boston: C.C. Birchard.

**Babbie, E. (2001). *The practice of social research* (9th ed.). Belmont, CA: Wadsworth Thomson.**

Baines, A. (1961). *Musical instruments through the ages*. Baltimore: Penguin books.

**Baines, A. (1991). *Woodwind instruments and their history* (3rd ed.). New York: Dover.**

Baker, M. (1970). *Complete handbook for the music arranger*. New York: AMSCO press.

**Bartolozzi, B. (1967). *New sounds for woodwind*. London: Oxford University Press.**

Becker, H. (1964). *History of instrumentation*. (R. Kolben, Trans.) Cologne: Arno Volk verlag.

**Becker, P. H. (1993). Common pitfalls in published grounded theory research. *Qualitative Health Research*, Vol. 3, pp.254-260.**

Bekker, P. (1963). *The orchestra*. New York: W.W. Norton.

**Belkin, A. (2008). *Artistic Orchestration*. Retrieved September 11, 2013, from <http://www.webdepot.umontreal.co/Usagers/belkina/MonDepotPublic/bk.O/O.pdf>**

**Berlioz, H. (1844). *Grande traité d'instrumentation et d'orchestration modernes*. Paris: Schonenberger.**

**Berlioz, H., & Strauss, R. (1991). *The treatise on instrumentation and orchestration* (Dover ed.). (T. Front, Trans.) New York: Courier Corporation.**

**Bishop, D., Karageorghis, C., & Loizou, G. (2007). A grounded theory of young tennis players' use of music to manipulate emotional state. *Journal of sport & exercise psychology*, 29, 584-607.**

**Blatter, A. (1997). *Instrumentation and orchestration* (2nd ed.). New York: Schirmer Books.**

Borch, G. (1918). *Practical manual of instrumentation, with numerous musical illustrations, and particular reference to the reduction of large scores for smaller orchestra*. New York: G. Schirmer.

- Borgatti, S. (1996). *Introduction to grounded theory*. Retrieved September 26, 2014, from [http://trp.jlu.edu.cn:8000/yuhongyan\\_jpk/uploadfile/200612/20061201165241756.doc](http://trp.jlu.edu.cn:8000/yuhongyan_jpk/uploadfile/200612/20061201165241756.doc)
- Bowles, E. A. (2002). *The Timpani: A history in pictures and documents*. Hillsdale: Pendragon Press.
- Bregman, A. (1990). *Auditory scene analysis*. Cambridge, MA: MIT Press.
- Brinkman, D. (2009). *How to orchestrate and arrange music*. Lecture Notes.
- Brunelli, S. (1992). *The use of the piano in the twentieth century orchestra: a study of pulitzer prize compositions by Copland, Basset, and Druckman*. University of Northern Colorado: (Unpublished doctoral dissertation).
- Bryant, A. (2002). Re-grounding grounded theory. *Journal of Information Technology Theory and Application*, 4(1), 25-42.
- Bryant, A. (2003). A constructive/ist response to Glaser. *FQS*. Retrieved October 03, 2014, from <http://www.qualitative-research.net/index.php/fqs/article/view/757>
- Burton, S. (1982). *Orchestration*. Englewood Cliffs: Prentice Hall.
- Cacavas, J. (1975). *Music arranging and orchestration*. Melville: Belwin Mills Publishing Co.
- Carlson, N. (2010). *Psychology and the science of behaviour*. Ontario: Pearson Canada Inc.
- Carse, A. (1964). *The history of orchestration*. New York: Dover Publications Inc.
- Casella, A., & Mortari, V. (2004). *The technique of contemporary orchestration* (2nd ed.). (T. Fraschillo, Trans.) Milan: Ricordi Publishers.
- Charmaz, K. (2000). Constructivist and objectivist grounded theory. In N. Denzin, & Y. Lincoln (Ed.), *Handbook of qualitative research* (2nd ed., pp. 509-535). Thousand Oaks, CA: Sage.
- Charmaz, K. (2005). Grounded theory in the 21st century: A qualitative method for advancing social justice research. In N. Denzin, & Y. Lincoln (Ed.), *The SAGE handbook of qualitative research* (3rd ed., pp. 507-535). Thousand Oaks, CA: Sage.
- Charmaz, K. (2006). *Constructing grounded theory*. Thousand Oaks, CA: Sage.
- Charmaz, K., & Bryant, A. (2008). Grounded Theory. In L. Given (Ed.), *The SAGE encyclopedia of qualitative research methods* (pp. 375-378). Thousand Oaks, CA: SAGE Publications, Inc.
- Chen, J.-M., Smith, J., & Wolfe, J. (2009). Pitch bending and glissandi on the clarinet: roles of the vocal tract and partial tone hole closure. *Acoustical Society of America*, 1511-1520.

- Chon, S., & McAdams, S. (2012). Exploring instrument blending as a function of timbre saliency. *Proceedings of the 12th international conference on music perception and cognition and the 8th triennial conference of the European Society for the Cognitive Sciences of Music*. Thessaloniki, Greece.
- Chon, S., & McAdams, S. (2012). Investigation of timbre saliency, the attention-capturing quality of timbre. *Proceedings of the Acoustics 2012 Hong Kong*. Hong Kong.
- Clark, T. (1987). Echoic memory explored and applied. *Journal of consumer marketing*, 4(1).
- Coerne, L. (1908). *The evolution of the modern orchestra*. New York: Macmillan.
- Cook, N. (1994). *A guide to musical analysis*. Oxford: Oxford University Press.
- Cook, N. (2015, 01 16). *Beyond the score: music as performance*. Retrieved from Oxford Scholarship: <http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780199357406.001.0001/acprof-9780199357406>.
- Cope, D. (1982). *New Directions in Music*. Dubuque: Wm. C. Brown Company.
- Corbin, J., & Strauss, A. (2008). *Basics of qualitative research*. Thousand Oaks, CA: Sage Publications.
- Corder, F. (1923). *The orchestra and how to write for it: a practical guide* (6th ed.). London: R.Cocks.
- Creswell, J. (2009). *Research design: Qualitative, quantitative and mixed approaches*. Thousand Oaks, CA: Sage.
- Cronbach, L. J. (1975). Beyond the two disciplines of scientific psychology. *American Psychologist*, Vol. 30, pp.116-127.
- Daveson, B., O'Callaghan, C., & Grocke, D. (2008). Indigenous music therapy theory building through grounded theory research: the developing indigenous theory framework. *The arts in psychotherapy*, 35(4), 280-286.
- DeFord, R. (1995). Tempo relationships between duple and triple time in the sixteenth century. *Early Music History* (14), 1-51.
- Del Mar, N. (1983). *Anatomy of the Orchestra*. London: Faber & Faber.
- Dick, B. (2014, 05 28). *Grounded Theory: a thumbnail sketch*. Retrieved from Resource Papers in Action Research: <http://www.aral.com.au/resources/grounded.html>
- Downes, E. (1963). Academic Festival Overture. *New York Philharmonic*. New York: [programme note].

- Downey, L., & Johnson, H. (1953). *Basic orchestration manual and workbook*. Dubuque: William C. Brown.
- Dunn, J. (1928). *A student's guide to orchestration*. London: Novello.
- Economics and Orchestras. (1953, April). *The Musical Times*, 94(1322), 159-160.
- Erpf, H. (1959). *Lehrbuch der Instrumentation*. Mainz: Schott.
- Evans, E. (1926). *Method of Instrumentation; how to write for the orchestra and arrange orchestral score or band score*. London: W. Reeves.
- Fagan, G. (1976). *Karoosimfonie*. Unpublished original score.
- Feder, A. (2015). *An orchestration for wind band of Peter Klatzow's From the Poets: exploring a systematic approach to orchestration*. Stellenbosch University: SUNScholar [available online: <http://hdl.handle.net/10019.1/96999>].
- Fidler, F. (1921). *A handbook of orchestration*. London: K. Paul, Trench, Trubner.
- Forsyth, C. (1914). *Orchestration*. London: Macmillan and co. limited.
- Foss, S. K., & Waters, W. (2007). *Destination Dissertation*. Lanham: Roman & Littlefield Publishers, Inc.
- Franke, V. (2014, November 22). *Composer Peter Klatzow chosen for 2015 JIMF*. Retrieved March 13, 2015, from Artslink: [http://www.artlink.co.za/news\\_article.htm?contentID=36960](http://www.artlink.co.za/news_article.htm?contentID=36960)
- Gelfand, S. (2004). *Hearing-- an introduction to psychological and physiological acoustics* (4th ed.). New York: Marcel Dekker.
- Glaser, B. (1978). *Theoretical sensitivity*. Mill Valley, CA: Sociology Press.
- Glaser, B. (1992). *Basics of grounded theory analysis*. Mill Valley, CA: Sociology Press.
- Glaser, B. G., & Strauss, A. (1965). *Awareness of dying*. Chicago: Aldine.
- Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: strategies for qualitative research*. Chicago: Aldine Publishing Inc.
- Gronow, J. (1997). *The Sociology of Taste*. London: Routledge.
- Grové, S. (1996). *Raka: a symphonic poem in the form of a concerto for piano and orchestra*. Unpublished original score.
- Haraway, D. (1988). Situated knowledges: the science question in feminism and the privilege of partial perspective. *Feminist Studies*, 14(3), 575-599.

- Henley, J. (2001, April 25). *Poor Ravel*. Retrieved from The Guardian:  
<http://www.theguardian.com/education/2001/apr/25/arts.highereducation>
- Herbert, T. (1997). *The Cambridge companion to brass instruments*. (J. Wallace, Ed.) Cambridge: Cambridge University Press.
- Hofmeyr, H. (2003). *Sinfonia Africana per soprano, coro e orchestra*. Darling: Hendrik Hofmeyr Edition.
- Holton, J. (2009). Qualitative Tussles in Undertaking a Grounded Theory Study. *The Grounded Theory Review*, 8(3), 37-49.
- Hsiung, P. C. (2010). *Lives and Legacies: A guide to qualitative interviewing*. Creative Commons.
- Jacob, G. (1956). *Orchestral technique: A manual for students* (2nd ed.). London: Oxford University Press.
- Jacob, G. (1962). *The elements of orchestration*. London: Herbert Jenkins.
- Jesteadt, W., Wier, C., & Green, D. (1977). Intensity discrimination as a function of frequency and sensation level. *The journal of the acoustical society of America* 61, 169.
- Ke, J., & Wenglesky, S. (2014, February 23). *Grounded Theory*. Retrieved from Research Methods:  
<http://avantgarde-jing.blogspot.com/2010/03/grounded-theory.html>
- Kechley, G. (1959). Orchestration: a practical handbook (Review). *Journal of Research in Music Education*, 7(2), 233-234.
- Kennan, K., & Grantham, D. (2002). *The technique of orchestration* (6th ed.). Upper Saddle River, New Jersey: Prentice Hall.
- Klatzow, P. (1984). *Incantations for orchestra*. Cape Town: Musications.
- Kling, H. (1905). *The art of instrumentation*. New York: Carl Fischer.
- Kreitner, K., Térey-Smith, M., Westrup, J., Holoman, K., Hopkins, G. W., Griffiths, P., & Conrad, J. A. (n.d.). *Instrumentation and orchestration*. Retrieved February 18, 2013, from Grove Music Online. Oxford Music Online.:  
<http://www.oxfordmusiconline.com/subscriber/article/grove/music/20404>.
- Kruckenbergh, S. (1997). *The symphony orchestra and its instruments*. Twickenham: Tiger books international.
- Laws, K., & McLeod, R. (2008). *Case Study and Grounded Theory: sharing some alternative qualitative research methodologies with systems professionals*. University of Sydney.
- Leibowitz, R., & Maguire, J. (1960). *Thinking for Orchestra*. New York: Eschig.

- Lesch, F. (2010). *The certificate programme in music: a means of broadening access to higher music education studies at the University of Stellenbosch*. Stellenbosch: SUNScholar [available online: <http://hdl.handle.net/10019.1/4104>].
- Lingard, L. (2008). Grounded theory, mixed methods, and action research. *British Medical Journal*, 337:a567.
- Lovelock, W. (1968). *The elements of orchestral arrangement*. London: Bell.
- Martin, P., & Turner, B. (1986, April). Grounded Theory and Organizational Research. *The Journal of Applied Behavioral Science*, 22(2), 141-157.
- Matei, C. (2009). *Intonation of woodwind instruments: the history of woodwinds and practical methods to improve the intonation in ensemble playing*. Saarbrücken: VDM verlag Dr. Müller Aktiengesellschaft & Co. KG and licensors.
- McKay, G. (1969). *Creative orchestration: a project method for classes in orchestration and instrumentation* (2nd ed.). Boston: Allyn and Bacon.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass Publishers.
- Merton, R. (1968). *Social Theory and Social Structure*. New York, NY: Free Press.
- Meyer, R. (2012). *Principles of Orchestration and the Analysis of Musical Gestures*. North-West University Potchefstroom: (Unpublished master's thesis).
- Miller, J., Ren, T.-Y., Dengerink, H., & Nuttal, A. (1996). Cochlear blood flow changes with short sound stimulation. In A. Axelsson, *Scientific basis of noise-induced hearing loss* (pp. 95-109). New York: Thieme Medical Publishers.
- Mills, C. (1959). *The sociological imagination*. Oxford: Oxford University Press.
- Mornhinweg, G. (1992). Effects of music preference and selection of stress reduction. *Journal of holistic nursing*, 10, 101-109.
- Morse, J., & Richards, L. (2002). *Read me first for a user's guide to qualitative methods*. London: Sage Publications.
- Mouton, J. (2012). *How to succeed in your master's and doctoral studies*. Pretoria: Van Schaik Publishers.
- Mozart, W. (1984/1985). Mozart Symphonien nos. 40 & 41 "Jupiter" (live recordings) [Recorded by L. Bernstein & Wiener Philharmoniker]. Deutsche Grammophon, Germany.
- Mussorgsky, M. (1918). *Tableaux d'une exposition* (1st reprint ed.). Leipzig: Breitkopf & Härtel.

- Mussorgsky, M. (2002). *Modest Mussorgsky: Bilder einer Ausstellung* [Recorded by E. Kissin]. RCA Victor, Freiburg.
- Mussorgsky, M. (2006). *Pictures at an exhibition* [Recorded by V. Ashkenazy]. London.
- O'Callaghan, C. (2001). Bringing music to life: a study of music therapy and palliative care experiences in cancer hospital. *Journal of palliative care*, 17(3), 155-160.
- O'Callaghan, C., & Colegrove, V. (1998). Effect of the music therapy introduction when engaging hospitalised cancer patients. *Music therapy perspectives*, 67-74.
- O'Callaghan, C., & Magill, L. (2009). Effect of music therapy on oncologic staff bystanders: a substantive grounded theory. *Palliative and Supportive Care*, 7(2), 219-228.
- O'Callaghan, C., & McDermott, F. (2004). Music therapy's relevance in a cancer hospital researched through a constructivist lens. *Journal of music therapy*, 41(2), 151-185.
- Pagani, R. (2014). *Scarlatti*. Retrieved March 19, 2015, from Grove Music Online. Oxford Music Online.: <http://www.oxfordmusiconline.com/subscriber/article/grove/music/24708pg1>
- Palmer, K. (1964). *Teach yourself orchestration*. London: The English University Press.
- Parrott, I. (1957). *Method of Orchestration*. London: Dobson Books.
- Perone, J. E. (1996). *Orchestration theory*. London: Greenwood Press.
- Peyser, J. (1986). *The orchestra: origins and transformations*. New York: Charls Scribner's Sons.
- Phelan, J., & Burkart, L. (2005). *The Complete Guide to the Flute and Piccolo* (2nd ed.). Shirley, Massachusetts: Burkart-Phelan Inc.
- Piston, W. (1961). *Orchestration*. London: Lowe and Brydone Printers Limited.
- Planchart, A. (1990). Tempo and proportions. In H. M. Brown, & S. Sadie (Ed.), *Performance practice: music before 1600* (pp. 126-140). New York: W. W. Norton.
- Polansky, L. (1986). *New instrumentation and orchestration; an outline for study*. Oakland: Frag Peak Music.
- Praetorius, M. (1615). *Syntagma musicum: de musica sacra* (Vol. I). Wittenberg: Johannes Richter.
- Praetorius, M. (1619). *Syntagmatis musici: de organographia*. Wolfenbüttel: Elias Holwein.
- Prout, E. (1969). *Instrumentation*. New York: Haskell House.
- Prout, E. (1972). *The orchestra*. St. Clair Shores: Scholarly Press.
- Radvansky, G. (2005). *Human Memory*. Boston: Allyn and Bacon.

- Rauscher, D. (1963). *Orchestration, scores and scoring*. New York: Free Press of Glencoe.
- Ravel, M. (1931, July 11). M. Ravel discusses his own work: The Boléro explained. (M. D. Calvocoressi, Interviewer) *The Daily Telegraph*.
- Read, G. (1969). *Thesaurus of orchestral devices*. New York: Greenwood Press.
- Read, G. (1979). *Style and orchestration*. New York: Schirmer Books.
- Read, G. (2004). *Orchestral combinations: the science and art of instrumental tone-colour*. Maryland: The Scarecrow Press, Inc.
- Reporter, D. M. (2009, February 13). *Ravel's Boléro*. Retrieved from *The Daily Mail*: <http://www.dailymail.co.uk/femail/article-1142937/10-things-knew-Ravels-Bolero.html>
- Rimsky-Korsakov, N. (1922). *Principles of Orchestration*. (M. Steinberg, Ed., & E. Agate, Trans.) Berlin: Editions Russes de Musique.
- Rimsky-Korsakov, N. (1964). *Principles of orchestration*. (M. Steinberg, Ed.) New York: Dover Publications.
- Roberts, B. (1991). Music teacher education as identity construction. *International journal of music education, 18*, 30-39.
- Rogers, B. (1951). *The art of orchestration*. New York: Appleton-century-croft.
- Roosenschoon, H. (1991). *The Magic Marimba*. Cape Town: Amanuensis Quality Editions.
- Ross, H. (1996). *E.H. Weber on the tactile senses* (2nd ed.). (D. Murray, Ed., & D. Murray, Trans.) Hove: Erlbaum Tayler & Francis.
- Saarikallio, S., & Erkkila, J. (2007). The role of music in adolescents' mood regulation. *Society for education, music and psychology research, 35*(1), 88-109.
- Schoenberg, A. (2008). *Style and Idea*. New York: Philosophical Library.
- Schonken, P. (2013). *Authorship and ownership of UShaka KaSenzangakhona*. Stellenbosch University: SUNScholar [available online: <http://hdl.handle.net/10019.1/80307>].
- Scott, H. (2009, September 24). *Grounded Theory Online*. Retrieved from *Grounded Theory*: <http://www.groundedtheoryonline.com/what-is-grounded-theory>
- Sevsay, E. (2013). *The Cambridge guide to orchestration*. New York: Cambridge University Press.
- Shatzkin, M. (1993). *Writing for Orchestra*. Englewood Cliffs: Prentice Hall.
- Shils, E. (1981). *Tradition*. Chicago: The University of Chicago Press.



- Shinn-Cunningham, B. (2008, February 03). Object-based auditory and visual attention. *Trends in cognitive sciences*, 12, pp. 182-186.
- Simmons, O. (2014, July 20). *Grounded Theory Institute*. Retrieved from Grounded Theory: <http://www.groundedtheory.com/what-is-gt.aspx>
- Small, C. (1998). *Musicking: the meanings of performing and listening*. Hanover: University Press of New England.
- Stiller, A. (1985). *Handbook of instrumentation*. Berkeley: University of California press.
- Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine Publishing.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research*. Newbury Park, CA: Sage.
- Strauss, A., & Corbin, J. (1997). *Grounded theory in practice*. Thousand Oaks, CA: Sage.
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Grounded theory procedures and techniques* (2nd ed.). Newbury Park, CA: Sage.
- Sundberg, J. (1972). A perceptual function of the 'singing formant'. *STL-QPSR*, 13(2-3), 61-63.
- Sundberg, J. (1987). *The science of the singing voice*. DeKalb: Northern Illinois University Press.
- Temmingh, R. (1992). *tjellokonsert*. Stellenbosch: Unpublished original score.
- Tolbert, E. (2001). Music and meaning: an evolutionary story. *Society for research in psychology of music and music education*, 29, 84-94.
- Tuthill, B. (1970). *Practical orchestration: a text for college students and listeners*.
- Van Wyk, A. (1960). *Primavera symphonic suite*. Arnold van Wyk Trust.
- Van der Linde, B.-M. (2013). *A comparative analysis of the singer's formant cluster*. (Master's thesis). Stellenbosch: SUNScholar. Retrieved from <http://hdl.handle.net/10019.1/85563>
- Wagner, J. (1959). *Orchestration, a practical handbook*. New York: McGraw-Hill Book Company, Inc.
- Ward, D. (1970). Musical perception. In J. Tobias (Ed.), *Foundations of modern auditory theory* (Vol. I). New York: Academic Press.
- Wasserman, J., Clair, J., & Wilson, K. (2009). Problematics of grounded theory: innovations for developing an increasingly rigorous qualitative method. *Qualitative research*, 9(3), 355-381.
- Weiss, P., & Taruskin, R. (1984). *Music in the Western World: A history in documents*. New York: Schirmer Books.


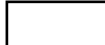
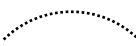
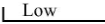
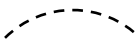



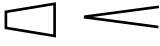
- Welman, C., Kruger, F., & Mitchel, B. (2012). *Research methodology* (3rd ed.). Cape Town: Oxford University Press.
- Widor, C. (1906). *The technique of the modern orchestra*. London: Joseph Williams Ltd.
- Wilson, S. (1979). Explorations of the usefulness of case study evaluations. *Evaluation Quarterly, Vol. 3*, pp.446-459.
- Wittgenstein, L. (1969). *On Certainty*. (D. Paul, & G. Anscombe, Trans.) Oxford: Basil Blackwell.
- Yin, R. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, California: Sage Publications.
- Zaidel-Rudolph, J. (1986). *Tempus Fugit*. Unpublished original score.
- Zanussi, K. (Director). (1990). *Witold Lutosławski in conversation with Krzysztof Zanussi* [Motion Picture].
- Zwicker, E. (2006). *Psychoacoustics: facts and models*. Heidelberg: Springer-Verlag.

## Addendum A: instrument ranges

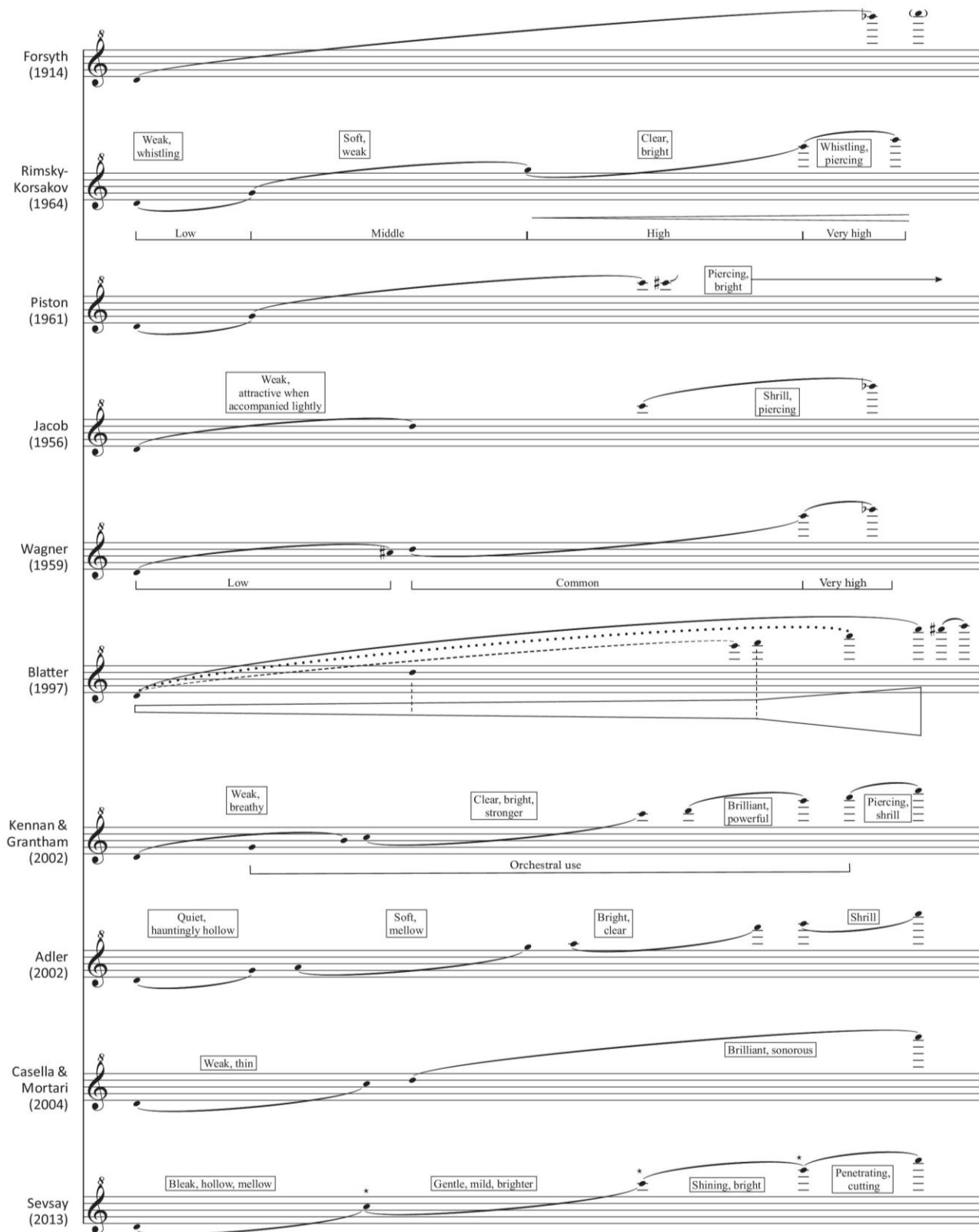
In this addendum, the written (transposed) ranges of various orchestral instruments are tabularised according to their various documented and acknowledged registers in a number of significant orchestration texts. These include Forsyth (1914), Rimsky-Korsakov (1964), Piston (1961), Jacob (1956), Wagner (1959), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004), and Sevsay (2013). By placing these various documented ranges in close proximity, the reader is able to perceive a) the areas (usually the mid-range) of overlapping between different authors, which constitute standard ranges, and b) the general disagreement over some of the outer limits of instrumental ranges. As a complement to this addendum, see Addendum C in which the saliency of a number of orchestral instruments is compared to other instruments of the same family and section.

In some textbooks, the range of an instrument is not discussed, or is only partially revealed by text references to some of the pitches in a range (usually in the outer limits); in those cases, the data that is available is included or extrapolated as is possible. The differences in presentation of ranges and characteristics in each of the textbooks is preserved in this addendum, and descriptors are also taken from each textbook to show how various authors choose to describe range qualities differently. Noticeably, some authors take a far more technical and detailed approach than others to their visualisations and descriptions: Forsyth provides nearly no useful information about range qualities, whereas Blatter provides a great deal of information about range, sound production and dynamic strength.

A number of visual aids are employed to differentiate different kinds of ranges and pitch possibilities:

	= normal or professional range		= description
	= semi-professional or college range		= register
	= high school or amateur range		= extrapolated information
	= available sometimes	10	= overtone position
	= higher limit is undefined	32"	= drum size (inches)
	= dynamic strength curve		

Piccolo

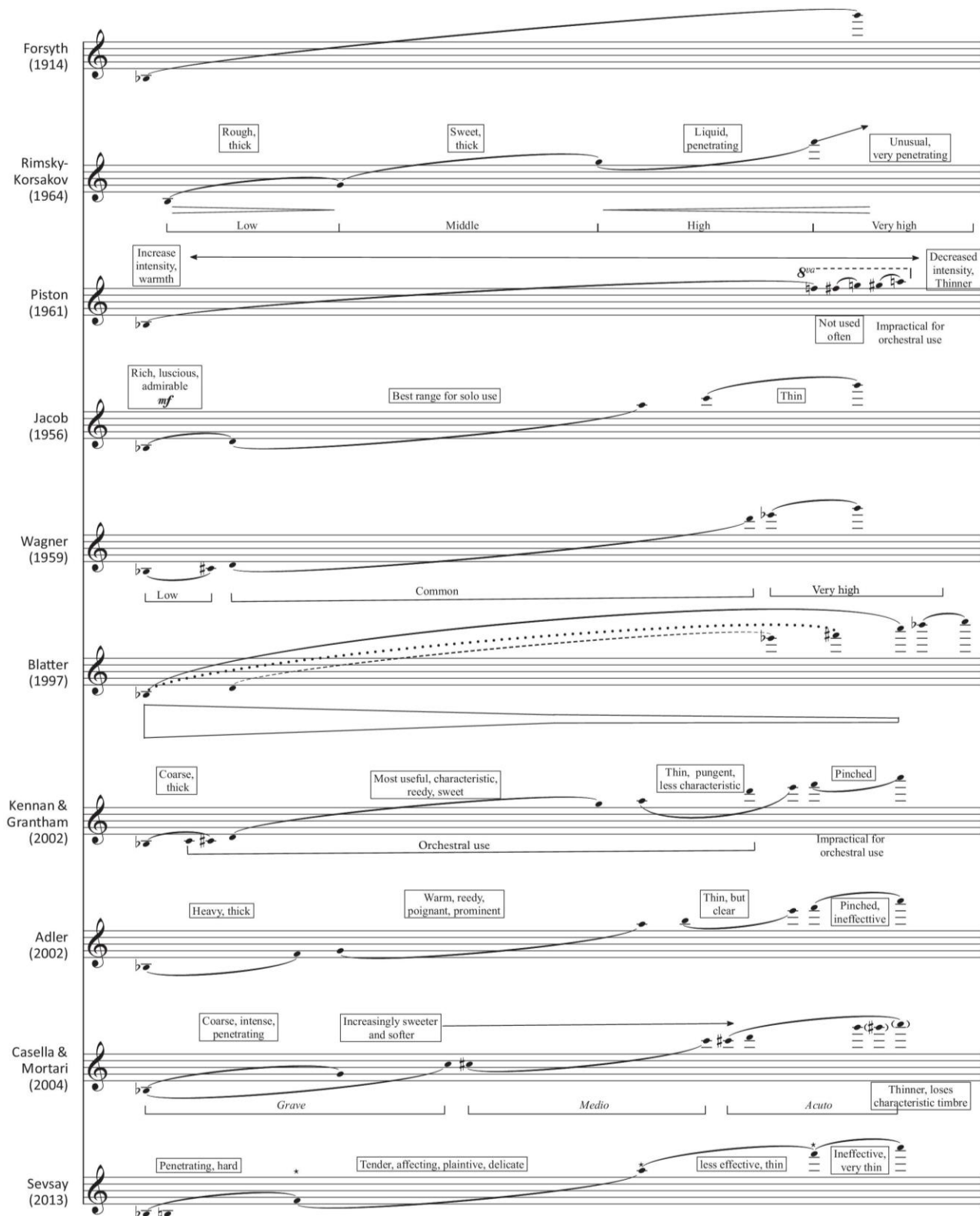


# Flute

The image displays ten musical staves, each representing a different composer's perspective on the flute's sound and range. Each staff shows a melodic line with descriptive text boxes and range labels below it. The composers are:

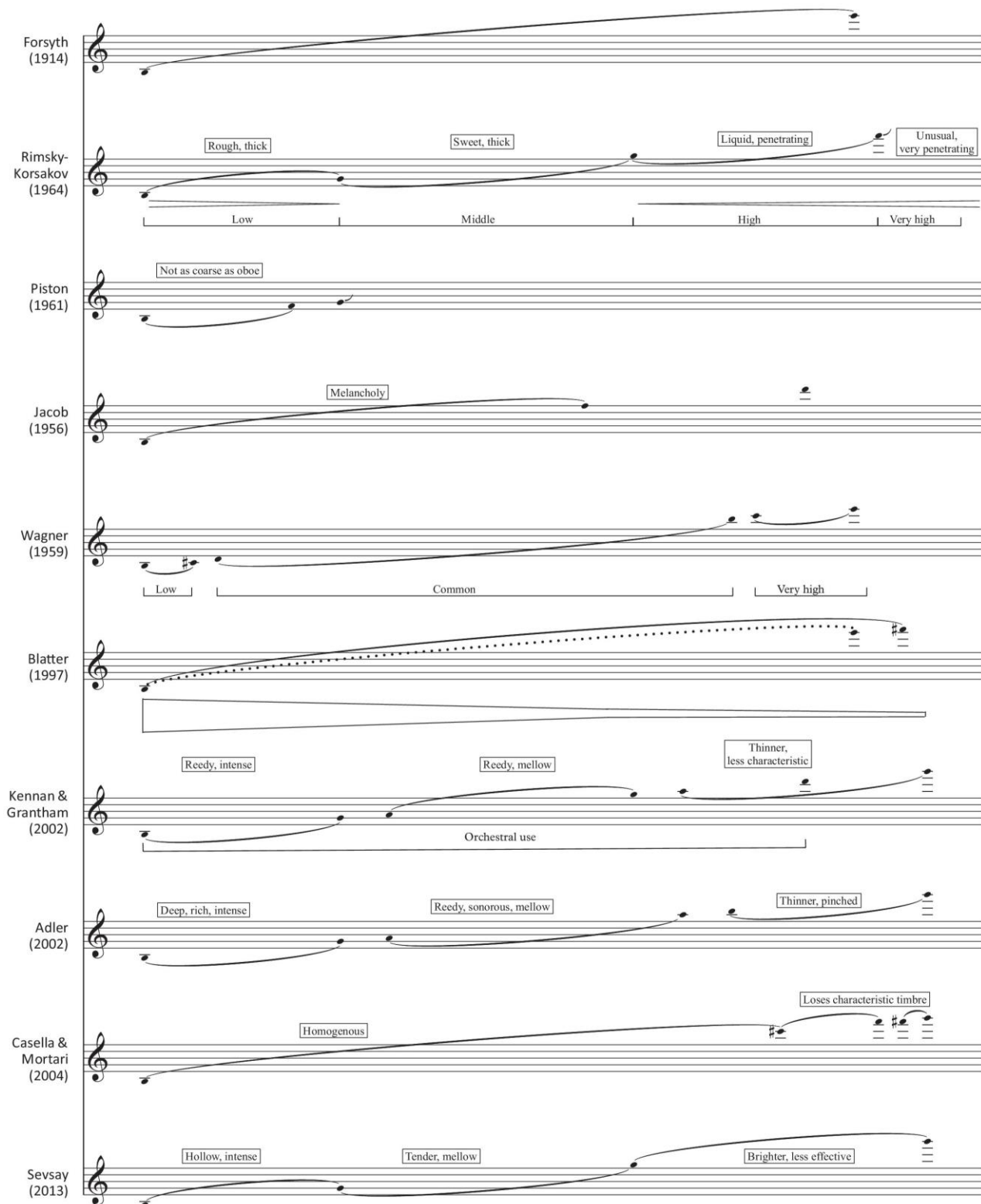
- Forsyth (1914):** Shows a single melodic line starting low and rising to a high note.
- Rimsky-Korsakov (1964):** Labels include "Dull, whistling" (Low), "Sweet, transparent" (Middle), "Clear, bright" (High), and "Clear, whistling" (Very high).
- Piston (1961):** Labels include "Velvet, heavy when heard alone" (Low), "Getting Brighter" (Middle), "Clear, brilliant" (High), and "Shrill" (Very high).
- Jacob (1956):** Labels include "Rich, beautiful" (Low), "Suited for melodic work" (Middle), and "Clear, bright, penetrating" (High).
- Wagner (1959):** Labels include "Low", "Common", and "Very high".
- Blatter (1997):** Shows a melodic line with a dotted line indicating a specific range and a shaded area below the staff.
- Kennan & Grantham (2002):** Labels include "Weak, breathy, velvety, sensous" (Low), "Progressively brighter and stronger" (Middle), "Strong, haunting, silvery brilliance, powerful" (High), and "Shrill, piercing" (Very high). A bracket labeled "Orchestral use" spans from the low to the high range.
- Adler (2002):** Labels include "Weak, but luscious" (Low), "Sweet but with little carrying power" (Middle), "Clear, brilliant" (High), and "Shrill" (Very high).
- Casella & Mortari (2004):** Labels include "Warm, mysterious intensity" (Low), "Increasingly brilliant" (Middle), and "Forced, whistling" (Very high). Range labels below include "Grave", "Medio", "Acuto", and "Sopracuto".
- Sevsay (2013):** Labels include "Bleak, hollow, mellow" (Low), "Gentle, mild, brighter" (Middle), "Shining, bright" (High), and "Penetrating, cutting" (Very high).

Oboe



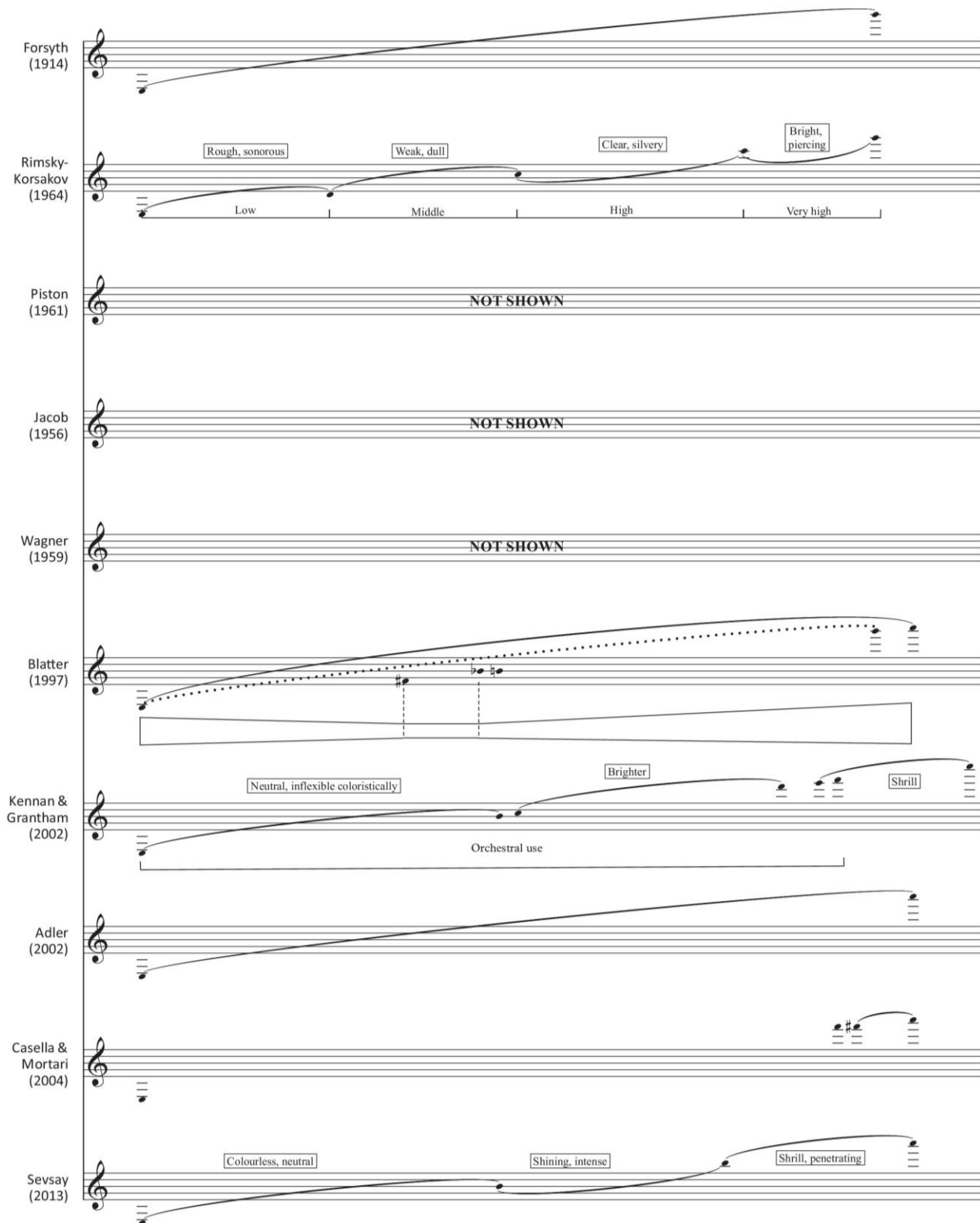
# English horn

(instrument in F sounds a perfect fifth lower)



## Piccolo clarinet

(instrument in E<sup>b</sup> is most common and sound a minor third higher)





# Soprano clarinet

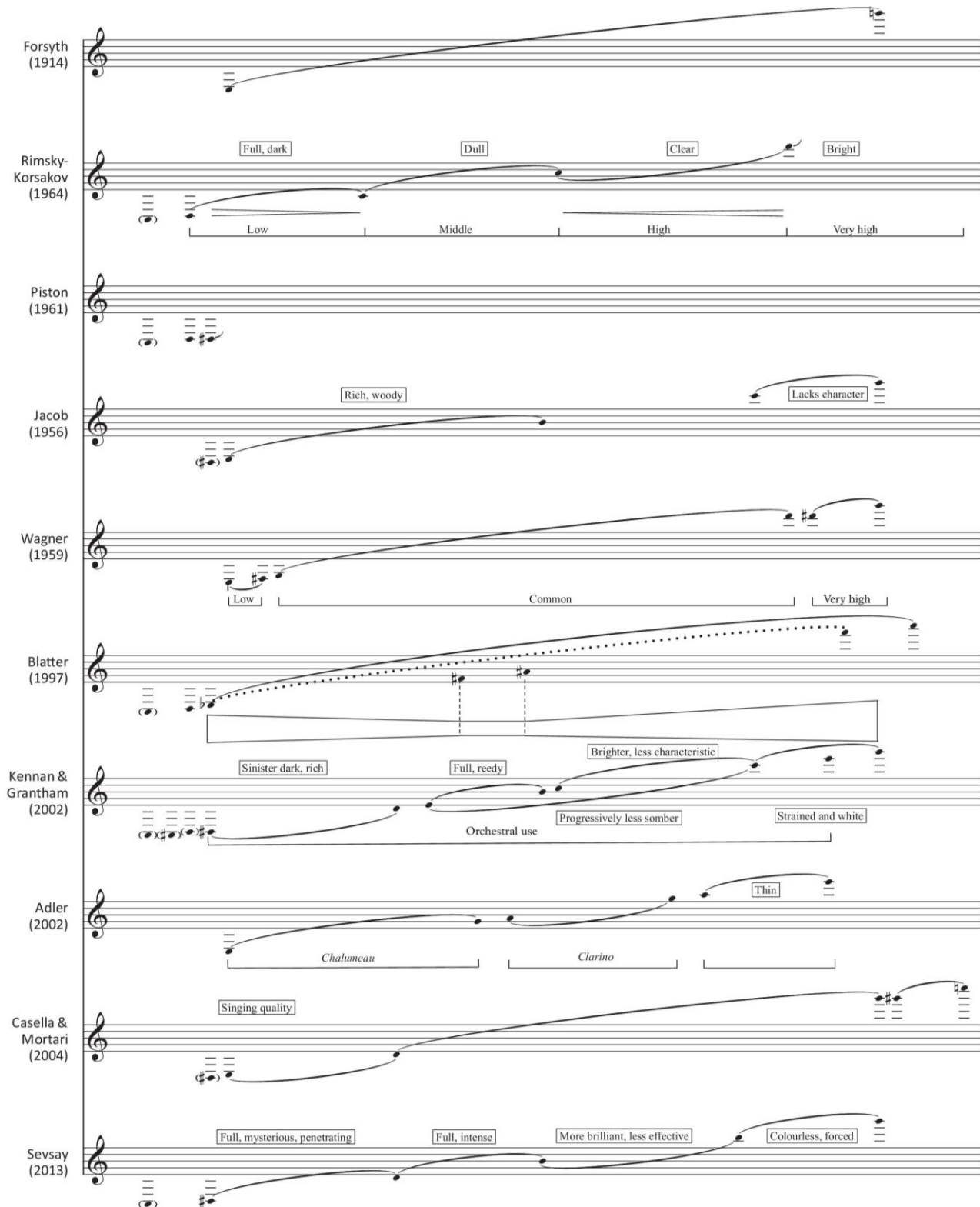
(instruments in B<sup>b</sup> and A are most common)

The image displays ten musical staves, each representing a different composer's perspective on the soprano clarinet's range and timbre. Each staff shows a melodic line with various annotations for timbre, dynamics, and performance techniques across different registers.

- Forsyth (1914):** Shows a range from low to very high with a continuous upward melodic line.
- Rimsky-Korsakov (1964):** Divides the range into Low, Middle, High, and Very high. Annotations include "Rough, sonorous" (Low), "Weak, dull" (Middle), "Clear, silvery" (High), and "Bright, piercing" (Very high).
- Piston (1961):** Divides the range into Chalumeau, Throat, Clarino, High, and Extreme high. Annotations include "Dark, dramatic menacing, rich" (Chalumeau), "Pale, less vibrant, awkward fingering" (Throat), "Bright, incisive, warm" (Clarino), "f Shrill, piercing p Flutelike" (High), and "Little sonorous value" (Extreme high).
- Jacob (1956):** Divides the range into Low, Common, and Very high. Annotations include "Rich, oily, hollow, sinister" (Low), "Dull, lifeless" (Common), "Safe range for solo work" (Common), and "Shrill, screaming" (Very high).
- Wagner (1959):** Divides the range into Low, Common, and Very high. Shows a melodic line starting in the low register and moving to the very high register.
- Blatter (1997):** Shows a melodic line with a dotted line indicating a specific range or technique.
- Kennan & Grantham (2002):** Divides the range into Dark, hollow; Not strong, neutral; Clear, bright; Shrill; and Very difficult. Includes the label "Orchestral use" for the middle range.
- Adler (2002):** Divides the range into Chalumeau, Throat tones, Clarino, and Shrill, piercing. Annotations include "Dark, rich" (Chalumeau), "Pale" (Throat tones), "Incisive, expressive, bright" (Clarino), and "Shrill, piercing" (Shrill).
- Casella & Mortari (2004):** Divides the range into Chalumeau, Clarino, and Extended. Annotations include "Dark, dramatic, menacing" (Chalumeau), "Brilliant, incisive" (Clarino), and "Forced" (Extended).
- Sevsay (2013):** Divides the range into Deep, eerie; Colourless, neutral; Elegiac, tender, plaintive; Shrill, intense, vehement; and Very shrill, penetrating. Annotations include "Deep, eerie" (Low), "Colourless, neutral" (Middle), "Elegiac, tender, plaintive" (High), "Shrill, intense, vehement" (Very high), and "Very shrill, penetrating" (Extreme high).

## Bass clarinet

(instrument in B<sup>b</sup> is most common and sounds a major ninth lower)

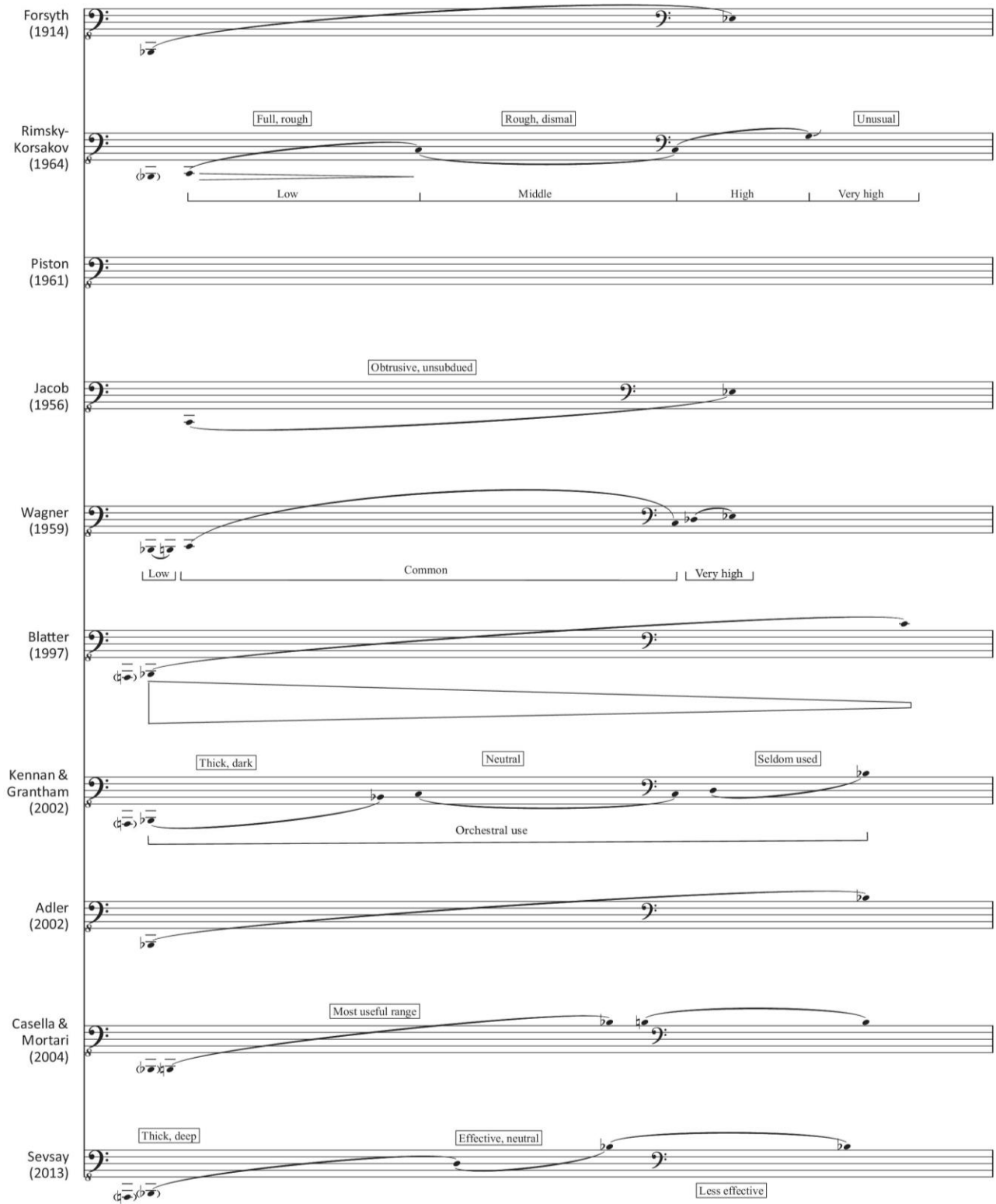


# Bassoon

The image displays ten musical staves, each representing a different composer's perspective on the bassoon's range and timbre. Each staff shows a melodic line with various dynamics and textures, accompanied by descriptive text boxes and range indicators.

- Forsyth (1914)**: Shows a single melodic line starting in the low register and moving to the high register.
- Rimsky-Korsakov (1964)**: Shows a melodic line with four distinct sections: *Full, rough* (Low), *Mournful, dull* (Middle), *Pale, soft* (High), and *Piercing* (Very high).
- Piston (1961)**: Shows a melodic line with a wide range, from low to very high.
- Jacob (1956)**: Shows a melodic line with three sections: *Rich, reedy, powerful* (Low), *Fine, slightly throaty* (Common), and *Possible, eerie* (Very high).
- Wagner (1959)**: Shows a melodic line with three sections: *Low*, *Common*, and *Very high*.
- Blatter (1997)**: Shows a melodic line with a wide range, from low to very high, and a corresponding range indicator below the staff.
- Kennan & Grantham (2002)**: Shows a melodic line with four sections: *Full, dark* (Low), *Neutral* (Common), *Progressively thinner, intense* (High), and *Pinched, complaining* (Very high). The text "Orchestral use" is written below the staff.
- Adler (2002)**: Shows a melodic line with four sections: *Sonorous, dark, vibrant* (Low), *Sweet, expressive, subdued* (Common), *Thin, intense* (High), and *Pinched, thin* (Very high).
- Casella & Mortari (2004)**: Shows a melodic line with three sections: *Sonorous potency, superb, vibrant* (Grave), *Veiled* (Medio), and *Tense expression* (Acuto).
- Sevsay (2013)**: Shows a melodic line with four sections: *Thick, strong, full* (Low), *Gentle, neutral* (Common), *Light but intense* (High), and *Thin* (Very high).

# Contrabassoon



## Saxophones

(soprano, alto, tenor and baritone are most common and share the same written range)

The image displays ten musical staves, each representing a different composer's work for saxophone. The composers and their years are listed on the left: Forsyth (1914), Rimsky-Korsakov (1964), Piston (1961), Jacob (1956), Wagner (1959), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004), and Sevsay (2013). The notation includes treble clefs, key signatures, and melodic lines with slurs. Some staves are marked "NOT SHOWN". The Blatter (1997) staff includes a large trapezoidal shape below the staff representing a dynamic or timbre contour, and several text boxes: "Rich, reedy, full, velvety", "Progressively more delicate, smooth and fluty", and "Very rich, string-flute tone".

Forsyth (1914) NOT SHOWN

Rimsky-Korsakov (1964) NOT SHOWN

Piston (1961)

Jacob (1956) NOT SHOWN

Wagner (1959)

Blatter (1997) Rich, reedy, full, velvety; Progressively more delicate, smooth and fluty; Very rich, string-flute tone

Kennan & Grantham (2002)

Adler (2002)

Casella & Mortari (2004)

Sevsay (2013)

# French horn

(double horn in F and B<sup>b</sup> is most common)

The image displays a series of musical staves for the French horn, each representing a different composer's perspective or typical usage. The staves are arranged vertically, with the composer's name and year on the left. The notes are written in bass clef, and some staves include a treble clef for comparison. Annotations in boxes and arrows describe the sound characteristics and usage of the instrument in each piece.

- Forsyth (1914):** Shows a long, sweeping melodic line.
- Rimsky-Korsakov (1964):** Includes annotations: "Not often used" (pointing to notes 2-3), "Very frequent" (pointing to notes 4-10), and "Little-used" (pointing to notes 12-16).
- Piston (1961):** Includes annotations: "Pedal tones" (pointing to low notes) and "Melodic use" (pointing to a higher melodic line).
- Jacob (1956):** Labeled "NOT SHOWN".
- Wagner (1959):** Labeled "NOT SHOWN".
- Blatter (1997):** Includes annotations: "Haunting, dark" (pointing to the lower register), "Heroic, brilliant" (pointing to the upper register), "Unobtrusive, poor projection" (pointing to the lower register), "Solo range" (pointing to the middle register), and "Provide excitement" (pointing to the upper register).
- Kennan & Grantham (2002):** Shows a melodic line with a slight rise.
- Adler (2002):** Shows a melodic line with a slight rise.
- Casella & Mortari (2004):** Includes annotations: "Pedal tones" (pointing to low notes), "Darker Fuller" (pointing to the lower register), "Round full sonority, great sweetness" (pointing to the middle register), and "Thinner, less expressive" (pointing to the upper register).
- Sevsay (2013):** Includes annotations: "Very dark, hesitant" (pointing to the lower register), "Dark, thick, somewhat uncertain" (pointing to the lower register), "Strong, solid" (pointing to the middle register), "Solemn, brilliant, clear" (pointing to the upper register), and "Loud, penetrating" (pointing to the upper register).

# Trumpet/Cornet

(trumpet in B<sup>b</sup> or C, and cornet in G are most common)

The image displays a series of musical staves for Trumpet/Cornet, each representing a different source or technique. The staves are as follows:

- Forsyth (1914):** Shows a single note in the bass clef.
- Rimsky-Korsakov (1964):** Shows a melodic line with fingerings 2, 3, 4, 5, 6, 8, 9, and 10. Annotations include "Not often used", "Very frequent", and "Little-used".
- Piston (1961):** Shows a melodic line with an asterisk above the first note. Annotations include "Full, solemnity", "Normal range", and "Penetrating, *p* difficult, beautiful".
- Jacob (1956):** Shows a single note. Annotation: "Use with care, brilliant".
- Wagner (1959):** Labeled "NOT SHOWN".
- Blatter (1997):** Shows a melodic line with a trapezoidal dynamic marking below it. Annotations include "Pedal tones" and "Cannot produce".
- Kennan & Grantham (2002):** Shows a melodic line.
- Adler (2002):** Shows a melodic line.
- Casella & Mortari (2004):** Shows a melodic line. Annotations include "Difficult, dignified rich in charm, full solemn sonorities" and "Difficult, ringing, forceful".
- Sevsay (2013):** Shows a melodic line. Annotations include "Serious, dull, dark", "Strong, transparent, brilliant", and "Penetrating, very brilliant".

# Tenor trombone

(instrument in B<sup>b</sup> does not transpose; F-trigger is common)

The image displays a series of musical staves for Tenor Trombone, each representing a different composer's approach to the instrument. The staves are arranged vertically, with the composer's name and year on the left. Each staff shows a melodic line in bass clef with a treble clef transposed above it. Performance instructions and technical notes are placed around the staves.

- Forsyth (1914):** Shows a simple melodic line starting on a low note and moving upwards.
- Rimsky-Korsakov (1964):** Includes fingerings (1-10) and notes like "Little-used" and "Very frequent".
- Piston (1961):** Features dynamic markings: *f* Dramatic, crashing, *p* subdued and Brilliant, penetrating.
- Jacob (1956):** Shows a long, sustained melodic line.
- Wagner (1959):** Labeled "NOT SHOWN".
- Blatter (1997):** Includes notes like "Pedal tones", "Cannot produce", and "Full, rich, sonorous".
- Kennan & Grantham (2002):** Shows a melodic line with a slight upward curve.
- Adler (2002):** Shows a melodic line with a slight upward curve.
- Casella & Mortari (2004):** Includes notes like "Pedal tones", "Fat, dark, menacing", "Cannot produce", "Heroic, brilliant", and "Difficult, forced".
- Sevsay (2013):** Includes notes like "Pedal tones, raw dark", "Cannot produce", "Somber, thick, threatening", "Very strong, heroic, blaring", and "Very intense, somewhat less strong".



## Bass trombone

(instrument in B<sup>b</sup> does not transpose; dependent F- and E-triggers are common)

The image displays ten musical staves for Bass Trombone, each representing a different composer and year. The staves are arranged vertically and include various musical notations such as notes, rests, and dynamic markings. Some staves have specific annotations:

- Forsyth (1914):** Shows a single note with a long, curved line above it, indicating a sustained or glissando effect.
- Rimsky-Korsakov (1964):** Labeled "SAME AS TENOR", showing a single note.
- Piston (1961):** Shows a single note with a curved line above it.
- Jacob (1956):** Shows a single note with a long, curved line above it.
- Wagner (1959):** Labeled "NOT SHOWN", showing a single note.
- Blatter (1997):** Shows a complex passage with multiple notes and a long, curved line above it. Annotations include "Pedal tones" and "Full, rich, sonorous".
- Kennan & Grantham (2002):** Shows a single note with a long, curved line above it.
- Adler (2002):** Shows a single note with a long, curved line above it.
- Casella & Mortari (2004):** Shows a single note with a long, curved line above it.
- Sevsay (2013):** Shows a complex passage with multiple notes and a long, curved line above it. Annotations include "Pedal tones, very massive, very dark", "Heavy, strong, full", "Solid, strong", and "Penetrating, very strong".

# Tuba

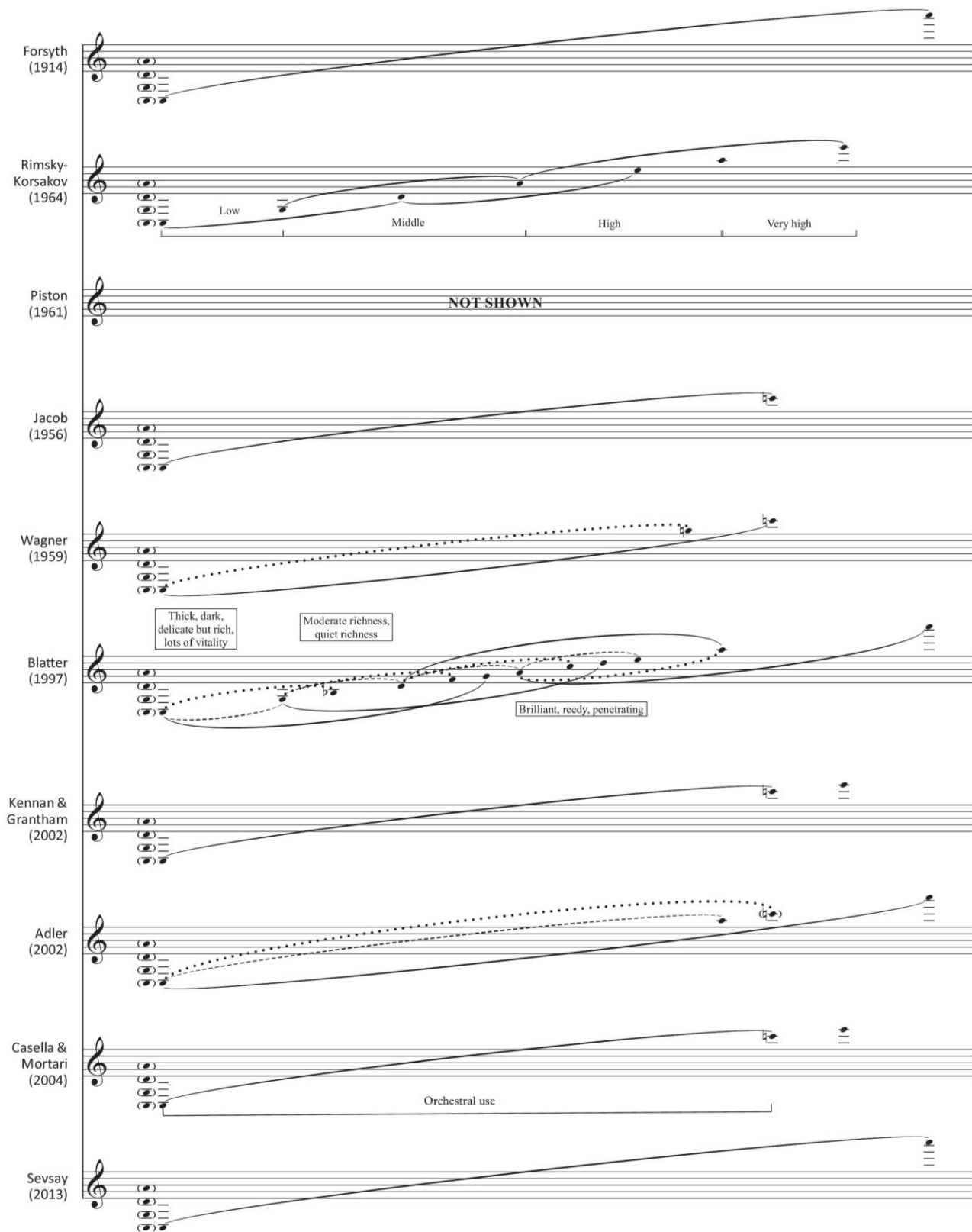
(instruments in F, E<sup>b</sup>, C or B<sup>b</sup> do not transpose)

The image displays ten musical staves, each representing a different composer's tuba part. The staves are arranged vertically and labeled with the composer's name and year in parentheses on the left. The notes and lines on the staves indicate the pitch range and timbre characteristics of the tuba part. Some staves are marked 'NOT SHOWN'. Annotations in boxes provide additional information about the frequency and timbre of the notes.

- Forsyth (1914):** NOT SHOWN
- Rimsky-Korsakov (1964):** Includes annotations: 'Little-used' (above note 1), 'Very frequent' (below notes 2-4), and 'Little-used' (above note 6). Notes are numbered 1 through 6.
- Piston (1961):**
- Jacob (1956):**
- Wagner (1959):** NOT SHOWN
- Blatter (1997):** Includes a large empty rectangular box below the staff.
- Kennan & Grantham (2002):**
- Adler (2002):**
- Casella & Mortari (2004):**
- Sevsay (2013):** Includes annotations: 'Very dark, heavy, low' (below note 1), 'Very strong, brassy' (below note 4), and 'Not that strong, intensive' (below note 6).



# Viola



# Violoncello

Forsyth (1914)

Rimsky-Korsakov (1964)  
Low Middle High Very high

Piston (1961)  
NOT SHOWN

Jacob (1956)

Wagner (1959)

Blatter (1997)  
Heavy, rich Lighter Tranquil Expressive, rich, powerful, melodious

Kennan & Grantham (2002)

Adler (2002)

Casella & Mortari (2004)

Sevsay (2013)

## Double bass

Forsyth (1914)

Rimsky-Korsakov (1964)

Piston (1961) **NOT SHOWN**

Jacob (1956)

Wagner (1959)

Blatter (1997)

Kennan & Grantham (2002)

Adler (2002)

Casella & Mortari (2004)

Sevsay (2013)

Low Middle High Very high

Dark, somber, dull, foreboding

Mellow, reedy, rich

More buzz, ponderous, trifle

Rich, expressive

Pianoforte

The image displays a series of musical staves for the instrument 'Pianoforte'. The composers and their respective years are listed on the left side of each staff:

- Forsyth (1914): NOT SHOWN
- Rimsky-Korsakov (1964): NOT SHOWN
- Piston (1961): NOT SHOWN
- Jacob (1956): NOT SHOWN
- Wagner (1959): NOT SHOWN
- Blatter (1997): Detailed notation including a melodic line with dynamic markings  $15^{mb}$  and  $8^{nb}$ . Annotations include 'Gonglike' (pointing to the first note), '1 String', '2 Strings', and '3 Strings' (pointing to subsequent notes), and 'Flutey, bell-like' (pointing to the final note). A 'No Dampers' instruction is also present.
- Kennan & Grantham (2002): Detailed notation with dynamic marking  $15^{mb}$ .
- Adler (2002): Detailed notation with dynamic marking  $15^{mb}$ .
- Casella & Mortari (2004): NOT SHOWN
- Sevsay (2013): Detailed notation with dynamic marking  $15^{mb}$ .

# Harp

The image displays ten musical staves for Harp, each representing a different composition. The staves are arranged vertically and include the following details:

- Forsyth (1914):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Rimsky-Korsakov (1964):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Piston (1961):** Includes material-specific labels: "Bound with Wire", "Gut", and "Nylon". It features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Jacob (1956):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Wagner (1959):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Blatter (1997):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Kennan & Grantham (2002):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Adler (2002):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Casella & Mortari (2004):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.
- Sevsay (2013):** Features a dynamic marking of  $8^{vb}$  and a melodic line ending with a  $15^{mi}$  marking.






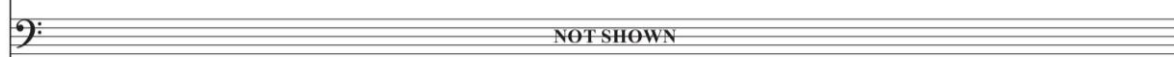
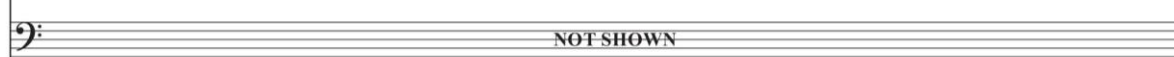

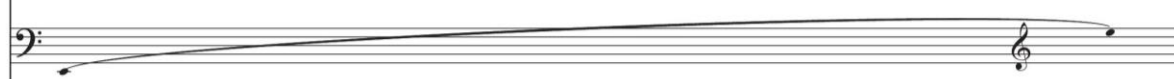

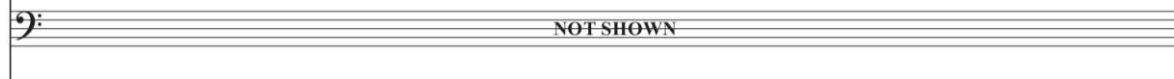

## Xylophone

(sounding one octave higher)

The image displays ten musical staves for xylophone, each representing a different composer and year. Each staff begins with a treble clef and a key signature of one flat (B-flat). The notes are connected by a slur, and a fermata is placed over the final note of each staff. The composers and their years are listed on the left of each staff:

- Forsyth (1914)
- Rimsky-Korsakov (1964)
- Piston (1961)
- Jacob (1956)
- Wagner (1959)
- Blatter (1997)
- Kennan & Grantham (2002)
- Adler (2002)
- Casella & Mortari (2004)
- Sevsay (2013)

## Roto-toms

Forsyth (1914)	
Rimsky-Korsakov (1964)	
Piston (1961)	
Jacob (1956)	
Wagner (1959)	
Blatter (1997)	
Kennan & Grantham (2002)	
Adler (2002)	
Casella & Mortari (2004)	
Sevsay (2013)	

# Timpani

The image displays ten musical staves for timpani, each representing a different composer's approach. The staves are arranged vertically and show various drum types and sizes. The composers and their years are: Forsyth (1914), Rimsky-Korsakov (1964), Piston (1961), Jacob (1956), Wagner (1959), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004), and Sevsay (2013).

Each staff shows a sequence of notes with slurs, indicating the pitch and duration of the drum sounds. The notes are often connected by slurs, suggesting a continuous or overlapping sound. The drum types and sizes are labeled above or below the notes:

- Forsyth (1914):** Middle-drum, Large-drum, Small-drum.
- Rimsky-Korsakov (1964):** Big-drum, Small-drum.
- Piston (1961):** 32", 28", 25", 23", 21".
- Jacob (1956):** Middle-drum, Lower-drum, High-drum.
- Wagner (1959):** 28", 25".
- Blatter (1997):** 30-32", 28-29", 25-26", 23-24", 20-21".
- Kennan & Grantham (2002):** 32", 28", 25", 23", 21".
- Adler (2002):** 32", 28", 25", 23", 21".
- Casella & Mortari (2004):** I, II, III, I, II, III.
- Sevsay (2013):** 30-32", 28-29", 25-26", 23-24", 20-21".

## Marimba

Forsyth (1914)

Rimsky-Korsakov (1964) NOT SHOWN

Piston (1961)

Jacob (1956) NOT SHOWN

Wagner (1959) NOT SHOWN

Blatter (1997)

Kennan & Grantham (2002)

Adler (2002)

Casella & Mortari (2004)

Sevsay (2013)

# Vibraphone

The image displays a list of vibraphone compositions, each with a corresponding musical staff. The compositions are as follows:

- Forsyth (1914)**: The staff contains the text "NOT SHOWN".
- Rimsky-Korsakov (1964)**: The staff contains the text "NOT SHOWN".
- Piston (1961)**: The staff shows a musical staff with a treble clef, a starting note with a fermata, and a long, curved line indicating a glissando or sustained note that ends with a final note and a fermata.
- Jacob (1956)**: The staff contains the text "NOT SHOWN".
- Wagner (1959)**: The staff contains the text "NOT SHOWN".
- Blatter (1997)**: The staff shows a musical staff with a treble clef, a starting note with a fermata, and a long, curved line indicating a glissando or sustained note that ends with a final note and a fermata.
- Kennan & Grantham (2002)**: The staff shows a musical staff with a treble clef, a starting note with a fermata, and a long, curved line indicating a glissando or sustained note that ends with a final note and a fermata.
- Adler (2002)**: The staff shows a musical staff with a treble clef, a starting note with a fermata, and a long, curved line indicating a glissando or sustained note that ends with a final note and a fermata.
- Casella & Mortari (2004)**: The staff shows a musical staff with a treble clef, a starting note with a fermata, and a long, curved line indicating a glissando or sustained note that ends with a final note and a fermata.
- Sevsay (2013)**: The staff shows a musical staff with a treble clef, a starting note with a fermata, and a long, curved line indicating a glissando or sustained note that ends with a final note and a fermata.

## Glockenspiel

(sounding two octaves higher)

The image displays ten musical staves for Glockenspiel, each representing a different composer and year. Each staff begins with a treble clef and a common time signature. The notes are written on a five-line staff, and a slur covers the entire melodic line, ending with a fermata. The composers and their respective years are listed to the left of each staff:

- Forsyth (1914)
- Rimsky-Korsakov (1964)
- Piston (1961)
- Jacob (1956)
- Wagner (1959)
- Blatter (1997)
- Kennan & Grantham (2002)
- Adler (2002)
- Casella & Mortari (2004)
- Sevsay (2013)

## Tubular bells

The image displays a vertical list of ten musical staves, each representing a different composition for tubular bells. Each staff begins with a treble clef and a key signature of one flat (B-flat). The composers and their respective years are listed on the left side of each staff. The compositions are as follows:

- Forsyth (1914):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Rimsky-Korsakov (1964):** The staff is empty, with the text "NOT SHOWN" centered across it.
- Piston (1961):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Jacob (1956):** The staff is empty, with the text "NOT SHOWN" centered across it.
- Wagner (1959):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Blatter (1997):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Kennan & Grantham (2002):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Adler (2002):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Casella & Mortari (2004):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.
- Sevsay (2013):** Shows a melodic line starting on a low note and rising to a higher note, with a fermata over the final note.

# Celesta

(sounding one octave higher)

The image displays a musical score for the Celesta instrument, featuring ten different compositions. Each composition is written on a grand staff, which consists of a bass clef on the left and a treble clef on the right. The notes are written on the bass clef staff, and the treble clef staff is left empty. A dynamic marking of  $sfz$  (sforzando) is placed above the first note of each piece. A dashed line with an arrow indicates a crescendo leading to the final note of each piece. The composers and their respective years are listed on the left side of the score:

- Forsyth (1914)
- Rimsky-Korsakov (1964)
- Piston (1961)
- Jacob (1956)
- Wagner (1959)
- Blatter (1997)
- Kennan & Grantham (2002)
- Adler (2002)
- Casella & Mortari (2004)
- Sevsay (2013)



## Addendum B: orchestral references

This addendum contains a collated list of examples are provided from a number of orchestration textbooks: Widor (1906), Wagner (1959), Piston (1961), Blatter (1997), Kennan & Grantham (2002), Adler (2002), Casella & Mortari (2004) and Sevsay (2013). For ease of use, the examples have been divided into six tables which contain references to 1) the brass family, 2) the woodwind family, 3) the string family, 4) the percussion family, 5) plucked and keyboard instruments, and 6) the orchestral tutti:

Addendum B Table 17:	Examples regarding brass instruments referenced in various orchestration textbooks: .....	p.323
Addendum B Table 18:	Examples regarding woodwind instruments referenced in various orchestration textbooks: .....	p.336
Addendum B Table 19:	Examples regarding stringed instruments referenced in various orchestration textbooks: .....	p.350
Addendum B Table 20:	Examples regarding percussion instruments referenced in various orchestration textbooks: .....	p.367
Addendum B Table 21:	Examples regarding keyboard and plucked string instruments referenced in various orchestration textbooks: .....	p.372
Addendum B Table 22:	Examples regarding orchestral tutti referenced in various orchestration textbooks: .....	p.376

In total, 1792 examples were counted from eight textbooks<sup>243</sup>, but in this addendum, duplicate references have been omitted where they occur within the same instrument, technique and source. The

---

<sup>243</sup> Textbooks that were included in the count contained examples from a wide variety of musical literature; inversely, textbooks that contained examples from fewer than twenty musical sources were excluded.

table entries are alphabetised by instrument name, then by technique referenced and lastly by author. Only examples that refer to specific techniques or ideas are included in these tables; general listening and reference lists that occur in Blatter (1997), Kennan & Grantham (2002) and Adler (2002) were therefore not included in this addendum. The terminology used in the second column (technique or reference) was invented according to the labels and categories that the various authors apply in their textbooks; their systems have been combined into the general categories that appear in this addendum.

**For Brass:** archaic instruments and instruments that are only seldom used (such as the bass trumpet and Wagner tubas) have been omitted from these tables, even if they are sometimes referenced in textbooks. Horns in B<sup>b</sup> and in F (and various other historic tunings) have been absorbed into single categories, as have different tunings of the trumpets and tubas. A distinction is still applied between tenor and bass trombones.

**For Woodwinds:** archaic instruments and instruments that are only seldom used (such as the alto clarinet, sarrusophone, bass oboe and soprano saxophone) have been omitted from these tables, even if they are sometimes referenced in textbooks. Different tunings of clarinets (B<sup>b</sup>, A, D, E<sup>b</sup>) have been absorbed into single categories, although a distinction is still applied to different members of the same instrument family (piccolo, soprano, alto, tenor, bass and contrabass instruments).

**For Strings:** archaic instruments and instruments that are seldom used (such as viola da gamba, octobass and the fiddle) are omitted from these tables, even if they are sometimes referenced in textbooks.

**For Percussion instruments:** in order to achieve a general consensus between different sources and the diverse manner in which they subdivide percussion instruments, this addendum divides instruments into three main groups (membranes, wood and metal), each with two subcategories (pitched and unpitched).

Addendum B Table 17 -- Examples regarding brass instruments referenced in various orchestration textbooks:

Instrument/Group	Technique or reference	Composer	Composition	Year	Reference Source
Brass Section	Articulation	Dvořák, Antonín	Symphony No.5	1887	Widor (1906)
Brass Section	Articulation	Strauss, Richard	Don Juan	1889	Widor (1906)
Brass Section	Articulation	Debussy, Claude	Jeux	1912	Widor (1906)
Brass Section	Articulation	Rochberg, George	Zodiac	1964	Widor (1906)
Brass Section	Double or Triple or Flutter tonguing	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Piston (1961)
Brass Section	Double or Triple or Flutter tonguing	Strauss, Richard	Don Quixote	1897	Widor (1906)
Brass Section	Double or Triple or Flutter tonguing	Debussy, Claude	Mer, La	1905	Blatter (1997)
Brass Section	Idiomatic scoring	Schubert, Franz	Rosamunde	1823	Casella & Mortari (2004)
Brass Section	Idiomatic scoring	Liszt, Franz	Préludes, Les	1845	Piston (1961)
Brass Section	Idiomatic scoring	Wagner, Richard	Lohengrin	1848	Blatter (1997)
Brass Section	Idiomatic scoring	Wagner, Richard	Siegfried	1871	Casella & Mortari (2004)
Brass Section	Idiomatic scoring	Tchaikovsky, Pyotr	1812 Overture	1880	Casella & Mortari (2004)
Brass Section	Idiomatic scoring	Bruckner, Anton	Symphony No.7	1885	Adler (2002)
Brass Section	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Blatter (1997)
Brass Section	Idiomatic scoring	Strauss, Richard	Don Juan	1889	Blatter (1997)
Brass Section	Idiomatic scoring	Strauss, Richard	Don Quixote	1897	Blatter (1997)
Brass Section	Idiomatic scoring	Strauss, Richard	Don Quixote	1897	Adler (2002)
Brass Section	Idiomatic scoring	Elgar, Edward	Enigma Variations	1899	Wagner (1959)
Brass Section	Idiomatic scoring	Ravel, Maurice	Rapsodie Espagnole	1907	Sevsay (2013)
Brass Section	Idiomatic scoring	Debussy, Claude	Jeux	1912	Kennan & Grantham (2002)
Brass Section	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Adler (2002)
Brass Section	Idiomatic scoring	Weinberger, Jaromír	Schwanda the Bagpiper	1926	Sevsay (2013)
Brass Section	Idiomatic scoring	Hindemith, Paul	Mathis der Maler	1934	Sevsay (2013)
Brass Section	Idiomatic scoring	Hindemith, Paul	Nobilissima Visione	1938	Widor (1906)
Brass Section	Idiomatic scoring	Britten, Benjamin	Serenade	1943	Sevsay (2013)
Brass Section	Idiomatic scoring	Prokofiev, Sergei	Symphony No.5	1944	Piston (1961)
Brass Section	Idiomatic scoring	Stravinsky, Igor	Variations	1964	Adler (2002)

Brass Section	Muting	Vaughan Williams, Ralph	Symphony No.6	1947	Wagner (1959)
Brass Section	Scoring Techniques: Balance	Schubert, Franz	Symphony No.9	1822	Kennan & Grantham (2002)
Brass Section	Scoring Techniques: Balance	Tchaikovsky, Pyotr	Symphony No.4	1877	Adler (2002)
Brass Section	Scoring Techniques: Balance	Franck, César	Symphony	1888	Piston (1961)
Brass Section	Scoring Techniques: Balance	Rochberg, George	Zodiac	1964	Adler (2002)
Brass Section	Scoring Techniques: Colour effects	Gershwin, George	Rhapsody in Blue	1924	Widor (1906)
Brass Section	Scoring Techniques: Colour effects	Gershwin, George	Concerto for Piano and Orchestra	1925	Blatter (1997)
Brass Section	Scoring Techniques: Colour effects	Gould, Morton	Interplay	1945	Piston (1961)
Brass Section	Scoring Techniques: Colour effects	Rochberg, George	Zodiac	1964	Adler (2002)
Brass Section	Scoring Techniques: Colour effects	Druckman, Jacob	Windows	1972	Kennan & Grantham (2002)
Brass Section	Scoring Techniques: Division of Material	Bach, Johann Sebastian	Brandenburg Concerto no.1	1721	Sevsay (2013)
Brass Section	Scoring Techniques: Division of Material	Berlioz, Hector	Carnival Romain, Le	1868	Kennan & Grantham (2002)
Brass Section	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.4	1877	Blatter (1997)
Brass Section	Scoring Techniques: Division of Material	Schoenberg, Arnold	Five Orchestral Pieces	1909	Widor (1906)
Brass Section	Scoring Techniques: Division of Material	Hindemith, Paul	Symphonic metamorphosis	1943	Piston (1961)
Brass Section	Scoring Techniques: Division of Material	Bartók, Béla	Concerto for Orchestra	1943	Wagner (1959)
Brass Section	Scoring Techniques: Division of Material	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Brass Section	Scoring Techniques: Division of Material	Rochberg, George	Zodiac	1964	Sevsay (2013)
Cornet	Expressive qualities	Tchaikovsky, Pyotr	Capriccio Italien	1880	Widor (1906)
Cornet	Expressive qualities	Holst, Gustav	First Suite in E <sup>b</sup> for Band	1909	Piston (1961)
Cornet	Idiomatic scoring	Meyerbeer, Giacomo	Prophète, Le	1849	Widor (1906)
Cornet	Idiomatic scoring	Berlioz, Hector	L'Enfance du Christ	1850	Widor (1906)
Cornet	Idiomatic scoring	Gounod, Charles	Faust	1859	Widor (1906)
Cornet	Idiomatic scoring	Bizet, Georges	l'Arlésienne	1872	Widor (1906)
Cornet	Idiomatic scoring	Widor, Charles-Marie	Ouverture Espagnole	1897	Widor (1906)
Cornet	Idiomatic scoring	Stravinsky, Igor	Petrouchka	1911	Widor (1906)
Cornet	Idiomatic scoring	Casella, Alfredo	Pupazzetti	1915	Widor (1906)
Cornet	Technical agility	Stravinsky, Igor	Petrouchka	1911	Wagner (1959)
Cornet	Technical agility	Stravinsky, Igor	Petrouchka	1911	Kennan & Grantham (2002)
Cornet	Technical agility	Stravinsky, Igor	L'Histoire du Soldat	1918	Widor (1906)

Euphonium	Idiomatic scoring	Schoenberg, Arnold	Theme and Variations for Band	1943	Adler (2002)
Euphonium	Ranges: sound quality	Strauss, Richard	Don Quixote	1897	Widor (1906)
Euphonium	Solo use in the orchestra	Holst, Gustav	Second Suite in F for Military Band	1911	Adler (2002)
Euphonium	Solo use in the orchestra	Jacob, Gordon	Giles Farnaby Suite for band	1970	Widor (1906)
Horn	Articulation	Wagner, Richard	Siegfried	1871	Wagner (1959)
Horn	Articulation	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Adler (2002)
Horn	Articulation	Tchaikovsky, Pyotr	Symphony No.5	1888	Widor (1906)
Horn	Articulation	Strauss, Richard	Don Juan	1889	Wagner (1959)
Horn	Articulation	Humperdinck, Engelbert	Hänsel und Gretel	1893	Blatter (1997)
Horn	Articulation	Scriabin, Alexander	Poem of Ecstasy	1908	Kennan & Grantham (2002)
Horn	Double or Triple or Flutter tonguing	Strauss, Richard	Don Quixote	1897	Wagner (1959)
Horn	Double or Triple or Flutter tonguing	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Horn	Double or Triple or Flutter tonguing	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Kennan & Grantham (2002)
Horn	Expressive qualities	Shostakovich, Dmitri	Symphony No.5	1937	Adler (2002)
Horn	Idiomatic scoring	Mozart, Amadeus	Symphony No.40	1788	Adler (2002)
Horn	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Piston (1961)
Horn	Idiomatic scoring	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.5	1810	Adler (2002)
Horn	Idiomatic scoring	Weber, Carl Maria von	Der Freishütz	1821	Kennan & Grantham (2002)
Horn	Idiomatic scoring	Rossini, Gioacchino	Semiramide	1823	Widor (1906)
Horn	Idiomatic scoring	Berlioz, Hector	Roméo et Juliette	1839	Kennan & Grantham (2002)
Horn	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Blatter (1997)
Horn	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Adler (2002)
Horn	Idiomatic scoring	Wagner, Richard	Lohengrin	1848	Blatter (1997)
Horn	Idiomatic scoring	Wagner, Richard	Siegfried	1871	Adler (2002)
Horn	Idiomatic scoring	Brahms, Johannes	Symphony No.3	1883	Kennan & Grantham (2002)
Horn	Idiomatic scoring	Humperdinck, Engelbert	Hänsel und Gretel	1893	Adler (2002)
Horn	Idiomatic scoring	Strauss, Richard	Till Eulenspiegel	1895	Kennan & Grantham (2002)
Horn	Idiomatic scoring	Schoenberg, Arnold	Five Orchestral Pieces	1909	Widor (1906)
Horn	Idiomatic scoring	Casella, Alfredo	Elegia Eroica	1916	Adler (2002)
Horn	Idiomatic scoring	Respighi, Ottorino	Pines of Rome, The	1924	Adler (2002)
Horn	Idiomatic scoring	Stravinsky, Igor	Symphonie de Psalms	1930	Adler (2002)

Horn	Idiomatic scoring	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Blatter (1997)
Horn	Muting	Beethoven, Ludwig van	Symphony No.3	1804	Kennan & Grantham (2002)
Horn	Muting	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.5	1810	Adler (2002)
Horn	Muting	Schubert, Franz	Symphony No.7	1821	Wagner (1959)
Horn	Muting	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Piston (1961)
Horn	Muting	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Horn	Muting	Strauss, Richard	Till Eulenspiegel	1895	Piston (1961)
Horn	Muting	d'Indy, Vincent	Istar	1897	Wagner (1959)
Horn	Muting	Mahler, Gustav	Symphony No.4	1901	Adler (2002)
Horn	Muting	Mahler, Gustav	Das Lied von der Erde	1909	Piston (1961)
Horn	Muting	de Falla, Manuel	El Amor Brujo	1986	Adler (2002)
Horn	Preparing Scores and Parts	Haydn, Josef	Symphony No.6	1761	Widor (1906)
Horn	Preparing Scores and Parts	Berlioz, Hector	Damnation of Faust, The	1846	Piston (1961)
Horn	Preparing Scores and Parts	Wagner, Richard	Rheingold	1854	Piston (1961)
Horn	Preparing Scores and Parts	Wagner, Richard	Tristan und Isolde	1859	Adler (2002)
Horn	Preparing Scores and Parts	Wagner, Richard	Die Meistersinger	1867	Piston (1961)
Horn	Preparing Scores and Parts	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
Horn	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.6	1808	Casella & Mortari (2004)
Horn	Ranges: sound quality	Brahms, Johannes	Symphony No.1	1876	Piston (1961)
Horn	Ranges: sound quality	Franck, César	Symphony	1888	Piston (1961)
Horn	Ranges: sound quality	Strauss, Richard	Till Eulenspiegel	1895	Adler (2002)
Horn	Ranges: sound quality	Ravel, Maurice	Pavane pour une Infante Défunte	1899	Piston (1961)
Horn	Ranges: sound quality	Tower, Joan	Sequoia	1981	Kennan & Grantham (2002)
Horn	Role as accompaniment	Stravinsky, Igor	Divertimento	1937	Piston (1961)
Horn	Scoring Techniques: Balance	Wagner, Richard	Siegfried	1871	Casella & Mortari (2004)
Horn	Scoring Techniques: Colour effects	Beethoven, Ludwig van	Symphony No.5	1808	Widor (1906)
Horn	Scoring Techniques: Colour effects	Schubert, Franz	Symphony No.8	1822	Piston (1961)
Horn	Scoring Techniques: Colour effects	Liszt, Franz	Faust Symphony, A	1857	Casella & Mortari (2004)
Horn	Scoring Techniques: Colour effects	Gounod, Charles	Faust	1859	Kennan & Grantham (2002)
Horn	Scoring Techniques: Colour effects	Bizet, Georges	l'Arlésienne	1872	Casella & Mortari (2004)
Horn	Scoring Techniques: Colour effects	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Casella & Mortari (2004)

Horn	Scoring Techniques: Colour effects	Dukas, Paul	L'Apprenti-Sorcier	1897	Blatter (1997)
Horn	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Horn	Scoring Techniques: Colour effects	Strauss, Richard	Der Rosenkavalier	1911	Piston (1961)
Horn	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Horn	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
Horn	Scoring Techniques: Colour effects	Barber, Samuel	Symphony No.1	1943	Piston (1961)
Horn	Scoring Techniques: Colour effects	Britten, Benjamin	Serenade	1943	Blatter (1997)
Horn	Scoring Techniques: Colour effects	Adams, John	Short Ride in a Fast Machine	1986	Blatter (1997)
Horn	Scoring Techniques: Division of Material	Handel, George Frideric	Judas Maccabaeus	1746	Piston (1961)
Horn	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.40	1788	Blatter (1997)
Horn	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.41	1788	Widor (1906)
Horn	Scoring Techniques: Division of Material	Weber, Carl Maria von	Der Freishütz	1821	Casella & Mortari (2004)
Horn	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.1	1888	Blatter (1997)
Horn	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.5	1888	Adler (2002)
Horn	Scoring Techniques: Division of Material	Strauss, Richard	Don Juan	1889	Piston (1961)
Horn	Scoring Techniques: Doubling	Mozart, Amadeus	Die Zauberflöte	1791	Adler (2002)
Horn	Scoring Techniques: Doubling	Schumann, Robert	Symphony No.1	1841	Widor (1906)
Horn	Scoring Techniques: Doubling	Liszt, Franz	Faust Symphony, A	1857	Adler (2002)
Horn	Scoring Techniques: Doubling	Saint-Saëns, Camille	Danse Macabre	1874	Widor (1906)
Horn	Scoring Techniques: Doubling	Brahms, Johannes	Symphony No.2	1877	Widor (1906)
Horn	Scoring Techniques: Doubling	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Horn	Scoring Techniques: Doubling	Franck, César	Symphony No.1	1888	Blatter (1997)
Horn	Scoring Techniques: Doubling	Strauss, Richard	Don Juan	1889	Widor (1906)
Horn	Scoring Techniques: Doubling	Dvořák, Antonín	Symphony No.9	1893	Adler (2002)
Horn	Scoring Techniques: Doubling	Ganaye, Jean-Baptiste	Ouverture dramatique	1902	Widor (1906)
Horn	Scoring Techniques: Doubling	Debussy, Claude	Mer, La	1905	Widor (1906)
Horn	Scoring Techniques: Doubling	Holst, Gustav	Planets, The	1916	Blatter (1997)
Horn	Scoring Techniques: Doubling	Widor, Charles-Marie	Symphony No.3	1918	Piston (1961)
Horn	Scoring Techniques: Doubling	Varèse, Edgard	Arcana	1927	Piston (1961)
Horn	Scoring Techniques: Reinforcing	Haydn, Josef	Symphony No.100	1794	Piston (1961)
Horn	Scoring Techniques: Reinforcing	Schubert, Franz	Symphony No.8	1822	Piston (1961)

Horn	Scoring Techniques: Reinforcing	Massenet, Jules	Roi de Lahore, Le	1877	Piston (1961)
Horn	Scoring Techniques: Reinforcing	Mahler, Gustav	Symphony No.1	1888	Blatter (1997)
Horn	Scoring Techniques: Reinforcing	Copland, Aaron	Symphony No.3	1946	Piston (1961)
Horn	Solo use in the orchestra	Wagner, Richard	Siegfried	1871	Piston (1961)
Horn	Solo use in the orchestra	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Horn	Solo use in the orchestra	Tchaikovsky, Pyotr	Symphony No.5	1888	Casella & Mortari (2004)
Horn	Solo use in the orchestra	Strauss, Richard	Till Eulenspiegel	1895	Piston (1961)
Horn	Solo use in the orchestra	Shostakovich, Dmitri	Symphony No.5	1937	Kennan & Grantham (2002)
Horn	Technical agility	Bach, Johann Sebastian	B minor Mass	1749	Casella & Mortari (2004)
Horn	Technical agility	Haydn, Josef	Symphony No.4	1761	Casella & Mortari (2004)
Horn	Technical agility	Beethoven, Ludwig van	Fidelio	1805	Piston (1961)
Horn	Technical agility	Wagner, Richard	Siegfried Idyll	1870	Casella & Mortari (2004)
Horn	Technical agility	Brahms, Johannes	Symphony No.1	1876	Piston (1961)
Horn	Technical agility	Debussy, Claude	Nocturnes	1899	Casella & Mortari (2004)
Horn	Technical agility	Mahler, Gustav	Symphony No.9	1909	Piston (1961)
Horn	Technical agility	Strauss, Richard	Elektra	1909	Blatter (1997)
Horn	Technical agility	Bach, Jan	Four 2-Bit Contraptions	1988	Piston (1961)
Horn	Unidiomatic scoring	Beethoven, Ludwig van	Symphony No.7	1812	Piston (1961)
Horn	Unidiomatic scoring	Beethoven, Ludwig van	Symphony No.7	1812	Casella & Mortari (2004)
Horn	Unidiomatic scoring	Berlioz, Hector	Roméo et Juliette	1839	Piston (1961)
Horn	Unidiomatic scoring	Schumann, Robert	Concerto for 4 Horns	1849	Casella & Mortari (2004)
Horn	Unidiomatic scoring	Strauss, Richard	Elektra	1909	Piston (1961)
Trombone	Articulation	Mozart, Amadeus	Requiem	1791	Adler (2002)
Trombone	Articulation	Beethoven, Ludwig van	Symphony No.9	1824	Piston (1961)
Trombone	Articulation	Schumann, Robert	Symphony No.1	1841	Adler (2002)
Trombone	Articulation	Berlioz, Hector	Damnation of Faust, The	1846	Adler (2002)
Trombone	Articulation	Wagner, Richard	Götterdämmerung	1848	Piston (1961)
Trombone	Articulation	Schumann, Robert	Symphony No.3	1850	Adler (2002)
Trombone	Articulation	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
Trombone	Articulation	Strauss, Richard	Till Eulenspiegel	1895	Blatter (1997)
Trombone	Articulation	Hindemith, Paul	Mathis der Maler	1934	Blatter (1997)



Trombone	Articulation	Berg, Alban	Concerto for violin and orchestra	1935	Blatter (1997)
Trombone	Articulation	Sessions, Roger	Symphony No.2	1946	Kennan & Grantham (2002)
Trombone	Double or Triple or Flutter tonguing	Schoenberg, Arnold	Five Orchestral Pieces	1909	Widor (1906)
Trombone	Double or Triple or Flutter tonguing	Petrassi, Goffredo	Concerto for Orchestra	1934	Kennan & Grantham (2002)
Trombone	Dovetailing	Mahler, Gustav	Symphony No.5	1902	Kennan & Grantham (2002)
Trombone	Expressive qualities	Mozart, Amadeus	Requiem	1791	Kennan & Grantham (2002)
Trombone	Expressive qualities	Schumann, Robert	Symphony No.3	1850	Kennan & Grantham (2002)
Trombone	Extended Techniques	Stravinsky, Igor	Noces, Les	1923	Adler (2002)
Trombone	Extended Techniques	Schuller, Gunther	Music for Brass Quintet	1961	Adler (2002)
Trombone	Extended Techniques	Johnston, Ben	One Man	1972	Adler (2002)
Trombone	Extended Techniques	Powell, Morgan	Inacabado	1973	Blatter (1997)
Trombone	Idiomatic scoring	Brahms, Johannes	Symphony No.4	1885	Adler (2002)
Trombone	Idiomatic scoring	Ravel, Maurice	L'Heure Espagnole	1911	Kennan & Grantham (2002)
Trombone	Idiomatic scoring	Prokofiev, Sergei	Chout	1915	Piston (1961)
Trombone	Idiomatic scoring	Ravel, Maurice	Valse, La	1920	Adler (2002)
Trombone	Idiomatic scoring	Hindemith, Paul	Symphonic metamorphosis	1943	Piston (1961)
Trombone	Muting	Copland, Aaron	Concerto for Piano and Orchestra	1926	Adler (2002)
Trombone	Muting	Berg, Alban	Concerto for violin and orchestra	1935	Adler (2002)
Trombone	Ranges: sound quality	Mozart, Amadeus	Requiem	1791	Kennan & Grantham (2002)
Trombone	Ranges: sound quality	Schubert, Franz	Symphony No.7	1821	Piston (1961)
Trombone	Ranges: sound quality	Sibelius, Jean	Symphony No.1	1899	Adler (2002)
Trombone	Ranges: sound quality	Debussy, Claude	Mer, La	1905	Kennan & Grantham (2002)
Trombone	Ranges: sound quality	Casella, Alfredo	Rapsodia spagnola	1909	Adler (2002)
Trombone	Ranges: sound quality	Schmitt, Florent	Antoine et Cléopatre	1920	Adler (2002)
Trombone	Role as accompaniment	Brahms, Johannes	Symphony No.4	1885	Adler (2002)
Trombone	Scoring Techniques: Balance	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Kennan & Grantham (2002)
Trombone	Scoring Techniques: Colour effects	Debussy, Claude	Images pour orchestre	1908	Sevsay (2013)
Trombone	Scoring Techniques: Colour effects	Stravinsky, Igor	L'Oiseau de Feu	1910	Piston (1961)
Trombone	Scoring Techniques: Colour effects	Bartók, Béla	Concerto for violin and orchestra	1938	Adler (2002)
Trombone	Scoring Techniques: Colour effects	Bartók, Béla	Concerto for violin and orchestra	1938	Adler (2002)
Trombone	Scoring Techniques: Colour effects	Khachaturian, Aram	Gayne	1942	Piston (1961)

Trombone	Scoring Techniques: Colour effects	Britten, Benjamin	Young Person's Guide to the Orchestra, The	1946	Adler (2002)
Trombone	Solo use in the orchestra	Mahler, Gustav	Symphony No.3	1896	Adler (2002)
Trombone	Solo use in the orchestra	Schoenberg, Arnold	Five Orchestral Pieces	1909	Piston (1961)
Trombone	Solo use in the orchestra	Stravinsky, Igor	L'Histoire du Soldat	1918	Adler (2002)
Trombone	Solo use in the orchestra	Copland, Aaron	Concerto for Piano and Orchestra	1926	Widor (1906)
Trombone	Solo use in the orchestra	Ravel, Maurice	Bolero	1928	Widor (1906)
Trombone	Technical agility	Mozart, Amadeus	Don Giovanni	1787	Widor (1906)
Trombone	Technical agility	Berlioz, Hector	Damnation of Faust, The	1846	Widor (1906)
Trombone	Technical agility	Wagner, Richard	Götterdämmerung	1848	Adler (2002)
Trombone	Technical agility	Widor, Charles-Marie	Korrigane, La	1880	Widor (1906)
Trombone	Technical agility	Wagner, Richard	Parsifal	1882	Adler (2002)
Trombone	Technical agility	Stravinsky, Igor	L'Oiseau de Feu	1910	Widor (1906)
Trombone	Technical agility	Strauss, Richard	Der Rosenkavalier	1911	Adler (2002)
Trombone	Unidiomatic scoring	Schumann, Robert	Symphony No.3	1850	Adler (2002)
Trombone	Unidiomatic scoring	Bartók, Béla	Dance Suite	1923	Piston (1961)
Trombone Bass	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Casella & Mortari (2004)
Trombone Bass	Idiomatic scoring	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
Trombone Bass	Idiomatic scoring	Stravinsky, Igor	Petrouchka	1911	Widor (1906)
Trombone Bass	Idiomatic scoring	Hindemith, Paul	Mathis der Maler	1934	Kennan & Grantham (2002)
Trombone Bass	Idiomatic scoring	Berio, Luciano	Chemins Ilb	1967	Blatter (1997)
Trombone Bass	Technical agility	Wagner, Richard	Tristan und Isolde	1859	Blatter (1997)
Trumpet	Articulation	Beethoven, Ludwig van	Overture to Coriolanus	1807	Adler (2002)
Trumpet	Articulation	Verdi, Giuseppe	Aida	1870	Adler (2002)
Trumpet	Articulation	Mahler, Gustav	Symphony No.1	1888	Piston (1961)
Trumpet	Articulation	Puccini, Giacomo	La Bohème	1896	Kennan & Grantham (2002)
Trumpet	Articulation	Debussy, Claude	Nocturnes	1899	Adler (2002)
Trumpet	Articulation	Stravinsky, Igor	L'Oiseau de Feu	1910	Blatter (1997)
Trumpet	Articulation	Ravel, Maurice	L'Enfant et les Sortilèges	1920	Widor (1906)
Trumpet	Articulation	Gershwin, George	Rhapsody in Blue	1924	Blatter (1997)
Trumpet	Articulation	Honegger, Arthur	Symphony No.1	1930	Piston (1961)
Trumpet	Articulation	Mortari, Virgilio	Trittico	1952	Piston (1961)

Trumpet	Double or Triple or Flutter tonguing	Berlioz, Hector	Damnation of Faust, The	1846	Piston (1961)
Trumpet	Double or Triple or Flutter tonguing	Meyerbeer, Giacomo	Marche aux Flambeaux 3	1853	Casella & Mortari (2004)
Trumpet	Double or Triple or Flutter tonguing	Wagner, Richard	Kaiser Marsch	1871	Casella & Mortari (2004)
Trumpet	Double or Triple or Flutter tonguing	Delibes, Léo	Sylvia	1876	Piston (1961)
Trumpet	Double or Triple or Flutter tonguing	Lalo, Édouard	Roi d'Ys, Le	1888	Piston (1961)
Trumpet	Double or Triple or Flutter tonguing	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Piston (1961)
Trumpet	Double or Triple or Flutter tonguing	Debussy, Claude	Mer, La	1905	Piston (1961)
Trumpet	Expressive qualities	Beethoven, Ludwig van	Symphony No.1	1800	Adler (2002)
Trumpet	Extended Techniques	Whittenberg, Charles	Polyphony	1960	Casella & Mortari (2004)
Trumpet	Extending the range of another instrument	Strauss, Richard	Ein Heldenleben	1898	Piston (1961)
Trumpet	Extending the range of another instrument	d'Indy, Vincent	Symphony No.2	1903	Blatter (1997)
Trumpet	Extending the range of another instrument	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)
Trumpet	Extending the range of another instrument	Britten, Benjamin	Peter Grimes	1945	Casella & Mortari (2004)
Trumpet	Idiomatic scoring	Bach, Johann Sebastian	Brandenburg Concerto no.2	1721	Blatter (1997)
Trumpet	Idiomatic scoring	Bach, Johann Sebastian	Cantate	1721	Adler (2002)
Trumpet	Idiomatic scoring	Bach, Johann Sebastian	Mass in B minor	1749	Casella & Mortari (2004)
Trumpet	Idiomatic scoring	Mozart, Amadeus	Symphony No.36	1783	Piston (1961)
Trumpet	Idiomatic scoring	Mozart, Amadeus	Concerto for Piano and Orchestra	1784	Piston (1961)
Trumpet	Idiomatic scoring	Haydn, Josef	Symphony No.94	1791	Piston (1961)
Trumpet	Idiomatic scoring	Haydn, Josef	Symphony No.101	1794	Casella & Mortari (2004)
Trumpet	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Piston (1961)
Trumpet	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Piston (1961)
Trumpet	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.5	1808	Adler (2002)
Trumpet	Idiomatic scoring	Saint-Saëns, Camille	Symphony No.3	1886	Kennan & Grantham (2002)
Trumpet	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.6	1893	Piston (1961)
Trumpet	Idiomatic scoring	Mahler, Gustav	Symphony No.5	1902	Piston (1961)
Trumpet	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Piston (1961)
Trumpet	Idiomatic scoring	Casella, Alfredo	Giara, La	1924	Casella & Mortari (2004)
Trumpet	Idiomatic scoring	Copland, Aaron	Music for the Theater	1925	Blatter (1997)
Trumpet	Idiomatic scoring	Adams, John	Short Ride in a Fast Machine	1986	Kennan & Grantham (2002)
Trumpet	Muting	Beethoven, Ludwig van	Leonore	1807	Blatter (1997)

Trumpet	Muting	Wagner, Richard	Die Meistersinger	1867	Piston (1961)
Trumpet	Muting	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Adler (2002)
Trumpet	Muting	Strauss, Richard	Ein Heldenleben	1898	Blatter (1997)
Trumpet	Muting	Debussy, Claude	Nocturnes	1899	Adler (2002)
Trumpet	Muting	Charpentier, Marc-Antonie	Louise	1900	Kennan & Grantham (2002)
Trumpet	Muting	Stravinsky, Igor	Petrouchka	1911	Piston (1961)
Trumpet	Muting	Berg, Alban	Concerto for violin and orchestra	1935	Kennan & Grantham (2002)
Trumpet	Muting	Copland, Aaron	Outdoor Overture, An	1938	Piston (1961)
Trumpet	Muting	Carter, Elliot	Symphony for 3 orchestras	1976	Blatter (1997)
Trumpet	Ranges: sound quality	Bach, Johann Sebastian	Brandenburg Concerto no.2	1721	Adler (2002)
Trumpet	Ranges: sound quality	Bach, Johann Sebastian	Oratorio de Noël	1734	Kennan & Grantham (2002)
Trumpet	Ranges: sound quality	Mozart, Amadeus	Symphony No.40	1788	Piston (1961)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.3	1804	Blatter (1997)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.4	1805	Casella & Mortari (2004)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Leonore	1807	Piston (1961)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.5	1808	Adler (2002)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.5	1808	Piston (1961)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.6	1808	Adler (2002)
Trumpet	Ranges: sound quality	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.5	1810	Piston (1961)
Trumpet	Ranges: sound quality	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Piston (1961)
Trumpet	Ranges: sound quality	d'Indy, Vincent	Symphony No.1	1875	Casella & Mortari (2004)
Trumpet	Ranges: sound quality	Tchaikovsky, Pyotr	Capriccio Italien	1880	Blatter (1997)
Trumpet	Ranges: sound quality	Bruckner, Anton	Symphony No.7	1885	Kennan & Grantham (2002)
Trumpet	Ranges: sound quality	Bruckner, Anton	Symphony No.7	1885	Casella & Mortari (2004)
Trumpet	Ranges: sound quality	Mahler, Gustav	Symphony No.2	1894	Piston (1961)
Trumpet	Ranges: sound quality	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Trumpet	Ranges: sound quality	Ravel, Maurice	Rapsodie Espagnole	1907	Adler (2002)
Trumpet	Ranges: sound quality	Ravel, Maurice	Rapsodie Espagnole	1907	Blatter (1997)
Trumpet	Ranges: sound quality	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Trumpet	Ranges: sound quality	Hindemith, Paul	Concerto for Orchestra	1925	Piston (1961)
Trumpet	Ranges: sound quality	Shostakovich, Dmitri	Symphony No.5	1937	Casella & Mortari (2004)

Trumpet	Ranges: sound quality	Copland, Aaron	Outdoor Overture, An	1938	Casella & Mortari (2004)
Trumpet	Ranges: sound quality	Stravinsky, Igor	Symphony No.2	1940	Piston (1961)
Trumpet	Ranges: sound quality	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Trumpet	Scoring Techniques: Balance	Beethoven, Ludwig van	Symphony No.6	1808	Piston (1961)
Trumpet	Scoring Techniques: Balance	Debussy, Claude	Mer, La	1905	Piston (1961)
Trumpet	Scoring Techniques: Balance	Casella, Alfredo	Partita	1924	Adler (2002)
Trumpet	Scoring Techniques: Colour effects	Ravel, Maurice	Daphnis et Chloé	1912	Blatter (1997)
Trumpet	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
Trumpet	Scoring Techniques: Doubling	Stravinsky, Igor	Sacre du Printemps, Le	1913	Blatter (1997)
Trumpet	Scoring Techniques: Doubling	Stravinsky, Igor	Suite for chamber orchestra	1921	Blatter (1997)
Trumpet	Unidiomatic scoring	Bach, Johann Sebastian	Brandenburg Concerto no.2	1721	Adler (2002)
Trumpet	Unidiomatic scoring	Mozart, Amadeus	Don Giovanni	1787	Adler (2002)
Trumpet	Unidiomatic scoring	Beethoven, Ludwig van	Symphony No.9	1824	Adler (2002)
Trumpet	Unidiomatic scoring	Schumann, Robert	Manfred	1848	Adler (2002)
Tuba	Articulation	Mahler, Gustav	Symphony No.8	1907	Adler (2002)
Tuba	Double or Triple or Flutter tonguing	Schoenberg, Arnold	Erwartung	1909	Adler (2002)
Tuba	Expressive qualities	Gershwin, George	American in Paris, An	1928	Adler (2002)
Tuba	Expressive qualities	Casella, Alfredo	Symphony No.3	1937	Adler (2002)
Tuba	Extended Techniques	Powell, Morgan	Midnight Realities	1973	Sevsay (2013)
Tuba	Extended Techniques	Blatter, Alfred	Cameos for tuba alone	1974	Adler (2002)
Tuba	Extending the range of another instrument	Bruckner, Anton	Symphony No.7	1885	Adler (2002)
Tuba	Idiomatic scoring	Wagner, Richard	Der fliegende Holländer	1841	Piston (1961)
Tuba	Idiomatic scoring	Mahler, Gustav	Symphony No.1	1888	Adler (2002)
Tuba	Idiomatic scoring	Mahler, Gustav	Symphony No.1	1888	Piston (1961)
Tuba	Idiomatic scoring	Mahler, Gustav	Symphony No.6	1904	Adler (2002)
Tuba	Idiomatic scoring	Ravel, Maurice	Valse, La	1920	Adler (2002)
Tuba	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Piston (1961)
Tuba	Idiomatic scoring	Prokofiev, Sergei	Symphony No.5	1944	Adler (2002)
Tuba	Muting	Wagner, Richard	Siegfried	1871	Adler (2002)
Tuba	Muting	Strauss, Richard	Don Juan	1889	Piston (1961)
Tuba	Muting	Stravinsky, Igor	L'Oiseau de Feu	1910	Adler (2002)

Tuba	Muting	Stravinsky, Igor	Petrouchka	1911	Piston (1961)
Tuba	Muting	Davies, Peter Maxwell	St. Thomas Wake	1969	Adler (2002)
Tuba	Preparing Scores and Parts	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Tuba	Ranges: sound quality	Wagner, Richard	Eine Faust Ouverture	1840	Adler (2002)
Tuba	Ranges: sound quality	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
Tuba	Ranges: sound quality	Stravinsky, Igor	Petrouchka	1911	Adler (2002)
Tuba	Role as accompaniment	Stravinsky, Igor	Jeu du cartes	1937	Adler (2002)
Tuba	Scoring Techniques: Colour effects	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Tuba	Scoring Techniques: Colour effects	Schoenberg, Arnold	Erwartung	1909	Adler (2002)
Tuba	Solo use in the orchestra	Wagner, Richard	Die Meistersinger	1867	Kennan & Grantham (2002)
Tuba	Solo use in the orchestra	Strauss, Richard	Don Quixote	1897	Adler (2002)
Tuba	Solo use in the orchestra	Stravinsky, Igor	Petrouchka	1911	Adler (2002)
Tuba	Solo use in the orchestra	Respighi, Ottorino	Fountains of Rome, The	1918	Adler (2002)
Tuba	Solo use in the orchestra	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Kennan & Grantham (2002)
Tuba	Solo use in the orchestra	Prokofiev, Sergei	Symphony No.5	1944	Adler (2002)
Tuba	Technical agility	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Tuba	Technical agility	Strauss, Richard	Also Sprach Zarathustra	1896	Adler (2002)
Tuba	Technical agility	Strauss, Richard	Don Quixote	1897	Adler (2002)
Tuba	Technical agility	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
Tuba	Technical agility	Ravel, Maurice	Valse, La	1920	Kennan & Grantham (2002)
Tuba	Technical agility	Shostakovich, Dmitri	Symphony No.7	1941	Kennan & Grantham (2002)
Tuba	Technical agility	Hindemith, Paul	Symphonic metamorphosis	1943	Kennan & Grantham (2002)
Tuba	Technical agility	Schuller, Gunther	Music for Brass Quintet	1961	Adler (2002)
Tuba	Unidiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Adler (2002)

Addendum B Table 18 -- Examples regarding woodwind instruments referenced in various orchestration textbooks:

Instrument/Group	Technique or reference	Composer	Composition	Year	Reference Source
Bassoon	Articulation	Beethoven, Ludwig van	Symphony No.4	1806	Piston (1961)
Bassoon	Articulation	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Blatter (1997)
Bassoon	Articulation	Gounod, Charles	Faust	1859	Widor (1906)
Bassoon	Articulation	Brahms, Johannes	Academic Festival Overture	1880	Blatter (1997)
Bassoon	Double or Triple or Flutter tonguing	Mozart, Amadeus	Cosi Fan Tutte	1789	Piston (1961)
Bassoon	Expressive qualities	Haydn, Josef	Symphony No.100	1794	Piston (1961)
Bassoon	Expressive qualities	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Piston (1961)
Bassoon	Expressive qualities	Stravinsky, Igor	Noces, Les	1923	Blatter (1997)
Bassoon	Expressive qualities	Stravinsky, Igor	Octet for wind instruments	1923	Casella & Mortari (2004)
Bassoon	Expressive qualities	Mortari, Virgilio	Rapsodia Elegiaca	1978	Casella & Mortari (2004)
Bassoon	Extended Techniques	Yannay, Yehuda	preFIX-FIX-sufFIX	1972	Blatter (1997)
Bassoon	Idiomatic scoring	Mozart, Amadeus	Nozze di Figaro, Le	1786	Adler (2002)
Bassoon	Idiomatic scoring	Mozart, Amadeus	Symphony No.41	1788	Sevsay (2013)
Bassoon	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.4	1806	Wagner (1959)
Bassoon	Idiomatic scoring	Berlioz, Hector	Symphonie Fantastique	1830	Wagner (1959)
Bassoon	Idiomatic scoring	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Blatter (1997)
Bassoon	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Sevsay (2013)
Bassoon	Idiomatic scoring	Bizet, Georges	Carmen	1875	Adler (2002)
Bassoon	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Wagner (1959)
Bassoon	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.6	1893	Adler (2002)
Bassoon	Idiomatic scoring	Dukas, Paul	L'apprenti sorcier	1897	Casella & Mortari (2004)
Bassoon	Idiomatic scoring	Dukas, Paul	L'Apprenti sorcier	1897	Wagner (1959)
Bassoon	Idiomatic scoring	Dukas, Paul	L'Apprenti-Sorcier	1897	Adler (2002)
Bassoon	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Bassoon	Idiomatic scoring	Stravinsky, Igor	Octet for wind instruments	1923	Casella & Mortari (2004)
Bassoon	Idiomatic scoring	Berg, Alban	Concerto for violin and orchestra	1935	Piston (1961)
Bassoon	Idiomatic scoring	Copland, Aaron	El Salon Mexico	1936	Wagner (1959)

Bassoon	Idiomatic scoring	Bartók, Béla	Concerto for Orchestra	1943	Adler (2002)
Bassoon	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.9	1824	Piston (1961)
Bassoon	Ranges: sound quality	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Blatter (1997)
Bassoon	Ranges: sound quality	Wagner, Richard	Tannhäuser	1845	Widor (1906)
Bassoon	Ranges: sound quality	Wagner, Richard	Tannhäuser	1845	Piston (1961)
Bassoon	Ranges: sound quality	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Bassoon	Ranges: sound quality	Tchaikovsky, Pyotr	Nutcracker, The	1892	Casella & Mortari (2004)
Bassoon	Ranges: sound quality	Tchaikovsky, Pyotr	Symphony No.6	1893	Blatter (1997)
Bassoon	Ranges: sound quality	Milhaud, Daries	Second Symphonic Suite	1919	Piston (1961)
Bassoon	Ranges: sound quality	Hindemith, Paul	Concerto for Orchestra	1925	Piston (1961)
Bassoon	Ranges: sound quality	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Casella & Mortari (2004)
Bassoon	Ranges: sound quality	Schoenberg, Arnold	Theme and Variations for Band	1943	Blatter (1997)
Bassoon	Ranges: sound quality	Carter, Elliot	Eight Etudes and a Fantasy	1950	Blatter (1997)
Bassoon	Role as accompaniment	Wagner, Richard	Die Meistersinger	1867	Widor (1906)
Bassoon	Role as accompaniment	Widor, Charles-Marie	Symphony No.4	1876	Widor (1906)
Bassoon	Scoring Techniques: Balance	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Widor (1906)
Bassoon	Scoring Techniques: Colour effects	Berlioz, Hector	Roméo et Juliette	1839	Piston (1961)
Bassoon	Scoring Techniques: Colour effects	Ravel, Maurice	Valses nobles et sentimentales	1912	Casella & Mortari (2004)
Bassoon	Scoring Techniques: Colour effects	Stravinsky, Igor	Chant du Rossignol	1923	Casella & Mortari (2004)
Bassoon	Scoring Techniques: Division of Material	Brahms, Johannes	Concerto for Piano and Orchestra no.1	1858	Piston (1961)
Bassoon	Scoring Techniques: Doubling	Mozart, Amadeus	Nozze di Figaro, Le	1786	Widor (1906)
Bassoon	Scoring Techniques: Doubling	Mozart, Amadeus	Die Zauberflöte	1791	Widor (1906)
Bassoon	Scoring Techniques: Doubling	Beethoven, Ludwig van	Symphony No.4	1806	Widor (1906)
Bassoon	Scoring Techniques: Doubling	Meyerbeer, Giacomo	Struensee	1862	Widor (1906)
Bassoon	Scoring Techniques: Dovetailing	Prokofiev, Sergei	Symphony No.5	1944	Piston (1961)
Bassoon	Solo use in the orchestra	Haydn, Josef	Symphony No.104	1795	Sevsay (2013)
Bassoon	Solo use in the orchestra	Beethoven, Ludwig van	Symphony No.5	1808	Kennan & Grantham (2002)
Bassoon	Solo use in the orchestra	Tchaikovsky, Pyotr	Symphony No.4	1877	Kennan & Grantham (2002)
Bassoon	Solo use in the orchestra	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Blatter (1997)
Bassoon	Solo use in the orchestra	Dukas, Paul	L'Apprenti-Sorcier	1897	Kennan & Grantham (2002)
Bassoon	Solo use in the orchestra	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)



Bassoon	Solo use in the orchestra	Casella, Alfredo	Elegia Eroica	1916	Casella & Mortari (2004)
Bassoon	Solo use in the orchestra	Stravinsky, Igor	Symphony No.2	1940	Piston (1961)
Bassoon	Solo use in the orchestra	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Bassoon	Solo use in the orchestra	Bartók, Béla	Concerto for Orchestra	1943	Kennan & Grantham (2002)
Bassoon	Technical agility	Castelnuovo-Tedesco, Mario	Overture: La Dodicesima notte	1933	Casella & Mortari (2004)
Bassoon	Technical agility	Yannay, Yehuda	preFIX-FIX-sufFIX	1972	Blatter (1997)
Bassoon	Unidiomatic scoring	Tchaikovsky, Pyotr	1812 Overture	1880	Piston (1961)
Bassoon: Contrabassoon	Articulation	Strauss, Richard	Till Eulenspiegel	1895	Piston (1961)
Bassoon: Contrabassoon	Expressive qualities	Strauss, Richard	Salome	1905	Casella & Mortari (2004)
Bassoon: Contrabassoon	Idiomatic scoring	Brahms, Johannes	Variations on a Theme by Haydn	1873	Adler (2002)
Bassoon: Contrabassoon	Idiomatic scoring	Saint-Saëns, Camille	Symphony No.3	1886	Widor (1906)
Bassoon: Contrabassoon	Idiomatic scoring	Strauss, Richard	Salome	1905	Adler (2002)
Bassoon: Contrabassoon	Idiomatic scoring	Ravel, Maurice	Ma Mère L'Oye	1911	Adler (2002)
Bassoon: Contrabassoon	Idiomatic scoring	Ravel, Maurice	Valse, La	1920	Adler (2002)
Bassoon: Contrabassoon	Scoring Techniques: Doubling	Beethoven, Ludwig van	Symphony No.5	1808	Blatter (1997)
Bassoon: Contrabassoon	Scoring Techniques: Doubling	Strauss, Richard	Elektra	1909	Piston (1961)
Bassoon: Contrabassoon	Scoring Techniques: Doubling	Tippett, Michael	Symphony No.4	1977	Kennan & Grantham (2002)
Bassoon: Contrabassoon	Scoring Techniques: Reinforcing	Brahms, Johannes	Variations on a Theme by Haydn	1873	Wagner (1959)
Bassoon: Contrabassoon	Solo use in the orchestra	Brahms, Johannes	Symphony No.4	1885	Blatter (1997)
Bassoon: Contrabassoon	Solo use in the orchestra	Dukas, Paul	L'Apprenti-Sorcier	1897	Kennan & Grantham (2002)
Bassoon: Contrabassoon	Solo use in the orchestra	Mahler, Gustav	Symphony No.9	1909	Piston (1961)
Bassoon: Contrabassoon	Solo use in the orchestra	Ravel, Maurice	Ma Mère L'Oye	1911	Casella & Mortari (2004)
Bassoon: Contrabassoon	Solo use in the orchestra	Ravel, Maurice	Ma Mère L'Oye	1911	Wagner (1959)
Bassoon: Contrabassoon	Solo use in the orchestra	Ravel, Maurice	Ma Mère L'Oye	1911	Kennan & Grantham (2002)
Bassoon: Contrabassoon	Solo use in the orchestra	Tippett, Michael	Symphony No.4	1977	Kennan & Grantham (2002)
Bassoon: Contrabassoon	Technical agility	Ravel, Maurice	Valse, La	1920	Piston (1961)
Bassoon: Contrabassoon	Unidiomatic scoring	Beethoven, Ludwig van	Symphony No.9	1824	Widor (1906)
Clarinet: Bass	Double or Triple or Flutter tonguing	Schoenberg, Arnold	Pierrot Lunaire	1912	Casella & Mortari (2004)
Clarinet: Bass	Expressive qualities	Schoenberg, Arnold	Pierrot Lunaire	1912	Casella & Mortari (2004)
Clarinet: Bass	Idiomatic scoring	Wagner, Richard	Götterdämmerung	1848	Adler (2002)
Clarinet: Bass	Idiomatic scoring	Wagner, Richard	Tristan und Isolde	1859	Adler (2002)

Clarinet: Bass	Idiomatic scoring	Strauss, Richard	Salome	1905	Adler (2002)
Clarinet: Bass	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Clarinet: Bass	Preparing Scores and Parts	Franck, César	Symphony	1888	Kennan & Grantham (2002)
Clarinet: Bass	Preparing Scores and Parts	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
Clarinet: Bass	Ranges: sound quality	Mozart, Amadeus	Symphony No.39	1788	Piston (1961)
Clarinet: Bass	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.7	1812	Piston (1961)
Clarinet: Bass	Ranges: sound quality	Strauss, Richard	Ein Heldenleben	1898	Piston (1961)
Clarinet: Bass	Ranges: sound quality	Bertelin, Albert	Legend of the Loreley	1900	Widor (1906)
Clarinet: Bass	Ranges: sound quality	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)
Clarinet: Bass	Ranges: sound quality	Schuman, William Howard	Symphony No.3	1941	Piston (1961)
Clarinet: Bass	Ranges: sound quality	Schuman, William Howard	Symphony No.3	1942	Kennan & Grantham (2002)
Clarinet: Bass	Ranges: sound quality	Milhaud, Daries	Symphony No.2	1944	Piston (1961)
Clarinet: Bass	Solo use in the orchestra	Strauss, Richard	Tod und Verklärung	1889	Wagner (1959)
Clarinet: Bass	Solo use in the orchestra	Strauss, Richard	Don Quixote	1897	Wagner (1959)
Clarinet: Bass	Solo use in the orchestra	Stravinsky, Igor	Sacre du Printemps, Le	1913	Wagner (1959)
Clarinet: Bass	Solo use in the orchestra	Shostakovich, Dmitri	Symphony No.7	1941	Piston (1961)
Clarinet: Bass	Technical agility	Stravinsky, Igor	Sacre du Printemps, Le	1913	Blatter (1997)
Clarinet: Bass	Technical agility	Grofé, Ferde	Grand Canyon Suite	1931	Blatter (1997)
Clarinet: Bass	Transposition	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)
Clarinet: Piccolo	Idiomatic scoring	Berlioz, Hector	Symphonie Fantastique	1830	Kennan & Grantham (2002)
Clarinet: Piccolo	Idiomatic scoring	Berlioz, Hector	Symphonie Fantastique	1830	Adler (2002)
Clarinet: Piccolo	Idiomatic scoring	Berlioz, Hector	Symphonie Fantastique	1830	Blatter (1997)
Clarinet: Piccolo	Idiomatic scoring	Wagner, Richard	Walküre	1856	Widor (1906)
Clarinet: Piccolo	Idiomatic scoring	Strauss, Richard	Till Eulenspiegel	1895	Piston (1961)
Clarinet: Piccolo	Idiomatic scoring	Strauss, Richard	Till Eulenspiegel	1895	Adler (2002)
Clarinet: Piccolo	Idiomatic scoring	Mahler, Gustav	Symphony No.3	1896	Adler (2002)
Clarinet: Piccolo	Idiomatic scoring	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Clarinet: Piccolo	Idiomatic scoring	Ravel, Maurice	L'Enfant et les Sortilèges	1920	Casella & Mortari (2004)
Clarinet: Piccolo	Idiomatic scoring	Copland, Aaron	El Salon Mexico	1936	Kennan & Grantham (2002)
Clarinet: Piccolo	Scoring Techniques: Doubling	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)
Clarinet: Piccolo	Solo use in the orchestra	Strauss, Richard	Till Eulenspiegel	1895	Blatter (1997)

Clarinet: Piccolo	Unidiomatic scoring	Berlioz, Hector	Symphonie fantastique	1830	Casella & Mortari (2004)
Clarinet: Soprano	Double or Triple or Flutter tonguing	Mendelssohn, Felix	Symphony No.4	1833	Piston (1961)
Clarinet: Soprano	Expressive qualities	Brahms, Johannes	Symphony No.4	1885	Blatter (1997)
Clarinet: Soprano	Expressive qualities	Tchaikovsky, Pyotr	Symphony No.6	1893	Blatter (1997)
Clarinet: Soprano	Idiomatic scoring	Mozart, Amadeus	Symphony No.39	1788	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Mendelssohn, Felix	Hebrides Overture, The	1832	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Sevsay (2013)
Clarinet: Soprano	Idiomatic scoring	Wagner, Richard	Tannhäuser	1845	Kennan & Grantham (2002)
Clarinet: Soprano	Idiomatic scoring	Brahms, Johannes	Symphony No.1	1876	Kennan & Grantham (2002)
Clarinet: Soprano	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Kennan & Grantham (2002)
Clarinet: Soprano	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Mahler, Gustav	Symphony No.7	1905	Casella & Mortari (2004)
Clarinet: Soprano	Idiomatic scoring	Mahler, Gustav	Symphony No.7	1905	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Golden Cockerel, The	1907	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Stravinsky, Igor	L'Histoire du Soldat	1918	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Kodály, Zoltán	Psalmus Hungaricus	1923	Adler (2002)
Clarinet: Soprano	Idiomatic scoring	Stravinsky, Igor	Divertimento	1937	Piston (1961)
Clarinet: Soprano	Ranges: sound quality	Mozart, Amadeus	Symphony No.39	1788	Wagner (1959)
Clarinet: Soprano	Ranges: sound quality	Mozart, Amadeus	Symphony no.39	1788	Blatter (1997)
Clarinet: Soprano	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.6	1808	Wagner (1959)
Clarinet: Soprano	Ranges: sound quality	Berlioz, Hector	Symphonie Fantastique	1830	Piston (1961)
Clarinet: Soprano	Ranges: sound quality	Mendelssohn, Felix	Hebrides Overture, The	1832	Wagner (1959)
Clarinet: Soprano	Ranges: sound quality	Wagner, Richard	Tannhäuser	1845	Wagner (1959)
Clarinet: Soprano	Ranges: sound quality	Tchaikovsky, Pyotr	Symphony No.5	1888	Wagner (1959)
Clarinet: Soprano	Ranges: sound quality	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Piston (1961)
Clarinet: Soprano	Ranges: sound quality	Sibelius, Jean	Symphony No.1	1899	Blatter (1997)
Clarinet: Soprano	Ranges: sound quality	Casella, Alfredo	Pupazzetti	1915	Piston (1961)
Clarinet: Soprano	Ranges: sound quality	Respighi, Ottorino	Fountains of Rome, The	1918	Piston (1961)
Clarinet: Soprano	Ranges: sound quality	Berg, Alban	Concerto for violin and orchestra	1935	Piston (1961)
Clarinet: Soprano	Ranges: sound quality	Stravinsky, Igor	Symphony No.2	1940	Piston (1961)

Clarinet: Soprano	Ranges: sound quality	Tower, Joan	Clarinet Concerto	1988	Blatter (1997)
Clarinet: Soprano	Role as accompaniment	Stravinsky, Igor	Petrouchka	1911	Piston (1961)
Clarinet: Soprano	Scoring Techniques: Balance	Beethoven, Ludwig van	Egmont	1787	Widor (1906)
Clarinet: Soprano	Scoring Techniques: Colour effects	Berlioz, Hector	Béatrice et Bénédict	1862	Widor (1906)
Clarinet: Soprano	Solo use in the orchestra	Tchaikovsky, Pyotr	Symphony No.6	1893	Kennan & Grantham (2002)
Clarinet: Soprano	Solo use in the orchestra	Stravinsky, Igor	Petrouchka	1911	Casella & Mortari (2004)
Clarinet: Soprano	Solo use in the orchestra	Schoenberg, Arnold	Pierrot Lunaire	1912	Casella & Mortari (2004)
Clarinet: Soprano	Solo use in the orchestra	Stravinsky, Igor	L'histoire du Soldat	1918	Casella & Mortari (2004)
Clarinet: Soprano	Solo use in the orchestra	Pizzetti, Ildebrando	Concerto dell'estate	1922	Casella & Mortari (2004)
Clarinet: Soprano	Solo use in the orchestra	Gershwin, George	Rhapsody in Blue	1924	Adler (2002)
Clarinet: Soprano	Solo use in the orchestra	Copland, Aaron	Appalachian Spring	1944	Adler (2002)
Clarinet: Soprano	Technical agility	Beethoven, Ludwig van	Septet	1799	Widor (1906)
Clarinet: Soprano	Technical agility	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Blatter (1997)
Clarinet: Soprano	Technical agility	Widor, Charles-Marie	Introduction and Rondo	1898	Widor (1906)
Clarinet: Soprano	Technical agility	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Clarinet: Soprano	Technical agility	Rimsky-Korsakov, Nicolai	Golden Cockerel, The	1907	Casella & Mortari (2004)
Clarinet: Soprano	Technical agility	Schoenberg, Arnold	Erwartung	1909	Casella & Mortari (2004)
Clarinet: Soprano	Technical agility	Debussy, Claude	Primière Rhapsodie	1910	Piston (1961)
Clarinet: Soprano	Technical agility	Schoenberg, Arnold	Pierrot Lunaire	1912	Piston (1961)
Clarinet: Soprano	Technical agility	Kodály, Zoltán	Psalmus Hungaricus	1923	Piston (1961)
Clarinet: Soprano	Technical agility	Walton, William	Sinfonia Concertante	1927	Casella & Mortari (2004)
Clarinet: Soprano	Unidiomatic scoring	Mendelssohn, Felix	Symphony No.4	1833	Widor (1906)
Clarinet: Soprano	Unidiomatic scoring	Ravel, Maurice	Alborada del Gracioso	1918	Casella & Mortari (2004)
English Horn	Expressive qualities	Dvořák, Antonín	Symphony No.9	1893	Blatter (1997)
English Horn	Extending the range of another instrument	Bartók, Béla	Second Rhapsody for Violin and Orchestra	1928	Piston (1961)
English Horn	Idiomatic scoring	Wagner, Richard	Tristan und Isolde	1859	Wagner (1959)
English Horn	Idiomatic scoring	Wagner, Richard	Tristan und Isolde	1859	Adler (2002)
English Horn	Idiomatic scoring	Berlioz, Hector	Carnival Romain, Le	1868	Adler (2002)
English Horn	Idiomatic scoring	Franck, César	Symphony	1888	Kennan & Grantham (2002)
English Horn	Idiomatic scoring	Franck, César	Symphony	1888	Wagner (1959)
English Horn	Idiomatic scoring	Sibelius, Jean	Swan of Tuonela, The	1895	Adler (2002)

English Horn	Idiomatic scoring	Sibelius, Jean	Swan of Tuonela, The	1895	Wagner (1959)
English Horn	Idiomatic scoring	Debussy, Claude	Mer, La	1905	Kennan & Grantham (2002)
English Horn	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Wagner (1959)
English Horn	Muting	Rimsky-Korsakov, Nicolai	Legend of the Invisible City of Kitèj, The	1904	Casella & Mortari (2004)
English Horn	Ranges: sound quality	Stravinsky, Igor	Petrouchka	1911	Casella & Mortari (2004)
English Horn	Scoring Techniques: Doubling	Debussy, Claude	Mer, La	1905	Piston (1961)
English Horn	Solo use in the orchestra	Berlioz, Hector	Carnival Romain, Le	1868	Piston (1961)
English Horn	Solo use in the orchestra	Dvořák, Antonín	Symphony No.9	1893	Kennan & Grantham (2002)
English Horn	Solo use in the orchestra	Strauss, Richard	Ein Heldenleben	1898	Piston (1961)
English Horn	Solo use in the orchestra	de Falla, Manuel	El sombrero de tres picos	1917	Casella & Mortari (2004)
English Horn	Unidiomatic scoring	Roussel, Albert	Bacchus et Ariane, Second Suite	1930	Piston (1961)
Flute	Articulation	Beethoven, Ludwig van	Symphony No.6	1808	Blatter (1997)
Flute	Articulation	Beethoven, Ludwig van	Symphony No.8	1812	Adler (2002)
Flute	Articulation	Mendelssohn, Felix	Symphony No.4	1833	Adler (2002)
Flute	Articulation	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Adler (2002)
Flute	Double or Triple or Flutter tonguing	Mendelssohn, Felix	Symphony No.4	1833	Blatter (1997)
Flute	Double or Triple or Flutter tonguing	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Widor (1906)
Flute	Double or Triple or Flutter tonguing	Gounod, Charles	Faust	1859	Widor (1906)
Flute	Double or Triple or Flutter tonguing	Saint-Saëns, Camille	Ascanio	1890	Widor (1906)
Flute	Double or Triple or Flutter tonguing	Tchaikovsky, Pyotr	Nutcracker, The	1892	Piston (1961)
Flute	Double or Triple or Flutter tonguing	Debussy, Claude	Pelléas et Mélisande	1902	Casella & Mortari (2004)
Flute	Double or Triple or Flutter tonguing	Debussy, Claude	Mer, La	1905	Piston (1961)
Flute	Double or Triple or Flutter tonguing	Schoenberg, Arnold	Pierrot Lunaire	1912	Casella & Mortari (2004)
Flute	Double or Triple or Flutter tonguing	Stravinsky, Igor	Dumbarton Oaks	1938	Casella & Mortari (2004)
Flute	Double or Triple or Flutter tonguing	Mortari, Virgilio	L'allegria Piazzetta	1949	Casella & Mortari (2004)
Flute	Expressive qualities	Widor, Charles-Marie	Conte d'Avril	1892	Widor (1906)
Flute	Expressive qualities	Tchaikovsky, Pyotr	Nutcracker, The	1892	Adler (2002)
Flute	Expressive qualities	Stravinsky, Igor	L'Oiseau de Feu	1910	Sevsay (2013)
Flute	Extended Techniques	Strauss, Richard	Salome	1905	Adler (2002)
Flute	Extended Techniques	Ravel, Maurice	Daphnis et Chloé	1912	Adler (2002)
Flute	Extended Techniques	Ravel, Maurice	Daphnis et Chloé	1912	Adler (2002)

Flute	Extended Techniques	Penderecki, Krzysztof	Passion and Death of Our Lord Jesus Christ According to St. Luke, The	1965	Blatter (1997)
Flute	Extended Techniques	Polin, Claire	Death of Procris, The	1973	Adler (2002)
Flute	Extended Techniques	Polin, Claire	Death of Procris, The	1973	Adler (2002)
Flute	Extended Techniques	Zonn, Paul	Well Pursued	1974	Blatter (1997)
Flute	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Kennan & Grantham (2002)
Flute	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Wagner (1959)
Flute	Idiomatic scoring	Rossini, Gioacchino	William Tell	1829	Adler (2002)
Flute	Idiomatic scoring	Bizet, Georges	Carmen	1875	Adler (2002)
Flute	Idiomatic scoring	Tchaikovsky, Pyotr	Concerto for Piano and Orchestra no.1	1875	Adler (2002)
Flute	Idiomatic scoring	Brahms, Johannes	Symphony No.1	1876	Kennan & Grantham (2002)
Flute	Idiomatic scoring	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
Flute	Idiomatic scoring	Brahms, Johannes	Symphony No.4	1885	Adler (2002)
Flute	Idiomatic scoring	Tchaikovsky, Pyotr	Nutcracker, The	1892	Kennan & Grantham (2002)
Flute	Idiomatic scoring	Dvořák, Antonín	Symphony No.9	1893	Adler (2002)
Flute	Idiomatic scoring	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Adler (2002)
Flute	Idiomatic scoring	Stravinsky, Igor	L'Oiseau de Feu	1910	Wagner (1959)
Flute	Idiomatic scoring	Ravel, Maurice	Daphnis et Chloé	1912	Kennan & Grantham (2002)
Flute	Idiomatic scoring	Prokofiev, Sergei	Peter and the Wolf	1936	Wagner (1959)
Flute	Idiomatic scoring	Piston, Walter	Incredible Flutist, The	1938	Wagner (1959)
Flute	Idiomatic scoring	Piston, Walter	Incredible Flutist, The	1938	Adler (2002)
Flute	Multiple Notes	Eberhard, Dennis	Paraphrases	1968	Blatter (1997)
Flute	Ranges: sound quality	Schumann, Robert	Symphony No.1	1841	Piston (1961)
Flute	Ranges: sound quality	Bizet, Georges	Carmen	1875	Blatter (1997)
Flute	Ranges: sound quality	Strauss, Richard	Symphonia Domestica	1903	Piston (1961)
Flute	Ranges: sound quality	Debussy, Claude	Images pour orchestre	1908	Casella & Mortari (2004)
Flute	Ranges: sound quality	Ravel, Maurice	Ma Mère L'Oye	1911	Piston (1961)
Flute	Ranges: sound quality	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Flute	Ranges: sound quality	Casella, Alfredo	Il convento Veneziano	1914	Casella & Mortari (2004)
Flute	Ranges: sound quality	Casella, Alfredo	A notta alta	1917	Casella & Mortari (2004)
Flute	Ranges: sound quality	Stravinsky, Igor	Symphonie de Psalms	1930	Piston (1961)

Flute	Ranges: sound quality	Tansman, Alexandre	Quatre danses polonaises	1932	Casella & Mortari (2004)
Flute	Ranges: sound quality	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Casella & Mortari (2004)
Flute	Ranges: sound quality	Varèse, Edgard	Density 21.5	1946	Blatter (1997)
Flute	Ranges: sound quality	Pizzetti, Ildebrando	Sacra rappresentazione di Abramo e d'Isacco, La	1964	Casella & Mortari (2004)
Flute	Scoring Techniques: Balance	Tchaikovsky, Pyotr	Nutcracker, The	1892	Blatter (1997)
Flute	Scoring Techniques: Colour effects	Debussy, Claude	Pelléas et Mélisande	1902	Casella & Mortari (2004)
Flute	Scoring Techniques: Colour effects	Ravel, Maurice	L'Heure Espagnole	1911	Casella & Mortari (2004)
Flute	Scoring Techniques: Colour effects	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Flute	Scoring Techniques: Colour effects	Petrassi, Goffredo	Concerto for Orchestra	1934	Casella & Mortari (2004)
Flute	Scoring Techniques: Division of Material	Mendelssohn, Felix	Symphony No.4	1833	Piston (1961)
Flute	Scoring Techniques: Division of Material	Verdi, Giuseppe	Aïda	1870	Piston (1961)
Flute	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Flute	Scoring Techniques: Division of Material	Debussy, Claude	Primièrè Rhapsodie	1910	Piston (1961)
Flute	Scoring Techniques: Division of Material	Berg, Alban	Wozzeck	1922	Piston (1961)
Flute	Scoring Techniques: Division of Material	Stravinsky, Igor	Orpheus	1947	Piston (1961)
Flute	Scoring Techniques: Doubling	Weber, Carl Maria von	Oberon	1826	Widor (1906)
Flute	Scoring Techniques: Dovetailing	Borodin, Alexander	Polovtsian Dances	1890	Blatter (1997)
Flute	Scoring Techniques: Dovetailing	Stravinsky, Igor	L'Oiseau de Feu	1910	Piston (1961)
Flute	Solo use in the orchestra	Debussy, Claude	Prélude à l'après-midi d'un faune	1894	Casella & Mortari (2004)
Flute	Solo use in the orchestra	Debussy, Claude	Nocturnes	1899	Casella & Mortari (2004)
Flute	Solo use in the orchestra	Stravinsky, Igor	Petrouchka	1911	Casella & Mortari (2004)
Flute	Technical agility	Strauss, Richard	Ein Heldenleben	1898	Piston (1961)
Flute	Technical agility	Strauss, Richard	Elektra	1909	Piston (1961)
Flute: Alto	Expressive qualities	Ravel, Maurice	Daphnis et Chloé	1912	Adler (2002)
Flute: Alto	Extending the range of another instrument	Ravel, Maurice	Daphnis et Chloé	1912	Casella & Mortari (2004)
Flute: Alto	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Flute: Alto	Idiomatic scoring	Holst, Gustav	Planets, The <sup>244</sup>	1916	Adler (2002)
Flute: Alto	Idiomatic scoring	Varèse, Edgard	Amériques	1921	Kennan & Grantham (2002)

<sup>244</sup> The passage referenced here by Adler (2002) is incorrectly attributed to *The Planets*, when it actually references the *Phantastes Suite*. The reference has been carried over in Adler (2002) directly from Forsyth (1914) and has been incorrectly named. Subsequent to its reference in Forsyth (1914), Holst destroyed the work.

Flute: Alto	Idiomatic scoring	Crumb, George	Night of the four moons	1969	Kennan & Grantham (2002)
Flute: Alto	Ranges: sound quality	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Flute: Alto	Ranges: sound quality	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Flute: Alto	Ranges: sound quality	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)
Flute: Alto	Ranges: sound quality	Stravinsky, Igor	Sacre du Printemps, Le	1913	Casella & Mortari (2004)
Flute: Alto	Ranges: sound quality	Holst, Gustav	Planets, The	1916	Piston (1961)
Flute: Alto	Solo use in the orchestra	Ravel, Maurice	Daphnis et Chloé	1912	Kennan & Grantham (2002)
Flute: Bass	Extended Techniques	Crumb, George	Lux Æterna	1972	Blatter (1997)
Flute: Bass	Idiomatic scoring	Zandonai, Riccardo	Francesca da Rimini	1914	Adler (2002)
Flute: Bass	Ranges: sound quality	Zandonai, Riccardo	Francesca da Rimini	1914	Casella & Mortari (2004)
Flute: Piccolo	Idiomatic scoring	Tchaikovsky, Pyotr	Nutcracker, The	1892	Wagner (1959)
Flute: Piccolo	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.6	1893	Wagner (1959)
Flute: Piccolo	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.6	1893	Wagner (1959)
Flute: Piccolo	Idiomatic scoring	Ravel, Maurice	Ma Mère L'Oye	1911	Kennan & Grantham (2002)
Flute: Piccolo	Idiomatic scoring	Kodály, Zoltán	Háry János Suite	1926	Kennan & Grantham (2002)
Flute: Piccolo	Ranges: sound quality	Gluck, Christoph Willibald	Iphigénie en Tauride	1779	Adler (2002)
Flute: Piccolo	Ranges: sound quality	Mozart, Amadeus	Die Zauberflöte	1791	Adler (2002)
Flute: Piccolo	Ranges: sound quality	Tchaikovsky, Pyotr	Symphony No.4	1877	Blatter (1997)
Flute: Piccolo	Ranges: sound quality	Prokofiev, Sergei	Lieutenant Kijé: Suite	1934	Adler (2002)
Flute: Piccolo	Ranges: sound quality	Shostakovich, Dmitri	Symphony No.7	1941	Piston (1961)
Flute: Piccolo	Ranges: sound quality	Milhaud, Daries	Symphony No.2	1944	Piston (1961)
Flute: Piccolo	Solo use in the orchestra	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Casella & Mortari (2004)
Flute: Piccolo	Solo use in the orchestra	Shostakovich, Dmitri	Symphony No.7	1941	Kennan & Grantham (2002)
Flute: Piccolo	Strengthening upper partials (doubling at more than an octave)	Catalani	Wally, La	1892	Casella & Mortari (2004)
Flute: Piccolo	Strengthening upper partials (doubling at more than an octave)	Debussy, Claude	Images pour orchestre	1908	Casella & Mortari (2004)
Flute: Piccolo	Strengthening upper partials (doubling at more than an octave)	Debussy, Claude	Images pour orchestre	1908	Casella & Mortari (2004)
Flute: Piccolo	Technical agility	Schoenberg, Arnold	Pierrot Lunaire	1912	Casella & Mortari (2004)
Oboe	Articulation	Rossini, Gioacchino	Scala di Seta	1812	Piston (1961)



Oboe	Articulation	Brahms, Johannes	Symphony No.3	1883	Kennan & Grantham (2002)
Oboe	Double or Triple or Flutter tonguing	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Oboe	Expressive qualities	Berlioz, Hector	Roméo et Juliette	1839	Widor (1906)
Oboe	Expressive qualities	Schumann, Robert	Symphony No.2	1847	Blatter (1997)
Oboe	Expressive qualities	Tchaikovsky, Pyotr	Symphony No.4	1877	Blatter (1997)
Oboe	Expressive qualities	Respighi, Ottorino	Pines of Rome, The	1924	Blatter (1997)
Oboe	Idiomatic scoring	Bach, Johann Sebastian	Brandenburg Concerto no.2	1721	Adler (2002)
Oboe	Idiomatic scoring	Mozart, Amadeus	Sinfonia Concertante	1778	Adler (2002)
Oboe	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Kennan & Grantham (2002)
Oboe	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.7	1812	Kennan & Grantham (2002)
Oboe	Idiomatic scoring	Schumann, Robert	Symphony No.2	1847	Kennan & Grantham (2002)
Oboe	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.4	1877	Adler (2002)
Oboe	Idiomatic scoring	Debussy, Claude	Images pour orchestre	1908	Kennan & Grantham (2002)
Oboe	Idiomatic scoring	Shostakovich, Dmitri	Symphony No.1	1925	Adler (2002)
Oboe	Idiomatic scoring	Pizzetti, Ildebrando	Fra Gherardo	1928	Casella & Mortari (2004)
Oboe	Muting	Rimsky-Korsakov, Nicolai	Kachtchei l'Immortale	1902	Casella & Mortari (2004)
Oboe	Muting	Stravinsky, Igor	Petrouchka	1911	Piston (1961)
Oboe	Ranges: sound quality	Bach, Johann Sebastian	Brandenburg Concerto no.1	1721	Piston (1961)
Oboe	Ranges: sound quality	Bach, Johann Sebastian	Mass in B minor	1749	Widor (1906)
Oboe	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.3	1804	Blatter (1997)
Oboe	Ranges: sound quality	Beethoven, Ludwig van	Symphony No.4	1806	Wagner (1959)
Oboe	Ranges: sound quality	Schumann, Robert	Symphony No.2	1847	Piston (1961)
Oboe	Ranges: sound quality	Schumann, Robert	Symphony No.4	1851	Wagner (1959)
Oboe	Ranges: sound quality	Brahms, Johannes	Symphony No.2	1877	Piston (1961)
Oboe	Ranges: sound quality	Brahms, Johannes	Symphony No.2	1877	Blatter (1997)
Oboe	Ranges: sound quality	Brahms, Johannes	Symphony No.4	1885	Wagner (1959)
Oboe	Ranges: sound quality	Chausson, Ernest	Symphony No.1	1890	Piston (1961)
Oboe	Ranges: sound quality	Ravel, Maurice	Ma Mère L'Oye	1911	Wagner (1959)
Oboe	Ranges: sound quality	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Oboe	Ranges: sound quality	Prokofiev, Sergei	Chout	1915	Piston (1961)
Oboe	Ranges: sound quality	Prokofiev, Sergei	Symphony No.1	1917	Wagner (1959)

Oboe	Ranges: sound quality	Stravinsky, Igor	Symphonie de Psauemes	1930	Casella & Mortari (2004)
Oboe	Ranges: sound quality	Bartók, Béla	Concerto for Orchestra	1943	Blatter (1997)
Oboe	Ranges: sound quality	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Oboe	Ranges: sound quality	de Falla, Manuel	El Amor Brujo	1986	Piston (1961)
Oboe	Role as accompaniment	Honegger, Arthur	Symphony No.1	1930	Casella & Mortari (2004)
Oboe	Scoring Techniques: Colour effects	Berlioz, Hector	Symphonie Fantastique	1830	Adler (2002)
Oboe	Scoring Techniques: Colour effects	Kodály, Zoltán	Háry János Suite	1926	Adler (2002)
Oboe	Scoring Techniques: Colour effects	Kodály, Zoltán	Háry János Suite	1926	Adler (2002)
Oboe	Scoring Techniques: Division of Material	Strauss, Richard	Till Eulenspiegel	1895	Piston (1961)
Oboe	Scoring Techniques: Division of Material	Debussy, Claude	Mer, La	1905	Piston (1961)
Oboe	Scoring Techniques: Division of Material	Sibelius, Jean	Symphony No.4	1911	Piston (1961)
Oboe	Scoring Techniques: Doubling	Beethoven, Ludwig van	Symphony No.8	1812	Widor (1906)
Oboe	Solo use in the orchestra	Bach, Johann Sebastian	Magnificat	1731	Blatter (1997)
Oboe	Technical agility	Ferling, Franz Wilhelm	48 Etudes	1835	Widor (1906)
Oboe	Technical agility	Ravel, Maurice	Rapsodie Espagnole	1907	Casella & Mortari (2004)
Oboe	Technical agility	Ravel, Maurice	Daphnis et Chloé	1912	Casella & Mortari (2004)
Oboe	Technical agility	Ravel, Maurice	Tombeau de Couperin, Le	1917	Piston (1961)
Oboe	Technical agility	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Casella & Mortari (2004)
Oboe	Technical agility	Eberhard, Dennis	Paraphrases	1968	Blatter (1997)
Oboe	Unidiomatic scoring	Dukas, Paul	L'apprenti sorcier	1897	Casella & Mortari (2004)
Oboe	Unidiomatic scoring	Ravel, Maurice	Daphnis et Chloé	1912	Casella & Mortari (2004)
Oboe	Unidiomatic scoring	Stravinsky, Igor	Jeu de cartes	1937	Casella & Mortari (2004)
Saxophone, Alto	Expressive qualities	Britten, Benjamin	Sinfonia da Requiem	1940	Piston (1961)
Saxophone, Alto	Solo use in the orchestra	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Casella & Mortari (2004)
Saxophone, Alto	Solo use in the orchestra	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Blatter (1997)
Saxophone, Alto	Solo use in the orchestra	Milhaud, Daries	Création du Monde, La	1923	Blatter (1997)
Saxophone, Alto	Solo use in the orchestra	Petrassi, Goffredo	Partita	1932	Casella & Mortari (2004)
Saxophone, Alto	Solo use in the orchestra	Hindemith, Paul	Symphony in Bb for Band	1951	Blatter (1997)
Saxophone, Alto	Technical agility	Bizet, Georges	l'Arlésienne	1872	Widor (1906)
Saxophone, Alto	Technical agility	Parker, Charlie	Now's the Time: Yardbird-solo	1945	Blatter (1997)
Saxophone, Alto	Technical agility	Parker, Charlie	Parker's Mood	1948	Blatter (1997)

Saxophone, Soprano	Expressive qualities	Copland, Aaron	Concerto for Piano and Orchestra	1926	Piston (1961)
Saxophone, Soprano	Solo use in the orchestra	Ravel, Maurice	Bolero	1928	Casella & Mortari (2004)
Saxophone, Tenor	Solo use in the orchestra	Prokofiev, Sergei	Lieutenant Kijé: Suite	1934	Blatter (1997)
Saxophones General	Expressive qualities	Gershwin, George	American in Paris, An	1928	Casella & Mortari (2004)
Saxophones General	Idiomatic scoring	Bizet, Georges	l'Arlésienne	1872	Adler (2002)
Saxophones General	Idiomatic scoring	Strauss, Richard	Symphonia Domestica	1903	Adler (2002)
Saxophones General	Idiomatic scoring	Ravel, Maurice	Bolero	1928	Adler (2002)
Saxophones General	Idiomatic scoring	Chávez, Carlos	Chapultepec	1935	Blatter (1997)
Saxophones General	Idiomatic scoring	Hindemith, Paul	Symphony in Bb for Band	1951	Blatter (1997)
Saxophones General	Scoring Techniques: Doubling	Hindemith, Paul	Symphony in Bb for Band	1951	Blatter (1997)
Woodwind Section	Articulation	Mozart, Amadeus	Nozze di Figaro, Le	1786	Piston (1961)
Woodwind Section	Articulation	Beethoven, Ludwig van	Symphony No.3	1804	Piston (1961)
Woodwind Section	Articulation	Berlioz, Hector	Symphonie Fantastique	1830	Piston (1961)
Woodwind Section	Articulation	Brahms, Johannes	Variations on a Theme by Haydn	1873	Piston (1961)
Woodwind Section	Articulation	Stravinsky, Igor	Symphonie de Psaumes	1930	Adler (2002)
Woodwind Section	Double or Triple or Flutter tonguing	Mendelssohn, Felix	Symphony No.4	1833	Adler (2002)
Woodwind Section	Double or Triple or Flutter tonguing	Wagner, Richard	Lohengrin	1848	Piston (1961)
Woodwind Section	Double or Triple or Flutter tonguing	Ravel, Maurice	Valse, La	1920	Piston (1961)
Woodwind Section	Double or Triple or Flutter tonguing	Berg, Alban	Concerto for violin and orchestra	1935	Piston (1961)
Woodwind Section	Expressive qualities	Beethoven, Ludwig van	Symphony No.1	1800	Adler (2002)
Woodwind Section	Extended Techniques	Schuller, Gunther	Seven Studies on Themes of Paul Klee	1960	Adler (2002)
Woodwind Section	Extended Techniques	Penderecki, Krzysztof	Dies Irae	1967	Adler (2002)
Woodwind Section	Extended Techniques	Musgrave, Thea	Night Music	1969	Kennan & Grantham (2002)
Woodwind Section	Extended Techniques	Stachowski, Marek	Irisation for Orchestra	1970	Adler (2002)
Woodwind Section	Idiomatic scoring	Haydn, Josef	Symphony No.104	1795	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Strauss, Johann	Die Fledermaus	1873	Adler (2002)
Woodwind Section	Idiomatic scoring	Wagner, Richard	Der Ring des Nibelungen	1874	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Tchaikovsky, Pyotr	Nutcracker, The	1892	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Dvořák, Antonín	Symphony No.9	1893	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Strauss, Richard	Also Sprach Zarathustra	1896	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Strauss, Richard	Also Sprach Zarathustra	1896	Sevsay (2013)

Woodwind Section	Idiomatic scoring	Mahler, Gustav	Symphony No.6	1904	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Debussy, Claude	Mer, La	1905	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Sevsay (2013)
Woodwind Section	Idiomatic scoring	Bartók, Béla	Concerto for Orchestra	1943	Adler (2002)
Woodwind Section	Role as accompaniment	Mozart, Amadeus	Symphony No.29	1774	Adler (2002)
Woodwind Section	Role as accompaniment	Schubert, Franz	Symphony No.8	1822	Adler (2002)
Woodwind Section	Scoring Techniques: Balance	Tchaikovsky, Pyotr	Symphony No.4	1877	Sevsay (2013)
Woodwind Section	Scoring Techniques: Balance	Debussy, Claude	Nocturnes	1899	Adler (2002)
Woodwind Section	Scoring Techniques: Balance	Debussy, Claude	Nocturnes	1899	Adler (2002)
Woodwind Section	Scoring Techniques: Colour effects	Mozart, Amadeus	Symphony No.29	1774	Adler (2002)
Woodwind Section	Scoring Techniques: Colour effects	Schumann, Robert	Symphony No.1	1841	Adler (2002)
Woodwind Section	Scoring Techniques: Colour effects	Brahms, Johannes	Symphony No.2	1877	Adler (2002)
Woodwind Section	Scoring Techniques: Colour effects	Debussy, Claude	Mer, La	1905	Adler (2002)
Woodwind Section	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.38	1786	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Nozze di Figaro, Le	1786	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.40	1788	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.40	1788	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.1	1800	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.5	1808	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Schubert, Franz	Symphony No.8	1822	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Schubert, Franz	Symphony No.9	1822	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Schubert, Franz	Symphony No.8	1822	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Berlioz, Hector	Damnation of Faust, The	1846	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Schumann, Robert	Symphony No.2	1847	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Wagner, Richard	Tristan und Isolde	1859	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.2	1877	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.3	1883	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.4	1901	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Scriabin, Alexander	Poem of Ecstasy	1908	Sevsay (2013)

Woodwind Section	Scoring Techniques: Division of Material	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Sevsay (2013)
Woodwind Section	Scoring Techniques: Division of Material	Copland, Aaron	Music for the Theater	1925	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Britten, Benjamin	Young Person's Guide to the Orchestra, The	1946	Adler (2002)
Woodwind Section	Scoring Techniques: Division of Material	Schuman, William Howard	New England Triptych	1956	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Beethoven, Ludwig van	Symphony No.3	1804	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Rossini, Gioacchino	Semiramide	1823	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Berlioz, Hector	Symphonie Fantastique	1830	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Dvořák, Antonín	Carnival Overture	1891	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Tchaikovsky, Pyotr	Symphony No.6	1893	Adler (2002)
Woodwind Section	Scoring Techniques: Doubling	Copland, Aaron	Appalachian Spring	1944	Adler (2002)
Woodwind Section	Technical agility	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)

Addendum B Table 19 -- Examples regarding stringed instruments referenced in various orchestration textbooks:

Instrument/Group	Technique or reference	Composer	Composition	Year	Reference Source
Cello	Articulation	Debussy, Claude	Mer, La	1905	Piston (1961)
Cello	Articulation	Schmitt, Florent	Antoine et Cléopâtre	1920	Piston (1961)
Cello	Expressive qualities	Wagner, Richard	Siegfried Idyll	1870	Piston (1961)
Cello	Expressive qualities	Franck, César	Variations Symphoniques	1885	Piston (1961)
Cello	Expressive qualities	Charpentier, Marc-Antonie	Impressions of Italy	1889	Piston (1961)
Cello	Extended Techniques	Schoenberg, Arnold	Pierrot Lunaire	1912	Blatter (1997)
Cello	Extended Techniques	Penderecki, Krzysztof	Threnody to the Victims of Hiroshima	1961	Blatter (1997)
Cello	Extended Techniques	Yannay, Yehuda	preFIX-FIX-sufFIX	1972	Blatter (1997)
Cello	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Kennan & Grantham (2002)
Cello	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.5	1808	Kennan & Grantham (2002)
Cello	Idiomatic scoring	Wagner, Richard	Die Meistersinger	1867	Widor (1906)
Cello	Idiomatic scoring	Brahms, Johannes	Symphony No.3	1883	Sevsay (2013)
Cello	Idiomatic scoring	Brahms, Johannes	Symphony No.4	1885	Kennan & Grantham (2002)

Cello	Idiomatic scoring	Borodin, Alexander	Symphony No.3	1887	Widor (1906)
Cello	Idiomatic scoring	Strauss, Richard	Don Juan	1889	Kennan & Grantham (2002)
Cello	Idiomatic scoring	Ravel, Maurice	Duo for Violin and Cello	1922	Casella & Mortari (2004)
Cello	Idiomatic scoring	Harris, Roy	Symphony No.3	1939	Kennan & Grantham (2002)
Cello	Idiomatic scoring	Mortari, Virgilio	Short serenade for solo cello	1955	Casella & Mortari (2004)
Cello	Multiple Notes	Franck, César	Symphony	1888	Kennan & Grantham (2002)
Cello	Multiple Notes	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Kennan & Grantham (2002)
Cello	Multiple Notes	Mahler, Gustav	Symphony No.4	1901	Kennan & Grantham (2002)
Cello	Multiple Notes	Strauss, Richard	Symphonia Domestica	1903	Piston (1961)
Cello	Multiple Notes	Debussy, Claude	Images pour orchestre	1908	Piston (1961)
Cello	Multiple Notes	Bartók, Béla	Second Rhapsody for Violin and Orchestra	1928	Piston (1961)
Cello	Pizzicato	Mussorgsky, Modest	Night on Bald Mountain	1867	Piston (1961)
Cello	Pizzicato	Brahms, Johannes	Symphony No.2	1877	Piston (1961)
Cello	Pizzicato	Debussy, Claude	Images pour orchestre	1908	Piston (1961)
Cello	Pizzicato	Shostakovich, Dmitri	Symphony No.5	1937	Piston (1961)
Cello	Ranges: sound quality	Rossini, Gioacchino	William Tell	1829	Adler (2002)
Cello	Ranges: sound quality	Wagner, Richard	Tristan und Isolde	1859	Adler (2002)
Cello	Ranges: sound quality	Widor, Charles-Marie	Concerto for Piano and Orchestra	1876	Widor (1906)
Cello	Ranges: sound quality	Strauss, Richard	Also Sprach Zarathustra	1896	Blatter (1997)
Cello	Ranges: sound quality	Harris, Roy	Symphony No.3	1939	Adler (2002)
Cello	Role as accompaniment	Beethoven, Ludwig van	Symphony No.8	1812	Piston (1961)
Cello	Role as accompaniment	Mendelssohn, Felix	Hebrides Overture, The	1832	Blatter (1997)
Cello	Role as accompaniment	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Blatter (1997)
Cello	Role as accompaniment	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Cello	Role as accompaniment	Dukas, Paul	Péri, La	1912	Piston (1961)
Cello	Role as accompaniment	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Cello	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.1	1888	Piston (1961)
Cello	Scoring Techniques: Colour effects	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Cello	Scoring Techniques: Colour effects	Stravinsky, Igor	L'Oiseau de Feu	1910	Piston (1961)
Cello	Scoring Techniques: Colour effects	Ravel, Maurice	L'Heure Espagnole	1911	Casella & Mortari (2004)
Cello	Scoring Techniques: Colour effects	Scott, Cyril	Pastoral and Reel	1913	Casella & Mortari (2004)

Cello	Scoring Techniques: Colour effects	Casella, Alfredo	Pupazzetti	1915	Piston (1961)
Cello	Scoring Techniques: Colour effects	Ravel, Maurice	Duo for Violin and Cello	1922	Casella & Mortari (2004)
Cello	Scoring Techniques: Colour effects	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Piston (1961)
Cello	Scoring Techniques: Colour effects	Mortari, Virgilio	Short serenade for solo cello	1955	Casella & Mortari (2004)
Cello	Solo use in the orchestra	Brahms, Johannes	Symphony No.2	1877	Blatter (1997)
Cello	Solo use in the orchestra	Brahms, Johannes	Concerto for Piano and Orchestra no.2	1881	Piston (1961)
Cello	Solo use in the orchestra	Strauss, Richard	Don Quixote	1897	Adler (2002)
Cello	Solo use in the orchestra	Shostakovich, Dmitri	Symphony No.5	1937	Blatter (1997)
Cello	Solo use in the orchestra	Barber, Samuel	Essay for Orchestra no.1	1938	Adler (2002)
Cello	Subdivide	Reich, Steve	Desert Music, The	1985	Blatter (1997)
Cello	Subdivide	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
Cello	Subdivide	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Cello	Technical agility	Tchaikovsky, Pyotr	Symphony No.6	1893	Piston (1961)
Cello	Technical agility	Stravinsky, Igor	Capriccio	1929	Casella & Mortari (2004)
Cello	Technical agility	Britten, Benjamin	Peter Grimes	1945	Piston (1961)
Cello	Unidiomatic scoring	Schoenberg, Arnold	Kammersymphonie	1906	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Casella, Alfredo	Sonata for piano and cello	1906	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Schoenberg, Arnold	Erwartung	1909	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Schoenberg, Arnold	Erwartung	1909	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Stravinsky, Igor	L'Oiseau de Feu	1910	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Ravel, Maurice	Duo for Violin and Cello	1922	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Schoenberg, Arnold	Variations for orchestra	1928	Casella & Mortari (2004)
Cello	Unidiomatic scoring	Schoenberg, Arnold	Concerto for Cello and Orchestra	1932	Casella & Mortari (2004)
Double Bass	Articulation	Wagner, Richard	Tristan und Isolde	1859	Piston (1961)
Double Bass	Articulation	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Piston (1961)
Double Bass	Articulation	Strauss, Richard	Don Juan	1889	Piston (1961)
Double Bass	Articulation	Mahler, Gustav	Symphony No.9	1909	Piston (1961)
Double Bass	Expressive qualities	Franck, César	Symphony	1888	Piston (1961)
Double Bass	Expressive qualities	Prokofiev, Sergei	Concerto for violin and orchestra no.2	1935	Piston (1961)
Double Bass	Expressive qualities	Riegger, Wallingford	Symphony No.3	1960	Piston (1961)
Double Bass	Extended Techniques	Penderecki, Krzysztof	Threnody to the Victims of Hiroshima	1961	Blatter (1997)

Double Bass	Extended Techniques	Schwartz, Elliot	Serenade for Flute, Contrabass and Percussion	1964	Blatter (1997)
Double Bass	Extended Techniques	Deak, Jon	Color Studies	1970	Blatter (1997)
Double Bass	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.5	1808	Kennan & Grantham (2002)
Double Bass	Idiomatic scoring	Schubert, Franz	Symphony No.8	1822	Kennan & Grantham (2002)
Double Bass	Idiomatic scoring	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Double Bass	Idiomatic scoring	Saint-Saëns, Camille	Carnival of the Animals	1886	Kennan & Grantham (2002)
Double Bass	Idiomatic scoring	Verdi, Giuseppe	Falstaff	1893	Casella & Mortari (2004)
Double Bass	Idiomatic scoring	Mahler, Gustav	Das Lied von der Erde	1909	Piston (1961)
Double Bass	Idiomatic scoring	Strauss, Richard	Der Rosenkavalier	1911	Kennan & Grantham (2002)
Double Bass	Idiomatic scoring	Ravel, Maurice	Daphnis et Chloé Suite no.2	1912	Kennan & Grantham (2002)
Double Bass	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Piston (1961)
Double Bass	Idiomatic scoring	Koussevitzky, Serge	Studio	1929	Casella & Mortari (2004)
Double Bass	Idiomatic scoring	Hindemith, Paul	Symphonic metamorphosis	1943	Kennan & Grantham (2002)
Double Bass	Multiple Notes	Kodály, Zoltán	Galánta Dances	1933	Piston (1961)
Double Bass	Pizzicato	Tchaikovsky, Pyotr	Symphony No.4	1877	Casella & Mortari (2004)
Double Bass	Pizzicato	Dvořák, Antonín	Symphony No.9	1895	Blatter (1997)
Double Bass	Pizzicato	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
Double Bass	Pizzicato	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Double Bass	Pizzicato	Ravel, Maurice	Valse, La	1920	Piston (1961)
Double Bass	Ranges: sound quality	Saint-Saëns, Camille	Carnival of the Animals	1886	Blatter (1997)
Double Bass	Ranges: sound quality	Mahler, Gustav	Symphony No.1	1888	Blatter (1997)
Double Bass	Ranges: sound quality	Strauss, Richard	Don Juan	1889	Blatter (1997)
Double Bass	Ranges: sound quality	Shostakovich, Dmitri	Symphony No.5	1937	Piston (1961)
Double Bass	Ranges: sound quality	Britten, Benjamin	Young Person's Guide to the Orchestra, The	1946	Blatter (1997)
Double Bass	Role as accompaniment	Beethoven, Ludwig van	Symphony No.9	1824	Piston (1961)
Double Bass	Role as accompaniment	Beethoven, Ludwig van	Symphony No.9	1824	Blatter (1997)
Double Bass	Scoring Techniques: Colour effects	Ravel, Maurice	Tombeau de Couperin, Le	1917	Piston (1961)
Double Bass	Scoring Techniques: Colour effects	Stravinsky, Igor	Concerto en Ré	1945	Piston (1961)
Double Bass	Solo use in the orchestra	Mahler, Gustav	Symphony No.1	1888	Blatter (1997)
Double Bass	Solo use in the orchestra	Ravel, Maurice	L'Enfant et les Sortilèges	1920	Piston (1961)
Double Bass	Solo use in the orchestra	Milhaud, Daries	Création du Monde, La	1923	Adler (2002)



Double Bass	Solo use in the orchestra	Stravinsky, Igor	Pulcinella	1933	Adler (2002)
Double Bass	Solo use in the orchestra	Stravinsky, Igor	Pulcinella	1933	Casella & Mortari (2004)
Double Bass	Subdivide	Dvořák, Antonín	Symphony No.5	1887	Piston (1961)
Double Bass	Subdivide	Debussy, Claude	Pelléas et Mélisande	1902	Piston (1961)
Double Bass	Subdivide	Debussy, Claude	Mer, La	1905	Piston (1961)
Double Bass	Technical agility	Gluck, Christoph Willibald	Armide	1776	Widor (1906)
Double Bass	Technical agility	Mozart, Amadeus	Symphony No.41	1788	Widor (1906)
Double Bass	Technical agility	Berlioz, Hector	Damnation of Faust, The	1846	Widor (1906)
Double Bass	Technical agility	Widor, Charles-Marie	Pêcheurs de St. Jean, Les	1895	Widor (1906)
Double Bass	Technical agility	Strauss, Richard	Ein Heldenleben	1898	Piston (1961)
Double Bass	Unidiomatic scoring	Beethoven, Ludwig van	Symphony No.4	1806	Adler (2002)
Double Bass	Unidiomatic scoring	Beethoven, Ludwig van	Symphony No.4	1806	Adler (2002)
Double Bass	Unidiomatic scoring	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
String Section	Articulation	Handel, George Frideric	Messiah	1741	Adler (2002)
String Section	Articulation	Bach, Johann Christian	Symphony No.4	1765	Wagner (1959)
String Section	Articulation	Gluck, Christoph Willibald	Iphigenia in Aulis	1774	Adler (2002)
String Section	Articulation	Mozart, Amadeus	Adagio and Fugue	1788	Wagner (1959)
String Section	Articulation	Beethoven, Ludwig van	Symphony No.1	1800	Piston (1961)
String Section	Articulation	Beethoven, Ludwig van	Symphony No.4	1806	Piston (1961)
String Section	Articulation	Beethoven, Ludwig van	Symphony No.4	1806	Kennan & Grantham (2002)
String Section	Articulation	Beethoven, Ludwig van	Overture to Coriolanus	1807	Piston (1961)
String Section	Articulation	Beethoven, Ludwig van	Overture to Coriolanus	1807	Adler (2002)
String Section	Articulation	Beethoven, Ludwig van	Symphony No.6	1808	Kennan & Grantham (2002)
String Section	Articulation	Beethoven, Ludwig van	Symphony No.8	1812	Kennan & Grantham (2002)
String Section	Articulation	Schubert, Franz	Symphony No.5	1816	Adler (2002)
String Section	Articulation	Schubert, Franz	Symphony No.5	1816	Piston (1961)
String Section	Articulation	Schubert, Franz	Symphony No.8	1822	Piston (1961)
String Section	Articulation	Weber, Carl Maria von	Euryanthe: Overture	1823	Adler (2002)
String Section	Articulation	Weber, Carl Maria von	Euryanthe: Overture	1823	Piston (1961)
String Section	Articulation	Rossini, Gioacchino	William Tell	1829	Piston (1961)
String Section	Articulation	Berlioz, Hector	Symphonie Fantastique	1830	Piston (1961)

String Section	Articulation	Berlioz, Hector	Symphonie Fantastique	1830	Kennan & Grantham (2002)
String Section	Articulation	Mendelssohn, Felix	Hebrides Overture, The	1832	Kennan & Grantham (2002)
String Section	Articulation	Mendelssohn, Felix	Symphony No.4	1833	Adler (2002)
String Section	Articulation	Mendelssohn, Felix	Symphony No.4	1833	Adler (2002)
String Section	Articulation	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Kennan & Grantham (2002)
String Section	Articulation	Mendelssohn, Felix	Concerto for violin and orchestra	1844	Adler (2002)
String Section	Articulation	Liszt, Franz	Préludes, Les	1845	Adler (2002)
String Section	Articulation	Wagner, Richard	Tristan und Isolde	1859	Kennan & Grantham (2002)
String Section	Articulation	Smetana, Bedřich	Overture, The Bartered Bride	1866	Wagner (1959)
String Section	Articulation	Wagner, Richard	Die Meistersinger	1867	Kennan & Grantham (2002)
String Section	Articulation	Verdi, Giuseppe	Requiem	1874	Wagner (1959)
String Section	Articulation	Verdi, Giuseppe	Requiem	1874	Wagner (1959)
String Section	Articulation	Tchaikovsky, Pyotr	Roméo et Juliette	1880	Adler (2002)
String Section	Articulation	Brahms, Johannes	Concerto for Piano and Orchestra no.2	1881	Wagner (1959)
String Section	Articulation	Brahms, Johannes	Concerto for Piano and Orchestra no.2	1881	Wagner (1959)
String Section	Articulation	Brahms, Johannes	Symphony No.4	1885	Kennan & Grantham (2002)
String Section	Articulation	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Piston (1961)
String Section	Articulation	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Adler (2002)
String Section	Articulation	Rimsky-Korsakov, Nicolai	Capriccio Espagnole	1887	Kennan & Grantham (2002)
String Section	Articulation	Franck, César	Symphony	1888	Piston (1961)
String Section	Articulation	Franck, César	Symphony	1888	Kennan & Grantham (2002)
String Section	Articulation	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Wagner (1959)
String Section	Articulation	Strauss, Richard	Don Juan	1889	Kennan & Grantham (2002)
String Section	Articulation	Borodin, Alexander	Polovtsian Dances	1890	Wagner (1959)
String Section	Articulation	Tchaikovsky, Pyotr	Symphony No.6	1893	Kennan & Grantham (2002)
String Section	Articulation	Tchaikovsky, Pyotr	Symphony No.6	1893	Wagner (1959)
String Section	Articulation	Tchaikovsky, Pyotr	Symphony No.6	1893	Adler (2002)
String Section	Articulation	Mahler, Gustav	Symphony No.2	1894	Kennan & Grantham (2002)
String Section	Articulation	Mahler, Gustav	Symphony No.2	1894	Kennan & Grantham (2002)
String Section	Articulation	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Wagner (1959)
String Section	Articulation	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)

String Section	Articulation	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
String Section	Articulation	Bruckner, Anton	Symphony No.9	1896	Piston (1961)
String Section	Articulation	Bruckner, Anton	Symphony No.9	1896	Adler (2002)
String Section	Articulation	Strauss, Richard	Don Quixote	1897	Piston (1961)
String Section	Articulation	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
String Section	Articulation	Mahler, Gustav	Symphony No.4	1901	Adler (2002)
String Section	Articulation	Mahler, Gustav	Symphony No.4	1901	Kennan & Grantham (2002)
String Section	Articulation	Elgar, Edward	Pomp and Circumstance	1901	Adler (2002)
String Section	Articulation	Sibelius, Jean	Symphony No.2	1902	Piston (1961)
String Section	Articulation	Sibelius, Jean	Symphony No.2	1902	Kennan & Grantham (2002)
String Section	Articulation	Stravinsky, Igor	L'Oiseau de Feu	1910	Kennan & Grantham (2002)
String Section	Articulation	Sibelius, Jean	Symphony No.4	1911	Wagner (1959)
String Section	Articulation	Stravinsky, Igor	Petrouchka	1911	Kennan & Grantham (2002)
String Section	Articulation	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
String Section	Articulation	Prokofiev, Sergei	Symphony No.1	1917	Wagner (1959)
String Section	Articulation	Prokofiev, Sergei	Symphony No.1	1917	Wagner (1959)
String Section	Articulation	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
String Section	Articulation	Sibelius, Jean	Symphony No.5	1919	Kennan & Grantham (2002)
String Section	Articulation	Shostakovich, Dmitri	Symphony No.1	1925	Kennan & Grantham (2002)
String Section	Articulation	Hindemith, Paul	Mathis der Maler	1934	Adler (2002)
String Section	Articulation	Vaughan Williams, Ralph	Symphony No.4	1935	Wagner (1959)
String Section	Articulation	Wagner, Joseph	Northland Evocation	1940	Wagner (1959)
String Section	Articulation	Rachmaninoff, Sergei	Symphonic Dances	1940	Adler (2002)
String Section	Articulation	Hindemith, Paul	Symphonic metamorphosis	1943	Adler (2002)
String Section	Articulation	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
String Section	Articulation	Bartók, Béla	Concerto for Orchestra	1943	Adler (2002)
String Section	Articulation	Shostakovich, Dmitri	Symphony No.8	1943	Adler (2002)
String Section	Articulation	Prokofiev, Sergei	Symphony No.5	1944	Kennan & Grantham (2002)
String Section	Articulation	Prokofiev, Sergei	Symphony No.5	1944	Kennan & Grantham (2002)
String Section	Articulation	Prokofiev, Sergei	Symphony No.5	1944	Kennan & Grantham (2002)
String Section	Articulation	Stravinsky, Igor	Symphony No.3	1945	Adler (2002)

String Section	Articulation	Stravinsky, Igor	Concerto for Orchestra	1946	Adler (2002)
String Section	Articulation	Stravinsky, Igor	Orpheus	1947	Piston (1961)
String Section	Articulation	Wagner, Joseph	Symphony No.4	1951	Wagner (1959)
String Section	Col Legno	Berlioz, Hector	Symphonie Fantastique	1830	Blatter (1997)
String Section	Expressive qualities	Schumann, Robert	Symphony No.2	1847	Sevsay (2013)
String Section	Extended Techniques	Borodin, Alexander	String Quartet no.1	1877	Adler (2002)
String Section	Extended Techniques	Saint-Saëns, Camille	Concerto for violin and orchestra	1880	Adler (2002)
String Section	Extended Techniques	Debussy, Claude	Images pour orchestre	1908	Adler (2002)
String Section	Extended Techniques	Penderecki, Krzysztof	Threnody to the Victims of Hiroshima	1961	Kennan & Grantham (2002)
String Section	Idiomatic scoring	Mozart, Amadeus	Symphony No.40	1788	Sevsay (2013)
String Section	Idiomatic scoring	Mozart, Amadeus	Symphony No.41	1788	Sevsay (2013)
String Section	Idiomatic scoring	Haydn, Josef	Symphony No.104	1795	Sevsay (2013)
String Section	Idiomatic scoring	Weber, Carl Maria von	Euryanthe: Overture	1821	Adler (2002)
String Section	Idiomatic scoring	Grieg, Edvard	Peer Gynt Suite no.1	1875	Adler (2002)
String Section	Idiomatic scoring	Tchaikovsky, Pyotr	Serenade for Strings	1880	Sevsay (2013)
String Section	Idiomatic scoring	Brahms, Johannes	Symphony No.3	1883	Sevsay (2013)
String Section	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.6	1893	Wagner (1959)
String Section	Idiomatic scoring	Sibelius, Jean	Symphony No.2	1902	Wagner (1959)
String Section	Idiomatic scoring	Bartók, Béla	Music for Strings, Percussion, and Celesta	1936	Adler (2002)
String Section	Idiomatic scoring	Penderecki, Krzysztof	Threnody to the Victims of Hiroshima	1961	Adler (2002)
String Section	Multiple Notes	Beethoven, Ludwig van	Symphony No.5	1808	Wagner (1959)
String Section	Multiple Notes	Schumann, Robert	Symphony No.1	1841	Kennan & Grantham (2002)
String Section	Multiple Notes	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)
String Section	Multiple Notes	Dvořák, Antonín	Symphony No.4	1888	Kennan & Grantham (2002)
String Section	Multiple Notes	Debussy, Claude	Images pour orchestre	1908	Kennan & Grantham (2002)
String Section	Multiple Notes	Stravinsky, Igor	L'Oiseau de Feu	1910	Wagner (1959)
String Section	Multiple Notes	Stravinsky, Igor	Ragtime	1918	Piston (1961)
String Section	Multiple Notes	Ravel, Maurice	L'Enfant et les Sortilèges	1920	Piston (1961)
String Section	Multiple Notes	Bartók, Béla	Concerto for violin and orchestra	1938	Piston (1961)
String Section	Multiple Stops	Crawford Seeger, Ruth	String Quartet 1931	1941	Blatter (1997)
String Section	Muting	Wagner, Joseph	Sinfonietta No.2	1930	Wagner (1959)

String Section	Percussive Techniques	Rossini, Gioacchino	Il Signor Bruschino	1810	Blatter (1997)
String Section	Pizzicato	Berlioz, Hector	Harold in Italy	1834	Piston (1961)
String Section	Pizzicato	Tchaikovsky, Pyotr	Symphony No.4	1877	Wagner (1959)
String Section	Pizzicato	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Wagner (1959)
String Section	Pizzicato	Dukas, Paul	L'Apprenti-Sorcier	1897	Piston (1961)
String Section	Pizzicato	Debussy, Claude	Pelléas et Mélisande	1902	Piston (1961)
String Section	Pizzicato	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
String Section	Pizzicato	Stravinsky, Igor	Ragtime	1918	Piston (1961)
String Section	Pizzicato	Ravel, Maurice	L'Enfant et les Sortilèges	1920	Piston (1961)
String Section	Pizzicato	Bartók, Béla	Concerto for violin and orchestra	1938	Piston (1961)
String Section	Pizzicato	Stravinsky, Igor	Symphony No.2	1940	Piston (1961)
String Section	Pizzicato	Wagner, Joseph	Variations on an Old Form	1942	Wagner (1959)
String Section	Pizzicato	Wagner, Joseph	Hudson River Legend	1943	Wagner (1959)
String Section	Pizzicato	Wagner, Joseph	Symphony No.4	1951	Wagner (1959)
String Section	Role as accompaniment	Mozart, Amadeus	Nozze di Figaro, Le	1786	Adler (2002)
String Section	Role as accompaniment	Mendelssohn, Felix	Elijah	1846	Adler (2002)
String Section	Role as accompaniment	Mendelssohn, Felix	Elijah	1846	Adler (2002)
String Section	Role as accompaniment	Bizet, Georges	Carmen	1875	Adler (2002)
String Section	Role as accompaniment	Fauré, Gabriel	Requiem	1890	Adler (2002)
String Section	Scoring Techniques: Balance	Berlioz, Hector	Symphonie Fantastique	1830	Adler (2002)
String Section	Scoring Techniques: Colour effects	Mozart, Amadeus	Symphony No.39	1788	Piston (1961)
String Section	Scoring Techniques: Colour effects	Weber, Carl Maria von	Oberon	1826	Adler (2002)
String Section	Scoring Techniques: Colour effects	Wagner, Richard	Der fliegende Holländer	1841	Adler (2002)
String Section	Scoring Techniques: Colour effects	Saint-Saëns, Camille	Danse Macabre	1874	Adler (2002)
String Section	Scoring Techniques: Colour effects	Verdi, Giuseppe	Requiem	1874	Adler (2002)
String Section	Scoring Techniques: Colour effects	Brahms, Johannes	Symphony No.1	1876	Piston (1961)
String Section	Scoring Techniques: Colour effects	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
String Section	Scoring Techniques: Colour effects	Tchaikovsky, Pyotr	Symphony No.4	1877	Adler (2002)
String Section	Scoring Techniques: Colour effects	Borodin, Alexander	In the Steppes of Central Asia	1880	Wagner (1959)
String Section	Scoring Techniques: Colour effects	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)

String Section	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.1	1888	Piston (1961)
String Section	Scoring Techniques: Colour effects	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Piston (1961)
String Section	Scoring Techniques: Colour effects	Strauss, Richard	Till Eulenspiegel	1895	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Strauss, Richard	Also Sprach Zarathustra	1896	Adler (2002)
String Section	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.4	1901	Adler (2002)
String Section	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.4	1901	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Strauss, Richard	Symphonia Domestica	1903	Piston (1961)
String Section	Scoring Techniques: Colour effects	Puccini, Giacomo	Madama Butterfly	1904	Adler (2002)
String Section	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.7	1905	Adler (2002)
String Section	Scoring Techniques: Colour effects	Debussy, Claude	Mer, La	1905	Piston (1961)
String Section	Scoring Techniques: Colour effects	Debussy, Claude	Mer, La	1905	Adler (2002)
String Section	Scoring Techniques: Colour effects	Debussy, Claude	Images pour orchestre	1908	Adler (2002)
String Section	Scoring Techniques: Colour effects	Debussy, Claude	Images pour orchestre	1908	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Debussy, Claude	Images pour orchestre	1908	Piston (1961)
String Section	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
String Section	Scoring Techniques: Colour effects	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Respighi, Ottorino	Pines of Rome, The	1924	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Bartók, Béla	String Quartet no.4	1928	Adler (2002)
String Section	Scoring Techniques: Colour effects	Bartók, Béla	String Quartet no.5	1934	Adler (2002)
String Section	Scoring Techniques: Colour effects	Diamond, David	Symphony No.4	1940	Adler (2002)
String Section	Scoring Techniques: Colour effects	Martinů, Bohuslav	Symphony No.1	1942	Adler (2002)
String Section	Scoring Techniques: Colour effects	Wagner, Joseph	Hudson River Legend	1943	Wagner (1959)
String Section	Scoring Techniques: Colour effects	Wagner, Joseph	Northland Evocation	1943	Wagner (1959)
String Section	Scoring Techniques: Colour effects	Bartók, Béla	Concerto for Orchestra	1943	Kennan & Grantham (2002)
String Section	Scoring Techniques: Colour effects	Bartók, Béla	Concerto for Orchestra	1943	Adler (2002)
String Section	Scoring Techniques: Colour effects	Britten, Benjamin	Peter Grimes	1945	Piston (1961)
String Section	Scoring Techniques: Division of Material	Vivaldi, Antonio	Concerto Grosso	1711	Adler (2002)
String Section	Scoring Techniques: Division of Material	Bach, Johann Sebastian	Brandenburg Concerto no.3	1721	Adler (2002)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	String Quartet no.3	1764	Adler (2002)

String Section	Scoring Techniques: Division of Material	Haydn, Josef	String Quartet no.3	1764	Adler (2002)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	String Quartet no.3	1764	Adler (2002)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	String Quartet no.3	1764	Adler (2002)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	String Quartet no.3	1764	Adler (2002)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	String Quartet no.3	1764	Adler (2002)
String Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.41	1788	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	Symphony No.100	1794	Sevsay (2013)
String Section	Scoring Techniques: Division of Material	Haydn, Josef	Symphony No.103	1794	Adler (2002)
String Section	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.4	1805	Adler (2002)
String Section	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.5	1808	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.7	1812	Adler (2002)
String Section	Scoring Techniques: Division of Material	Schumann, Robert	Symphony No.1	1841	Sevsay (2013)
String Section	Scoring Techniques: Division of Material	Schumann, Robert	Symphony No.2	1847	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Schumann, Robert	Symphony No.2	1847	Adler (2002)
String Section	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.4	1877	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Eine kleine Nachtmusik	1878	Adler (2002)
String Section	Scoring Techniques: Division of Material	Mozart, Amadeus	Eine kleine Nachtmusik	1878	Adler (2002)
String Section	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Serenade for Strings	1880	Sevsay (2013)
String Section	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Serenade for Strings	1880	Adler (2002)
String Section	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.4	1885	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Dvořák, Antonín	Symphony No.9	1893	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Strauss, Richard	Also Sprach Zarathustra	1896	Adler (2002)
String Section	Scoring Techniques: Division of Material	Debussy, Claude	Nocturnes	1899	Adler (2002)
String Section	Scoring Techniques: Division of Material	Debussy, Claude	Nocturnes	1899	Adler (2002)
String Section	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.9	1909	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.9	1909	Sevsay (2013)
String Section	Scoring Techniques: Division of Material	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
String Section	Scoring Techniques: Division of Material	Shostakovich, Dmitri	Symphony No.6	1939	Adler (2002)
String Section	Scoring Techniques: Doubling	Haydn, Josef	Symphony No.103	1794	Adler (2002)
String Section	Scoring Techniques: Doubling	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.4	1805	Adler (2002)
String Section	Scoring Techniques: Doubling	Beethoven, Ludwig van	Leonore	1807	Adler (2002)

String Section	Scoring Techniques: Doubling	Beethoven, Ludwig van	Leonore	1807	Adler (2002)
String Section	Scoring Techniques: Doubling	Tchaikovsky, Pyotr	Symphony No.4	1877	Sevsay (2013)
String Section	Scoring Techniques: Doubling	Mozart, Amadeus	Eine kleine Nachtmusik	1878	Adler (2002)
String Section	Scoring Techniques: Doubling	Hindemith, Paul	Mathis der Maler	1934	Adler (2002)
String Section	Scoring Techniques: Voicing	Brahms, Johannes	Symphony No.3	1883	Adler (2002)
String Section	Scoring Techniques: Voicing	Brahms, Johannes	Symphony No.3	1883	Adler (2002)
String Section	Scoring Techniques: Voicing	Brahms, Johannes	Symphony No.3	1883	Adler (2002)
String Section	Scoring Techniques: Voicing	Brahms, Johannes	Symphony No.3	1883	Adler (2002)
String Section	Subdivide	Stravinsky, Igor	Sacre du Printemps, Le	1913	Blatter (1997)
String Section	Technical agility	Mahler, Gustav	Symphony No.10	1910	Adler (2002)
String Section	Technical agility	Ravel, Maurice	Valse, La	1920	Adler (2002)
String Section	Technical agility	Bartók, Béla	Music for Strings, Percussion, and Celesta	1936	Adler (2002)
Viola	Extended Techniques	Hannay, Roger	Elegy for Tape and viola	1974	Blatter (1997)
Viola	Extending the range of another instrument	Casella, Alfredo	Scarlattiana	1926	Casella & Mortari (2004)
Viola	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.5	1808	Adler (2002)
Viola	Idiomatic scoring	Berlioz, Hector	Symphonie Fantastique	1830	Adler (2002)
Viola	Idiomatic scoring	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Adler (2002)
Viola	Idiomatic scoring	Wagner, Richard	Lohengrin	1848	Adler (2002)
Viola	Idiomatic scoring	Wagner, Richard	Tristan und Isolde	1859	Kennan & Grantham (2002)
Viola	Idiomatic scoring	Tchaikovsky, Pyotr	Roméo et Juliette	1880	Kennan & Grantham (2002)
Viola	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Kennan & Grantham (2002)
Viola	Idiomatic scoring	Hindemith, Paul	Der Schwanendreher	1922	Casella & Mortari (2004)
Viola	Idiomatic scoring	Carter, Elliot	Second String Quartet	1961	Blatter (1997)
Viola	Multiple Notes	Mozart, Amadeus	Symphony No.36	1783	Piston (1961)
Viola	Multiple Notes	Mozart, Amadeus	Symphony in G minor	1788	Piston (1961)
Viola	Multiple Notes	Beethoven, Ludwig van	Concerto for violin and orchestra	1806	Piston (1961)
Viola	Multiple Notes	Wagner, Richard	Parsifal	1882	Piston (1961)
Viola	Multiple Notes	d'Indy, Vincent	Symphony on a French Mountain Air	1886	Piston (1961)
Viola	Pizzicato	Roussel, Albert	Suite in F	1926	Piston (1961)
Viola	Pizzicato	Berg, Alban	Concerto for violin and orchestra	1935	Piston (1961)



Viola	Ranges: sound quality	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Viola	Ranges: sound quality	Strauss, Richard	Tod und Verklärung	1889	Piston (1961)
Viola	Ranges: sound quality	Elgar, Edward	Enigma Variations	1899	Blatter (1997)
Viola	Ranges: sound quality	Debussy, Claude	Nocturnes	1899	Piston (1961)
Viola	Ranges: sound quality	Hindemith, Paul	Der Schwanendreher	1922	Adler (2002)
Viola	Ranges: sound quality	Shostakovich, Dmitri	Symphony No.5	1937	Piston (1961)
Viola	Ranges: sound quality	Hindemith, Paul	Sonata for Viola	1938	Adler (2002)
Viola	Ranges: sound quality	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Viola	Ranges: sound quality	Bartók, Béla	Concerto for Orchestra	1943	Adler (2002)
Viola	Role as accompaniment	Wagner, Richard	Parsifal	1882	Blatter (1997)
Viola	Role as accompaniment	Franck, César	Symphony	1888	Blatter (1997)
Viola	Role as accompaniment	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Blatter (1997)
Viola	Scoring Techniques: Colour effects	Ravel, Maurice	L'Heure Espagnole	1911	Casella & Mortari (2004)
Viola	Scoring Techniques: Colour effects	Strauss, Richard	Der Rosenkavalier	1911	Piston (1961)
Viola	Scoring Techniques: Colour effects	Strauss, Richard	Der Rosenkavalier	1911	Piston (1961)
Viola	Scoring Techniques: Colour effects	Stravinsky, Igor	Der Rosenkavalier	1911	Piston (1961)
Viola	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Viola	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.7	1905	Piston (1961)
Viola	Scoring Techniques: Doubling	Strauss, Richard	Till Eulenspiegel	1895	Kennan & Grantham (2002)
Viola	Scoring Techniques: Doubling	Ravel, Maurice	Daphnis et Chloé Suite no.2	1912	Kennan & Grantham (2002)
Viola	Solo use in the orchestra	Berlioz, Hector	Harold in Italy	1834	Blatter (1997)
Viola	Solo use in the orchestra	Tchaikovsky, Pyotr	Roméo et Juliette	1880	Blatter (1997)
Viola	Solo use in the orchestra	Strauss, Richard	Don Quixote	1897	Adler (2002)
Viola	Solo use in the orchestra	Enescu, George	Roumanian Rhapsodie	1901	Piston (1961)
Viola	Solo use in the orchestra	Scriabin, Alexander	Poem of Ecstasy	1908	Adler (2002)
Viola	Solo use in the orchestra	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)
Viola	Solo use in the orchestra	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Viola	Solo use in the orchestra	Hindemith, Paul	Konzertmusik	1930	Casella & Mortari (2004)
Viola	Solo use in the orchestra	Copland, Aaron	Billy the Kid	1938	Blatter (1997)
Viola	Subdivide	Strauss, Richard	Don Quixote	1897	Piston (1961)
Viola	Technical agility	Brahms, Johannes	Symphony No.2	1877	Piston (1961)

Viola	Technical agility	Prokofiev, Sergei	Chout	1915	Piston (1961)
Viola	Unidiomatic scoring	Schoenberg, Arnold	Serenade	1896	Piston (1961)
Viola	Unidiomatic scoring	Strauss, Richard	Elektra	1909	Casella & Mortari (2004)
Violin	Articulation	Bach, Johann Sebastian	Brandenburg Concerto no.1	1721	Sevsay (2013)
Violin	Articulation	Bach, Johann Sebastian	Brandenburg Concerto no.3	1721	Sevsay (2013)
Violin	Articulation	Pugnani-Kreisler, Gaetano	Preludio e allegro	1773	Casella & Mortari (2004)
Violin	Articulation	Mozart, Amadeus	Nozze di Figaro, Le	1786	Casella & Mortari (2004)
Violin	Articulation	Beethoven, Ludwig van	Overture to Coriolanus	1807	Sevsay (2013)
Violin	Articulation	Beethoven, Ludwig van	Symphony No.7	1812	Casella & Mortari (2004)
Violin	Articulation	Beethoven, Ludwig van	Symphony No.9	1824	Casella & Mortari (2004)
Violin	Articulation	Mendelssohn, Felix	Concerto for violin and orchestra	1844	Sevsay (2013)
Violin	Articulation	Wieniawski, Henryk	Carnaval Russe, Le	1853	Casella & Mortari (2004)
Violin	Articulation	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Casella & Mortari (2004)
Violin	Articulation	Dvořák, Antonín	Symphony No.9	1893	Sevsay (2013)
Violin	Articulation	Mahler, Gustav	Symphony No.9	1909	Sevsay (2013)
Violin	Articulation	Castelnuovo-Tedesco, Mario	Merchant of Venice, The	1933	Casella & Mortari (2004)
Violin	Articulation	Mortari, Virgilio	Concerto for quartet and orchestra	1938	Casella & Mortari (2004)
Violin	Expressive qualities	Ravel, Maurice	L'Heure Espagnole	1911	Casella & Mortari (2004)
Violin	Extended Techniques	Yannay, Yehuda	Two Fragments	1970	Blatter (1997)
Violin	Idiomatic scoring	Mozart, Amadeus	Symphony No.39	1788	Sevsay (2013)
Violin	Idiomatic scoring	Mozart, Amadeus	Symphony No.40	1788	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Haydn, Josef	Symphony No.103	1794	Blatter (1997)
Violin	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.3	1804	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Weber, Carl Maria von	Oberon	1826	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Mendelssohn, Felix	Midsummer Night's Dream, A	1842	Sevsay (2013)
Violin	Idiomatic scoring	Mendelssohn, Felix	Symphony No.3	1842	Blatter (1997)
Violin	Idiomatic scoring	Mendelssohn, Felix	Concerto for violin and orchestra	1844	Sevsay (2013)
Violin	Idiomatic scoring	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Violin	Idiomatic scoring	Wagner, Richard	Siegfried Idyll	1870	Blatter (1997)
Violin	Idiomatic scoring	Brahms, Johannes	Symphony No.1	1876	Sevsay (2013)
Violin	Idiomatic scoring	Tchaikovsky, Pyotr	Serenade for Strings	1880	Sevsay (2013)

Violin	Idiomatic scoring	Brahms, Johannes	Symphony No.4	1885	Sevsay (2013)
Violin	Idiomatic scoring	Brahms, Johannes	Symphony No.4	1885	Sevsay (2013)
Violin	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Sevsay (2013)
Violin	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Sevsay (2013)
Violin	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Sevsay (2013)
Violin	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Strauss, Richard	Don Juan	1889	Blatter (1997)
Violin	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.6	1893	Sevsay (2013)
Violin	Idiomatic scoring	Wieniawski, Henryk	Concerto for violin and orchestra no.2	1897	Sevsay (2013)
Violin	Idiomatic scoring	Mahler, Gustav	Symphony No.4	1901	Blatter (1997)
Violin	Idiomatic scoring	Mahler, Gustav	Symphony No.5	1902	Sevsay (2013)
Violin	Idiomatic scoring	Mahler, Gustav	Symphony No.5	1902	Sevsay (2013)
Violin	Idiomatic scoring	von Webern, Anton	Six Pieces for Orchestra	1910	Adler (2002)
Violin	Idiomatic scoring	Strauss, Richard	Der Rosenkavalier	1911	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Schoenberg, Arnold	Pierrot Lunaire	1912	Blatter (1997)
Violin	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Sevsay (2013)
Violin	Idiomatic scoring	Stravinsky, Igor	Sacre du Printemps, Le	1913	Kennan & Grantham (2002)
Violin	Idiomatic scoring	Berg, Alban	Lyric Suite	1925	Adler (2002)
Violin	Idiomatic scoring	Grofé, Ferde	Grand Canyon Suite	1931	Blatter (1997)
Violin	Idiomatic scoring	Bartók, Béla	Divertimento	1939	Adler (2002)
Violin	Idiomatic scoring	Casella, Alfredo	Paganiniana	1942	Casella & Mortari (2004)
Violin	Idiomatic scoring	Casella, Alfredo	Paganiniana	1942	Casella & Mortari (2004)
Violin	Idiomatic scoring	Copland, Aaron	Symphony No.3	1946	Adler (2002)
Violin	Idiomatic scoring	Adams, John	Tromba Lontana	1986	Blatter (1997)
Violin	Multiple Notes	Beethoven, Ludwig van	Symphony No.3	1804	Piston (1961)
Violin	Multiple Notes	Beethoven, Ludwig van	Concerto for violin and orchestra	1806	Sevsay (2013)
Violin	Multiple Notes	Wagner, Richard	Die Walküre: Siegmunds Lebeslied	1856	Piston (1961)
Violin	Multiple Notes	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Piston (1961)
Violin	Multiple Notes	Mahler, Gustav	Symphony No.1	1888	Sevsay (2013)
Violin	Multiple Notes	Mahler, Gustav	Symphony No.5	1902	Sevsay (2013)

Violin	Multiple Notes	Prokofiev, Sergei	Chout	1915	Piston (1961)
Violin	Multiple Notes	Szymanowski, Karol	Mythes	1921	Casella & Mortari (2004)
Violin	Multiple Notes	Szymanowski, Karol	Mythes	1921	Casella & Mortari (2004)
Violin	Multiple Notes	Szymanowski, Karol	Mythes	1921	Casella & Mortari (2004)
Violin	Multiple Notes	Bartók, Béla	String Quartet no.4	1928	Casella & Mortari (2004)
Violin	Multiple Notes	Berg, Alban	Concerto for violin and orchestra	1935	Casella & Mortari (2004)
Violin	Multiple Notes	Cobián, Juan Carlos	Nostalgias	1936	Sevsay (2013)
Violin	Muting	Stravinsky, Igor	Petrouchka	1911	Casella & Mortari (2004)
Violin	Pizzicato	Mozart, Amadeus	Symphony No.41	1788	Sevsay (2013)
Violin	Pizzicato	Delibes, Léo	Sylvia	1876	Widor (1906)
Violin	Pizzicato	Tchaikovsky, Pyotr	Symphony No.4	1877	Sevsay (2013)
Violin	Pizzicato	Tchaikovsky, Pyotr	Symphony No.4	1877	Blatter (1997)
Violin	Pizzicato	Mozart, Amadeus	Eine kleine Nachtmusik	1878	Widor (1906)
Violin	Pizzicato	Wagner, Richard	Parsifal	1882	Widor (1906)
Violin	Pizzicato	Malherbe, Charles	Sérénade - Philipp	1886	Widor (1906)
Violin	Pizzicato	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Sevsay (2013)
Violin	Pizzicato	Mahler, Gustav	Symphony No.3	1896	Sevsay (2013)
Violin	Pizzicato	Mahler, Gustav	Symphony No.3	1896	Sevsay (2013)
Violin	Pizzicato	Mahler, Gustav	Symphony No.4	1901	Sevsay (2013)
Violin	Pizzicato	Debussy, Claude	Images pour orchestre	1908	Casella & Mortari (2004)
Violin	Pizzicato	Bartók, Béla	String Quartet no.4	1928	Casella & Mortari (2004)
Violin	Ranges: sound quality	Mendelssohn, Felix	Symphony No.4	1833	Piston (1961)
Violin	Ranges: sound quality	Wagner, Richard	Tannhäuser	1845	Piston (1961)
Violin	Ranges: sound quality	Schumann, Robert	Symphony No.2	1847	Piston (1961)
Violin	Ranges: sound quality	Brahms, Johannes	Symphony No.1	1876	Kennan & Grantham (2002)
Violin	Ranges: sound quality	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
Violin	Ranges: sound quality	Widor, Charles-Marie	Concerto for violin and orchestra	1877	Widor (1906)
Violin	Ranges: sound quality	Brahms, Johannes	Symphony No.4	1885	Piston (1961)
Violin	Ranges: sound quality	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Adler (2002)
Violin	Ranges: sound quality	Tchaikovsky, Pyotr	Symphony No.5	1888	Adler (2002)
Violin	Ranges: sound quality	Strauss, Richard	Don Juan	1889	Adler (2002)

Violin	Ranges: sound quality	Strauss, Richard	Tod und Verklärung	1889	Casella & Mortari (2004)
Violin	Ranges: sound quality	Sibelius, Jean	Symphony No.2	1902	Kennan & Grantham (2002)
Violin	Ranges: sound quality	Puccini, Giacomo	Madama Butterfly	1904	Adler (2002)
Violin	Ranges: sound quality	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
Violin	Ranges: sound quality	Prokofiev, Sergei	Symphony No.1	1917	Adler (2002)
Violin	Ranges: sound quality	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
Violin	Ranges: sound quality	Hanson, Howard Harold	Symphony No.3	1922	Kennan & Grantham (2002)
Violin	Scoring Techniques: Colour effects	Beethoven, Ludwig van	Concerto for Piano and Orchestra no.4	1805	Piston (1961)
Violin	Scoring Techniques: Colour effects	Schubert, Franz	Symphony No.5	1816	Piston (1961)
Violin	Scoring Techniques: Colour effects	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Violin	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.3	1896	Piston (1961)
Violin	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Violin	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.4	1901	Casella & Mortari (2004)
Violin	Scoring Techniques: Colour effects	Stravinsky, Igor	L'Oiseau de Feu	1910	Piston (1961)
Violin	Scoring Techniques: Colour effects	Ravel, Maurice	L'Heure Espagnole	1911	Piston (1961)
Violin	Scoring Techniques: Colour effects	Strauss, Richard	Der Rosenkavalier	1911	Piston (1961)
Violin	Scoring Techniques: Colour effects	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Violin	Scoring Techniques: Colour effects	Milhaud, Daries	Second Symphonic Suite	1919	Piston (1961)
Violin	Scoring Techniques: Colour effects	Ravel, Maurice	Valse, La	1920	Piston (1961)
Violin	Scoring Techniques: Colour effects	Bartók, Béla	Dance Suite	1923	Piston (1961)
Violin	Scoring Techniques: Colour effects	Bartók, Béla	Dance Suite	1923	Piston (1961)
Violin	Scoring Techniques: Colour effects	Roussel, Albert	Symphony No.3	1930	Piston (1961)
Violin	Scoring Techniques: Colour effects	Chávez, Carlos	Chapultepec	1935	Blatter (1997)
Violin	Scoring Techniques: Colour effects	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Violin	Scoring Techniques: Colour effects	Milhaud, Daries	Symphony No.2	1944	Piston (1961)
Violin	Scoring Techniques: Colour effects	Copland, Aaron	Symphony No.3	1946	Piston (1961)
Violin	Scoring Techniques: Division of Material	Liszt, Franz	Faust Symphony, A	1857	Piston (1961)
Violin	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.4	1885	Piston (1961)
Violin	Scoring Techniques: Doubling	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Blatter (1997)
Violin	Solo use in the orchestra	Brahms, Johannes	Symphony No.1	1876	Adler (2002)
Violin	Solo use in the orchestra	Tchaikovsky, Pyotr	Suite No.4	1887	Kennan & Grantham (2002)

Violin	Solo use in the orchestra	Strauss, Richard	Don Juan	1889	Adler (2002)
Violin	Solo use in the orchestra	Stravinsky, Igor	Concerto for violin and orchestra	1931	Casella & Mortari (2004)
Violin	Technical agility	Mozart, Amadeus	Nozze di Figaro, Le	1786	Kennan & Grantham (2002)
Violin	Technical agility	Mozart, Amadeus	Symphony No.41	1788	Kennan & Grantham (2002)
Violin	Technical agility	Beethoven, Ludwig van	Symphony No.1	1800	Kennan & Grantham (2002)
Violin	Technical agility	Verdi, Guiseppe	Aïda	1870	Casella & Mortari (2004)
Violin	Technical agility	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Violin	Technical agility	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
Violin	Technical agility	Mahler, Gustav	Symphony No.9	1909	Piston (1961)
Violin	Technical agility	Reger, Max	Romantic Suite, A	1912	Piston (1961)
Violin	Technical agility	Ravel, Maurice	Trio	1914	Casella & Mortari (2004)
Violin	Technical agility	Holst, Gustav	Planets, The	1916	Piston (1961)
Violin	Technical agility	Szymanowski, Karol	Violin Concerto	1916	Casella & Mortari (2004)
Violin	Technical agility	Berg, Alban	Lyric Suite	1925	Piston (1961)
Violin	Technical agility	Stravinsky, Igor	Apollon Musagète	1928	Piston (1961)
Violin	Technical agility	Hindemith, Paul	Mathis der Maler	1934	Kennan & Grantham (2002)
Violin	Technical agility	Stravinsky, Igor	Jeu du cartes	1937	Casella & Mortari (2004)
Violin	Technical agility	Hindemith, Paul	Symphony No.2	1940	Piston (1961)

*Addendum B Table 20 -- Examples regarding percussion instruments referenced in various orchestration textbooks:*

<b>Instrument/Group</b>	<b>Technique or reference</b>	<b>Composer</b>	<b>Composition</b>	<b>Year</b>	<b>Reference Source</b>
Perc-membrane pitched	Articulation	Mahler, Gustav	Symphony No.4	1901	Kennan & Grantham (2002)
Perc-membrane pitched	Extending the range of another instrument	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Perc-membrane pitched	Idiomatic scoring	Beethoven, Ludwig van	Symphony No.9	1824	Adler (2002)
Perc-membrane pitched	Idiomatic scoring	Berlioz, Hector	Symphonie Fantastique	1830	Adler (2002)
Perc-membrane pitched	Idiomatic scoring	Bloch, Ernest	Schelomo	1916	Adler (2002)
Perc-membrane pitched	Idiomatic scoring	Prokofiev, Sergei	Lieutenant Kijé: Suite	1934	Blatter (1997)
Perc-membrane pitched	Idiomatic scoring	Massenet, Jules	Érynnies, Les	1876	Widor (1906)

Perc-membrane pitched	Idiomatic scoring	Gernsheim, Friedrich	Symphony No.4	1895	Widor (1906)
Perc-membrane pitched	Multiple Notes	Strauss, Richard	Till Eulenspiegel	1895	Kennan & Grantham (2002)
Perc-membrane pitched	Ranges: sound quality	Ravel, Maurice	L'Enfant et les Sortilèges	1920	Casella & Mortari (2004)
Perc-membrane pitched	Scoring Techniques: Colour effects	Debussy, Claude	Nocturnes	1899	Piston (1961)
Perc-membrane pitched	Scoring Techniques: Colour effects	d'Indy, Vincent	Jour d'été à la Montagne	1905	Piston (1961)
Perc-membrane pitched	Scoring Techniques: Colour effects	Bartók, Béla	Music for Strings, Percussion, and Celesta	1936	Piston (1961)
Perc-membrane pitched	Scoring Techniques: Reinforcing	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Perc-membrane pitched	Solo use in the orchestra	Beethoven, Ludwig van	Symphony No.9	1824	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Strauss, Richard	Don Juan	1889	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Dvořák, Antonín	Symphony No.9	1893	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Bartók, Béla	Music for Strings, Percussion, and Celesta	1936	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Harris, Roy	Symphony No.3	1939	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Barber, Samuel	Symphony No.1	1943	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Bartók, Béla	Concerto for Orchestra	1943	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Carter, Elliot	Symphony for 3 orchestras	1976	Kennan & Grantham (2002)
Perc-membrane pitched	Solo use in the orchestra	Tchaikovsky, Pyotr	Symphony No.4	1877	Piston (1961)
Perc-membrane pitched	Solo use in the orchestra	Holst, Gustav	Planets, The	1916	Piston (1961)
Perc-membrane pitched	Technical agility	Stravinsky, Igor	Sacre du Printemps, Le	1913	Blatter (1997)
Perc-membrane pitched	Technical agility	d'Indy, Vincent	Symphony No.2	1903	Casella & Mortari (2004)
Perc-membrane pitched	Technical agility	Casella, Alfredo	Elegia Eroica	1916	Casella & Mortari (2004)
Perc-membrane pitched	Technical agility	Beethoven, Ludwig van	Symphony No.7	1812	Sevsay (2013)
Perc-membrane pitched	Technical agility	Beethoven, Ludwig van	Symphony No.8	1812	Sevsay (2013)
Perc-membrane pitched	Technical agility	Beethoven, Ludwig van	Symphony No.9	1824	Sevsay (2013)
Perc-membrane unpitched	Articulation	Ravel, Maurice	Rapsodie Espagnole	1907	Piston (1961)
Perc-membrane unpitched	Articulation	Prokofiev, Sergei	Symphony No.5	1944	Piston (1961)
Perc-membrane unpitched	Idiomatic scoring	Bizet, Georges	l'Arlésienne	1872	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Stravinsky, Igor	L'Oiseau de Feu	1910	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Ravel, Maurice	Bolero	1928	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Schuman, William Howard	Overture to American Festival	1939	Kennan & Grantham (2002)

Perc-membrane unpitched	Idiomatic scoring	Hindemith, Paul	Symphonic metamorphosis	1943	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Copland, Aaron	Appalachian Spring	1944	Kennan & Grantham (2002)
Perc-membrane unpitched	Idiomatic scoring	Bizet, Georges	l'Arlésienne	1872	Widor (1906)
Perc-membrane unpitched	Idiomatic scoring	Bizet, Georges	l'Arlésienne	1872	Widor (1906)
Perc-membrane unpitched	Idiomatic scoring	Bizet, Georges	Carmen	1875	Widor (1906)
Perc-membrane unpitched	Idiomatic scoring	Massenet, Jules	Fête Bohême	1876	Widor (1906)
Perc-membrane unpitched	Idiomatic scoring	Büsser, Henri	Hercule au Jardin des Hespérides	1901	Widor (1906)
Perc-membrane unpitched	Muting	Mackenzie, Alexander	Story of Sayid	1886	Widor (1906)
Perc-membrane unpitched	Scoring Techniques: Colour effects	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Perc-membrane unpitched	Scoring Techniques: Reinforcing	Gounod, Charles	Faust	1859	Widor (1906)
Perc-membrane unpitched	Solo use in the orchestra	Wagner, Richard	Tannhäuser	1845	Kennan & Grantham (2002)
Perc-membrane unpitched	Solo use in the orchestra	Copland, Aaron	El Salon Mexico	1936	Kennan & Grantham (2002)
Perc-metal pitched	Extended Techniques	Adams, John	Tromba Lontana	1943	Blatter (1997)
Perc-metal pitched	Idiomatic scoring	Kodály, Zoltán	Háry János Suite	1926	Adler (2002)
Perc-metal pitched	Idiomatic scoring	Copland, Aaron	Billy the Kid	1938	Adler (2002)
Perc-metal pitched	Idiomatic scoring	Wagner, Richard	Götterdämmerung	1848	Blatter (1997)
Perc-metal pitched	Idiomatic scoring	Penderecki, Krzysztof	De Natura Sonoris	1966	Kennan & Grantham (2002)
Perc-metal pitched	Idiomatic scoring	Mozart, Amadeus	Die Zauberflöte	1791	Widor (1906)
Perc-metal pitched	Ranges: sound quality	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Perc-metal pitched	Ranges: sound quality	Debussy, Claude	Mer, La	1905	Piston (1961)
Perc-metal pitched	Scoring Techniques: Colour effects	Khachaturian, Aram	Concerto for Piano and Orchestra	1936	Kennan & Grantham (2002)
Perc-metal pitched	Scoring Techniques: Colour effects	Harris, Roy	Symphony No.3	1939	Kennan & Grantham (2002)
Perc-metal pitched	Scoring Techniques: Colour effects	Stockhausen, Karlheinz	Gruppen für drie Orchester	1957	Kennan & Grantham (2002)
Perc-metal pitched	Scoring Techniques: Colour effects	Bassett, Leslie	Echoes from an Invisible World	1976	Kennan & Grantham (2002)
Perc-metal pitched	Scoring Techniques: Colour effects	Davies, Peter Maxwell	Symphony No.1	1976	Kennan & Grantham (2002)
Perc-metal pitched	Scoring Techniques: Division of Material	Schoenberg, Arnold	Variations for orchestra	1928	Kennan & Grantham (2002)
Perc-metal pitched	Solo use in the orchestra	Tchaikovsky, Pyotr	Nutcracker, The	1892	Blatter (1997)
Perc-metal pitched	Solo use in the orchestra	Crumb, George	Ancient Voices of Children	1970	Blatter (1997)
Perc-metal pitched	Solo use in the orchestra	Debussy, Claude	Images pour orchestre	1908	Kennan & Grantham (2002)
Perc-metal pitched	Solo use in the orchestra	Hindemith, Paul	Mathis der Maler	1934	Kennan & Grantham (2002)
Perc-metal pitched	Solo use in the orchestra	Stockhausen, Karlheinz	Formel	1951	Kennan & Grantham (2002)



Perc-metal pitched	Solo use in the orchestra	Takemitsu, Toru	Green	1967	Kennan & Grantham (2002)
Perc-metal pitched	Solo use in the orchestra	Argento, Dominick	Ring of Time, A	1972	Kennan & Grantham (2002)
Perc-metal pitched	Solo use in the orchestra	Davies, Peter Maxwell	Mirror of Whitening Light, A	1977	Kennan & Grantham (2002)
Perc-metal pitched	Unidiomatic scoring	Stockhausen, Karlheinz	Gruppen für drie Orchester	1957	Kennan & Grantham (2002)
Perc-metal pitched	Unidiomatic scoring	Wagner, Richard	Parsifal	1882	Widor (1906)
Perc-metal unpitched	Idiomatic scoring	Bizet, Georges	Carmen	1875	Kennan & Grantham (2002)
Perc-metal unpitched	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)
Perc-metal unpitched	Idiomatic scoring	Griffes, Charles Tomlinson	White Peacock, The	1917	Kennan & Grantham (2002)
Perc-metal unpitched	Idiomatic scoring	Copland, Aaron	El Salon Mexico	1936	Kennan & Grantham (2002)
Perc-metal unpitched	Idiomatic scoring	Schumann, Robert	Symphony No.1	1841	Widor (1906)
Perc-metal unpitched	Idiomatic scoring	Berlioz, Hector	Damnation of Faust, The	1846	Widor (1906)
Perc-metal unpitched	Idiomatic scoring	Grieg, Edvard	Peer Gynt Suite no.1	1875	Widor (1906)
Perc-metal unpitched	Idiomatic scoring	Saint-Saëns, Camille	Jeunesse d'Hercule, La	1877	Widor (1906)
Perc-metal unpitched	Idiomatic scoring	Paladilhe, Émile	Ouverture de Suzanne	1878	Widor (1906)
Perc-metal unpitched	Idiomatic scoring	Lalo, Édouard	Namouna	1882	Widor (1906)
Perc-metal unpitched	Scoring Techniques: Colour effects	Strauss, Richard	Tod und Verklärung	1889	Kennan & Grantham (2002)
Perc-metal unpitched	Scoring Techniques: Colour effects	Tchaikovsky, Pyotr	Symphony No.6	1893	Kennan & Grantham (2002)
Perc-metal unpitched	Scoring Techniques: Reinforcing	Dubois Théodore	Suite miniature	1904	Widor (1906)
Percussion Section	Extended Techniques	Oliveros, Pauline	Outline	1963	Blatter (1997)
Percussion Section	Extended Techniques	Penderecki, Krzysztof	Passion and Death of Our Lord Jesus Christ According to St. Luke, The	1965	Blatter (1997)
Percussion Section	Extended Techniques	Crumb, George	Ancient Voices of Children	1970	Blatter (1997)
Percussion Section	Extended Techniques	Crumb, George	Lux Æterna	1972	Blatter (1997)
Percussion Section	Extended Techniques	Berio, Luciano	Circles	1960	Kennan & Grantham (2002)
Percussion Section	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Blatter (1997)
Percussion Section	Idiomatic scoring	Varèse, Edgard	Ionisation	1931	Blatter (1997)
Percussion Section	Preparing Scores and Parts	Stravinsky, Igor	Noces, Les	1923	Adler (2002)
Percussion Section	Preparing Scores and Parts	Orff, Carl	Carmina Burana	1936	Adler (2002)
Percussion Section	Preparing Scores and Parts	Shostakovich, Dmitri	Symphony No.6	1939	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Debussy, Claude	Nocturnes	1899	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Stravinsky, Igor	Sacre du Printemps, Le	1913	Adler (2002)

Percussion Section	Scoring Techniques: Colour effects	Bernstein, Leonard	Fancy Free	1944	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Copland, Aaron	Appalachian Spring	1944	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Benson, Warren	Symphony No.1	1962	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Bassett, Leslie	Variations for orchestra	1963	Adler (2002)
Percussion Section	Scoring Techniques: Colour effects	Schwartz, Elliot	Serenade for Flute, Contrabass and Percussion	1964	Blatter (1997)
Percussion Section	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.9	1824	Adler (2002)
Percussion Section	Scoring Techniques: Division of Material	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Adler (2002)
Percussion Section	Scoring Techniques: Division of Material	Copland, Aaron	Appalachian Spring	1944	Adler (2002)
Percussion Section	Scoring Techniques: Division of Material	Copland, Aaron	Appalachian Spring	1944	Adler (2002)
Percussion Section	Scoring Techniques: Division of Material	Berio, Luciano	Circles	1960	Adler (2002)
Percussion Section	Scoring Techniques: Division of Material	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Ravel, Maurice	Bolero	1928	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Hindemith, Paul	Symphonic metamorphosis	1943	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Gerhard, Roberto	Symphony No.2	1959	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Schuller, Gunther	Seven Studies on Themes of Paul Klee	1960	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Penderecki, Krzysztof	Fluorescences	1962	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Haubenstock-Ramati, Roman	Tableau III	1971	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Henze, Hans, Werner	Heliogabalus Imperator	1991	Kennan & Grantham (2002)
Percussion Section	Scoring Techniques: Division of Material	Ravel, Maurice	Daphnis et Chloé	1912	Piston (1961)
Percussion Section	Scoring Techniques: Division of Material	Hindemith, Paul	Symphonic metamorphosis	1943	Piston (1961)
Percussion Section	Scoring Techniques: Doubling	Balakirev, Mily	Thamar	1882	Widor (1906)
Percussion Section	Scoring Techniques: Reinforcing	Beethoven, Ludwig van	Concerto for violin and orchestra	1806	Adler (2002)
Percussion Section	Scoring Techniques: Reinforcing	Rossini, Gioacchino	La Gazza Ladra	1817	Adler (2002)
Percussion Section	Scoring Techniques: Reinforcing	Brahms, Johannes	Symphony No.2	1877	Adler (2002)
Percussion Section	Scoring Techniques: Reinforcing	Tchaikovsky, Pyotr	Symphony No.4	1877	Adler (2002)
Percussion Section	Scoring Techniques: Reinforcing	Shostakovich, Dmitri	Symphony No.5	1937	Adler (2002)
Percussion Section	Technical agility	Tower, Joan	Sequoia	1981	Blatter (1997)
Perc-wood pitched	Idiomatic scoring	Saint-Saëns, Camille	Danse Macabre	1874	Blatter (1997)
Perc-wood pitched	Idiomatic scoring	Saint-Saëns, Camille	Danse Macabre	1874	Widor (1906)
Perc-wood pitched	Solo use in the orchestra	Stravinsky, Igor	Petrouchka	1911	Kennan & Grantham (2002)
Perc-wood pitched	Solo use in the orchestra	Britten, Benjamin	Young Person's Guide to the Orchestra, The	1946	Kennan & Grantham (2002)

Perc-wood pitched	Solo use in the orchestra	Messiaen, Olivier	Chronochromie	1960	Kennan & Grantham (2002)
Perc-wood pitched	Solo use in the orchestra	Husa, Karel	Two Sonnets by Michelangelo	1971	Kennan & Grantham (2002)
Perc-wood pitched	Solo use in the orchestra	Debussy, Claude	Images pour orchestre	1908	Piston (1961)
Perc-wood unpitched	Idiomatic scoring	Saint-Saëns, Camille	Lyre et la Harpe, La	1879	Widor (1906)
Perc-wood unpitched	Scoring Techniques: Colour effects	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Kennan & Grantham (2002)
Perc-wood unpitched	Scoring Techniques: Colour effects	Copland, Aaron	Symphony No.3	1946	Kennan & Grantham (2002)

Addendum B Table 21 -- Examples regarding keyboard and plucked string instruments referenced in various orchestration textbooks:

Instrument/Group	Technique or reference	Composer	Composition	Year	Reference Source
Guitar	Idiomatic scoring	Boulez, Pierre	Marteau sans Maître, Le	1955	Blatter (1997)
Guitar	Idiomatic scoring	Brindle, Smith	El Polifemo de Oro	1956	Blatter (1997)
Guitar	Idiomatic scoring	Crumb, George	Songs, Drones and Refrains of Death	1968	Blatter (1997)
Harp	Expressive qualities	Tocchi, Gian Luca	Canzone, notturno e ballo	1945	Casella & Mortari (2004)
Harp	Expressive qualities	Tocchi, Gian Luca	Canzone, notturno e ballo	1945	Casella & Mortari (2004)
Harp	Idiomatic scoring	Mozart, Amadeus	Concerto for Flute and Orchestra	1777	Adler (2002)
Harp	Idiomatic scoring	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Adler (2002)
Harp	Idiomatic scoring	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Adler (2002)
Harp	Idiomatic scoring	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Adler (2002)
Harp	Idiomatic scoring	Debussy, Claude	Nocturnes	1899	Adler (2002)
Harp	Idiomatic scoring	Ravel, Maurice	Daphnis et Chloé	1912	Adler (2002)
Harp	Idiomatic scoring	Salzedo, Carlos	Modern study of the harp	1921	Adler (2002)
Harp	Idiomatic scoring	Franck, César	Symphony	1888	Blatter (1997)
Harp	Idiomatic scoring	Brahms, Johannes	Requiem	1868	Kennan & Grantham (2002)
Harp	Idiomatic scoring	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Harp	Idiomatic scoring	Ravel, Maurice	Daphnis et Chloé	1912	Kennan & Grantham (2002)
Harp	Idiomatic scoring	Griffes, Charles Tomlinson	White Peacock, The	1917	Kennan & Grantham (2002)
Harp	Idiomatic scoring	Stravinsky, Igor	Orpheus	1947	Piston (1961)
Harp	Idiomatic scoring	Wagner, Richard	Götterdämmerung	1848	Widor (1906)

Harp	Idiomatic scoring	Wagner, Richard	Lohengrin	1848	Widor (1906)
Harp	Idiomatic scoring	Liszt, Franz	Dante Symphony	1857	Widor (1906)
Harp	Idiomatic scoring	Saint-Saëns, Camille	Oratorio de Noël	1858	Widor (1906)
Harp	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Widor (1906)
Harp	Idiomatic scoring	Massenet, Jules	Esclarmonde	1889	Widor (1906)
Harp	Idiomatic scoring	Debussy, Claude	Pelléas et Mélisande	1902	Widor (1906)
Harp	Multiple Notes	Bartók, Béla	Concerto for violin and orchestra	1938	Adler (2002)
Harp	Multiple Notes	Debussy, Claude	Mer, La	1905	Piston (1961)
Harp	Multiple Notes	Bartók, Béla	Concerto for violin and orchestra	1938	Piston (1961)
Harp	Muting	Stravinsky, Igor	Perséphone	1934	Piston (1961)
Harp	Preparing Scores and Parts	Tower, Joan	Sequoia	1981	Blatter (1997)
Harp	Preparing Scores and Parts	Dukas, Paul	Ariane et Barbe-Bleu	1906	Piston (1961)
Harp	Preparing Scores and Parts	Roussel, Albert	Bacchus et Ariane, Second Suite	1930	Piston (1961)
Harp	Preparing Scores and Parts	Bartók, Béla	Concerto for violin and orchestra	1938	Piston (1961)
Harp	Ranges: sound quality	Mortari, Virgilio	Studi Galanti	1961	Casella & Mortari (2004)
Harp	Scoring Techniques: Colour effects	Britten, Benjamin	Peter Grimes	1945	Adler (2002)
Harp	Scoring Techniques: Colour effects	Hindemith, Paul	Sonata for harp	1939	Casella & Mortari (2004)
Harp	Scoring Techniques: Colour effects	Perrachio, Luigi	Sonata popolare sca per arpa	1943	Casella & Mortari (2004)
Harp	Scoring Techniques: Colour effects	Tocchi, Gian Luca	Canzone, notturno e ballo	1945	Casella & Mortari (2004)
Harp	Scoring Techniques: Colour effects	Mortari, Virgilio	Sonatina prodigio	1948	Casella & Mortari (2004)
Harp	Scoring Techniques: Colour effects	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Harp	Scoring Techniques: Colour effects	Stravinsky, Igor	L'Oiseau de Feu	1910	Kennan & Grantham (2002)
Harp	Scoring Techniques: Colour effects	Stravinsky, Igor	L'Oiseau de Feu	1910	Kennan & Grantham (2002)
Harp	Scoring Techniques: Colour effects	Ravel, Maurice	Daphnis et Chloé	1912	Kennan & Grantham (2002)
Harp	Scoring Techniques: Colour effects	Ravel, Maurice	Daphnis et Chloé	1912	Kennan & Grantham (2002)
Harp	Scoring Techniques: Colour effects	Varèse, Edgard	Amériques	1921	Kennan & Grantham (2002)
Harp	Scoring Techniques: Colour effects	Debussy, Claude	Printemps	1887	Piston (1961)
Harp	Scoring Techniques: Colour effects	Strauss, Richard	Also Sprach Zarathustra	1896	Piston (1961)
Harp	Scoring Techniques: Colour effects	Debussy, Claude	Nocturnes	1899	Piston (1961)
Harp	Scoring Techniques: Colour effects	Ravel, Maurice	Valses nobles et sentimentales	1912	Piston (1961)
Harp	Scoring Techniques: Colour effects	Britten, Benjamin	Peter Grimes	1945	Piston (1961)

Harp	Scoring Techniques: Colour effects	Widor, Charles-Marie	Choral et Variations	1900	Widor (1906)
Harp	Scoring Techniques: Reinforcing	Casella, Alfredo	Midsummer Night's Dream, A	1826	Piston (1961)
Harp	Scoring Techniques: Reinforcing	Massenet, Jules	Navarraise, La	1894	Widor (1906)
Harp	Solo use in the orchestra	Ravel, Maurice	Concerto for Piano and Orchestra no.2	1932	Casella & Mortari (2004)
Harp	Solo use in the orchestra	Berg, Alban	Concerto for violin and orchestra	1935	Piston (1961)
Harp	Solo use in the orchestra	Stravinsky, Igor	Orpheus	1947	Piston (1961)
Harp	Subdivide	Berlioz, Hector	Symphonie Fantastique	1830	Blatter (1997)
Harp	Technical agility	Sibelius, Jean	Symphony No.1	1899	Blatter (1997)
Harp	Technical agility	Tower, Joan	Sequoia	1981	Blatter (1997)
Harp	Technical agility	Salzedo, Carlos	Modern study of the harp	1921	Casella & Mortari (2004)
Harp	Technical agility	Salzedo, Carlos	Modern study of the harp	1921	Casella & Mortari (2004)
Harp	Technical agility	Casella, Alfredo	Sonata per arpa	1943	Casella & Mortari (2004)
Harp	Technical agility	Berlioz, Hector	Symphonie Fantastique	1830	Piston (1961)
Harp	Technical agility	Debussy, Claude	Martyre de Saint Sébastien, Le	1911	Piston (1961)
Harp	Technical agility	Ravel, Maurice	Tombeau de Couperin, Le	1917	Piston (1961)
Harp	Technical agility	Hasselmans, Alphonse	Prelude	1884	Widor (1906)
Harp	Technical agility	Hasselmans, Alphonse	Ballade	1887	Widor (1906)
Harp	Technical agility	Hasselmans, Alphonse	Gitana	1890	Widor (1906)
Harp	Technical agility	Dubois Théodore	Fantasie, Harpe et Orchestre	1890	Widor (1906)
Harp	Technical agility	Hasselmans, Alphonse	Conte de Noël	1895	Widor (1906)
Harp	Unidiomatic scoring	Tchaikovsky, Pyotr	Nutcracker, The	1892	Adler (2002)
Harp	Unidiomatic scoring	Sibelius, Jean	Symphony No.1	1899	Blatter (1997)
Harp	Unidiomatic scoring	Verdi, Guiseppe	Falstaff	1893	Widor (1906)
Celesta	Idiomatic scoring	Tchaikovsky, Pyotr	Nutcracker, The	1892	Kennan & Grantham (2002)
Celesta	Idiomatic scoring	Schoenberg, Arnold	Five Orchestral Pieces	1909	Kennan & Grantham (2002)
Celesta	Idiomatic scoring	Ravel, Maurice	Daphnis et Chloé	1912	Kennan & Grantham (2002)
Celesta	Idiomatic scoring	Bloch, Ernest	Schelomo	1916	Kennan & Grantham (2002)
Celesta	Scoring Techniques: Colour effects	Tchaikovsky, Pyotr	Nutcracker, The	1892	Adler (2002)
Celesta	Scoring Techniques: Colour effects	Strauss, Richard	Der Rosenkavalier	1911	Adler (2002)
Celesta	Scoring Techniques: Colour effects	Bartók, Béla	Music for Strings, Percussion, and Celesta	1936	Piston (1961)
Celesta	Scoring Techniques: Colour effects	Shostakovich, Dmitri	Symphony No.5	1937	Piston (1961)

Celesta	Solo use in the orchestra	Strauss, Richard	Der Rosenkavalier	1911	Piston (1961)
Harpichord	Idiomatic scoring	de Falla, Manuel	Concerto for Harpichord and 5 instruments	1926	Casella & Mortari (2004)
Piano	Expressive qualities	Stravinsky, Igor	Petrouchka	1911	Casella & Mortari (2004)
Piano	Expressive qualities	Stravinsky, Igor	Symphonie de Psaumes	1930	Casella & Mortari (2004)
Piano	Extended Techniques	Cowell, Henry	Banshee, The	1925	Blatter (1997)
Piano	Extended Techniques	Adler, Samuel	Sonatina	1943	Blatter (1997)
Piano	Idiomatic scoring	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Kennan & Grantham (2002)
Piano	Idiomatic scoring	Stravinsky, Igor	L'Oiseau de Feu	1910	Kennan & Grantham (2002)
Piano	Idiomatic scoring	Respighi, Ottorino	Pines of Rome, The	1924	Kennan & Grantham (2002)
Piano	Idiomatic scoring	Shostakovich, Dmitri	Symphony No.1	1925	Kennan & Grantham (2002)
Piano	Percussive Techniques	Casella, Alfredo	Missa Solemnis pro pace	1944	Casella & Mortari (2004)
Piano	Percussive Techniques	Bartók, Béla	Dance Suite	1923	Piston (1961)
Piano	Preparing Scores and Parts	Adler, Samuel	Sonatina	1943	Blatter (1997)
Piano	Role as accompaniment	Copland, Aaron	Music for the Theater	1925	Piston (1961)
Piano	Scoring Techniques: Colour effects	Stravinsky, Igor	Petrouchka	1911	Adler (2002)
Piano	Scoring Techniques: Colour effects	Shostakovich, Dmitri	Symphony No.1	1925	Adler (2002)
Piano	Scoring Techniques: Colour effects	Copland, Aaron	Billy the Kid	1938	Adler (2002)
Piano	Scoring Techniques: Colour effects	Bernstein, Leonard	On the Town	1944	Adler (2002)
Piano	Scoring Techniques: Colour effects	Britten, Benjamin	Sinfonia da Requiem	1940	Piston (1961)
Piano	Scoring Techniques: Colour effects	Prokofiev, Sergei	Symphony No.5	1944	Piston (1961)
Piano	Scoring Techniques: Doubling	Copland, Aaron	Symphony No.1	1928	Piston (1961)
Piano	Scoring Techniques: Doubling	Shostakovich, Dmitri	Symphony No.5	1937	Piston (1961)
Piano	Scoring Techniques: Doubling	Martinů, Bohuslav	Symphony No.4	1945	Piston (1961)
Piano	Scoring Techniques: Doubling	Copland, Aaron	Symphony No.3	1946	Piston (1961)
Piano	Solo use in the orchestra	Stravinsky, Igor	Petrouchka	1911	Piston (1961)
Piano	Solo use in the orchestra	Stravinsky, Igor	Symphony No.2	1940	Piston (1961)
Synth	Preparing Scores and Parts	Adams, John	Short Ride in a Fast Machine	1986	Blatter (1997)

Addendum B Table 22 -- Examples regarding orchestral tutti referenced in various orchestration textbooks:

Instrument/Group	Technique or reference	Composer	Composition	Year	Reference Source
Tutti	Double or Triple or Flutter tonguing	Schoenberg, Arnold	Erwartung	1909	Casella & Mortari (2004)
Tutti	Double or Triple or Flutter tonguing	Casella, Alfredo	Giara, La	1924	Casella & Mortari (2004)
Tutti	Expressive qualities	Honegger, Arthur	Rugby	1922	Casella & Mortari (2004)
Tutti	Extending the range of another instrument	Bruckner, Anton	Symphony No.7	1885	Blatter (1997)
Tutti	Extending the range of another instrument	Milhaud, Daries	Cinq études pour piano et orchestre	1921	Casella & Mortari (2004)
Tutti	Idiomatic scoring	Stravinsky, Igor	Noces, Les	1923	Casella & Mortari (2004)
Tutti	Idiomatic scoring	Petrassi, Goffredo	Coro di morti	1941	Casella & Mortari (2004)
Tutti	Idiomatic scoring	Dallapiccola, Luigi	Preghiera di Maria Stuarda	1962	Casella & Mortari (2004)
Tutti	Idiomatic scoring	Strauss, Richard	Tod und Verklärung	1889	Kennan & Grantham (2002)
Tutti	Idiomatic scoring	Mahler, Gustav	Symphony No.1	1888	Sevsay (2013)
Tutti	Idiomatic scoring	Tchaikovsky, Pyotr	Symphony No.5	1888	Sevsay (2013)
Tutti	Idiomatic scoring	Dvořák, Antonín	Symphony No.9	1893	Sevsay (2013)
Tutti	Idiomatic scoring	Debussy, Claude	Mer, La	1905	Sevsay (2013)
Tutti	Idiomatic scoring	Debussy, Claude	Mer, La	1905	Sevsay (2013)
Tutti	Idiomatic scoring	Schoenberg, Arnold	Five Orchestral Pieces	1909	Sevsay (2013)
Tutti	Idiomatic scoring	von Webern, Anton	Six Pieces for Orchestra	1910	Sevsay (2013)
Tutti	Idiomatic scoring	Stravinsky, Igor	L'Oiseau de Feu	1910	Sevsay (2013)
Tutti	Idiomatic scoring	Stravinsky, Igor	Petrouchka	1911	Sevsay (2013)
Tutti	Idiomatic scoring	Berg, Alban	Three Pieces for Orchestra	1914	Sevsay (2013)
Tutti	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Sevsay (2013)
Tutti	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Sevsay (2013)
Tutti	Idiomatic scoring	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Sevsay (2013)
Tutti	Idiomatic scoring	Respighi, Ottorino	Pines of Rome, The	1924	Sevsay (2013)
Tutti	Idiomatic scoring	Dutilleux, Henri	Symphony No.1	1951	Sevsay (2013)
Tutti	Idiomatic scoring	Ligeti, György	Atmosphères	1961	Sevsay (2013)
Tutti	Idiomatic scoring	Berio, Luciano	Laborintus II	1965	Sevsay (2013)
Tutti	Idiomatic scoring	Penderecki, Krzysztof	De Natura Sonoris	1966	Sevsay (2013)

Tutti	Idiomatic scoring	Boulez, Pierre	Notations	1978	Sevsay (2013)
Tutti	Idiomatic scoring	Lutoslawski, Witold	Chain 3	1986	Sevsay (2013)
Tutti	Preparing Scores and Parts	Bach, Johann Sebastian	Herzlich Tut Mich Verlangen	1685	Blatter (1997)
Tutti	Preparing Scores and Parts	Haydn, Josef	Symphony No.104	1795	Blatter (1997)
Tutti	Preparing Scores and Parts	Berg, Alban	Lyric Suite	1925	Blatter (1997)
Tutti	Preparing Scores and Parts	Carter, Elliot	Second String Quartet	1961	Blatter (1997)
Tutti	Preparing Scores and Parts	Schuller, Gunther	Music for Brass Quintet	1961	Blatter (1997)
Tutti	Ranges: sound quality	Ghedini, Giorgio Federico	Maria d'Alessandra	1937	Casella & Mortari (2004)
Tutti	Role as accompaniment	Mozart, Amadeus	Concerto for Flute and Orchestra	1777	Adler (2002)
Tutti	Role as accompaniment	Mozart, Amadeus	Concerto for Horn and Orchestra	1791	Adler (2002)
Tutti	Role as accompaniment	Haydn, Josef	Creation, The	1798	Adler (2002)
Tutti	Role as accompaniment	Haydn, Josef	Creation, The	1798	Adler (2002)
Tutti	Role as accompaniment	Beethoven, Ludwig van	Romance for Violin and Orchestra	1802	Adler (2002)
Tutti	Role as accompaniment	Beethoven, Ludwig van	Fidelio	1805	Adler (2002)
Tutti	Role as accompaniment	Beethoven, Ludwig van	Concerto for violin and orchestra	1806	Adler (2002)
Tutti	Role as accompaniment	Schumann, Robert	Concerto for Piano and Orchestra	1845	Adler (2002)
Tutti	Role as accompaniment	Mendelssohn, Felix	Elijah	1846	Adler (2002)
Tutti	Role as accompaniment	Liszt, Franz	Concerto for Piano and Orchestra no.1	1849	Adler (2002)
Tutti	Role as accompaniment	Verdi, Guiseppe	La Traviata	1853	Adler (2002)
Tutti	Role as accompaniment	Dvořák, Antonín	Concerto for Cello and Orchestra	1865	Adler (2002)
Tutti	Role as accompaniment	Saint-Saëns, Camille	Concerto for Cello and Orchestra	1872	Adler (2002)
Tutti	Role as accompaniment	Bizet, Georges	Carmen	1875	Adler (2002)
Tutti	Role as accompaniment	Tchaikovsky, Pyotr	Concerto for Piano and Orchestra no.1	1875	Adler (2002)
Tutti	Role as accompaniment	Tchaikovsky, Pyotr	Francesca da Rimini	1876	Adler (2002)
Tutti	Role as accompaniment	Tchaikovsky, Pyotr	Concerto for violin and orchestra	1878	Adler (2002)
Tutti	Role as accompaniment	Mahler, Gustav	Lieder eines fahrenden Gesellen	1885	Adler (2002)
Tutti	Role as accompaniment	Sibelius, Jean	Concerto for violin and orchestra	1904	Adler (2002)
Tutti	Role as accompaniment	Walton, William	Belshazzar's Feast	1931	Adler (2002)
Tutti	Role as accompaniment	Orff, Carl	Carmina Burana	1936	Adler (2002)
Tutti	Role as accompaniment	Bartók, Béla	Concerto for Piano and Orchestra no.3	1945	Adler (2002)
Tutti	Scoring Techniques: Balance	Mahler, Gustav	Symphony No.3	1896	Casella & Mortari (2004)



Tutti	Scoring Techniques: Balance	Mozart, Amadeus	Nozze di Figaro, Le	1786	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Schubert, Franz	Symphony No.5	1816	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Brahms, Johannes	Variations on a Theme by Haydn	1873	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Britten, Benjamin	Sinfonietta	1932	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Prokofiev, Sergei	Symphony No.5	1944	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Copland, Aaron	Symphony No.3	1946	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Balance	Weber, Carl Maria von	Der Freishütz	1821	Piston (1961)
Tutti	Scoring Techniques: Balance	Berlioz, Hector	Roméo et Juliette	1839	Piston (1961)
Tutti	Scoring Techniques: Balance	Brahms, Johannes	Symphony No.3	1883	Piston (1961)
Tutti	Scoring Techniques: Balance	Strauss, Richard	Don Juan	1889	Piston (1961)
Tutti	Scoring Techniques: Balance	Stravinsky, Igor	Symphonies of Wind Instruments	1920	Piston (1961)
Tutti	Scoring Techniques: Balance	Hindemith, Paul	Mathis der Maler	1934	Piston (1961)
Tutti	Scoring Techniques: Balance	Schuman, William Howard	Symphony No.3	1941	Piston (1961)
Tutti	Scoring Techniques: Balance	Rimsky-Korsakov, Nicolai	Capriccio Espagnol	1887	Wagner (1959)
Tutti	Scoring Techniques: Colour effects	Berlioz, Hector	Carnival Romain, Le	1868	Adler (2002)
Tutti	Scoring Techniques: Colour effects	Schoenberg, Arnold	Five Orchestral Pieces	1909	Adler (2002)
Tutti	Scoring Techniques: Colour effects	von Webern, Anton	Symphony	1928	Adler (2002)
Tutti	Scoring Techniques: Colour effects	Barber, Samuel	Symphony No.1	1943	Adler (2002)
Tutti	Scoring Techniques: Colour effects	Carter, Elliot	Eight Etudes and a Fantasy	1950	Blatter (1997)
Tutti	Scoring Techniques: Colour effects	Dukas, Paul	Ariane et Barbe-Bleu	1906	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Alfano, Franco	Eliana	1909	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Stravinsky, Igor	L'Oiseau de Feu	1910	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Casella, Alfredo	Pagine di Guerra	1918	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Busoni, Ferruccio	Sposa sorteggiata, La	1923	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Respighi, Ottorino	Roman Festivals	1926	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Ravel, Maurice	Bolero	1928	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Casella, Alfredo	Symphony No.3	1940	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Casella, Alfredo	Paganiniana	1942	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Mortari, Virgilio	L'allegria Piazzetta	1949	Casella & Mortari (2004)

Tutti	Scoring Techniques: Colour effects	Mortari, Virgilio	Trittico	1952	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Mortari, Virgilio	Fantasy for piano and orchestra	1966	Casella & Mortari (2004)
Tutti	Scoring Techniques: Colour effects	Mozart, Amadeus	Nozze di Figaro, Le	1786	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Schubert, Franz	Symphony No.5	1816	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Brahms, Johannes	Variations on a Theme by Haydn	1873	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.4	1901	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Mahler, Gustav	Symphony No.9	1909	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	von Webern, Anton	Six Pieces for Orchestra	1910	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Britten, Benjamin	Sinfonietta	1932	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Stravinsky, Igor	Agon	1957	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Stravinsky, Igor	Variations	1964	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Ligeti, György	Melodien	1971	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Adams, John	Tromba Lontana	1986	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Colour effects	Stravinsky, Igor	Symphony No.2	1940	Piston (1961)
Tutti	Scoring Techniques: Colour effects	de Falla, Manuel	El Amor Brujo	1986	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.41	1788	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Weber, Carl Maria von	Der Freishütz	1821	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Schubert, Franz	Symphony No.8	1822	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Missa Solemnis pro pace	1823	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Schumann, Robert	Symphony No.1	1841	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.3	1883	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.1	1888	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.4	1901	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.4	1901	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Bloch, Ernest	Schelomo	1916	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Holst, Gustav	Planets, The	1916	Adler (2002)
Tutti	Scoring Techniques: Division of Material	Schubert, Franz	Octet	1824	Blatter (1997)

Tutti	Scoring Techniques: Division of Material	Liszt, Franz	Préludes, Les	1845	Blatter (1997)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Tannhäuser	1845	Blatter (1997)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Siegfried Idyll	1870	Blatter (1997)
Tutti	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.4	1877	Blatter (1997)
Tutti	Scoring Techniques: Division of Material	d'Indy, Vincent	Jour d'été à la Montagne	1905	Casella & Mortari (2004)
Tutti	Scoring Techniques: Division of Material	Tommasini, Vincenzo	Paesaggi Toscani	1922	Casella & Mortari (2004)
Tutti	Scoring Techniques: Division of Material	Puccini, Giacomo	Turandot	1926	Casella & Mortari (2004)
Tutti	Scoring Techniques: Division of Material	Varèse, Edgard	Ionisation	1931	Casella & Mortari (2004)
Tutti	Scoring Techniques: Division of Material	Previtali, Fernando	Espressioni sinfoniche	1941	Casella & Mortari (2004)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Nozze di Figaro, Le	1786	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Schubert, Franz	Symphony No.5	1816	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Liszt, Franz	Préludes, Les	1845	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Die Meistersinger	1867	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Die Meistersinger	1867	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Brahms, Johannes	Variations on a Theme by Haydn	1873	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.4	1877	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Franck, César	Symphony	1888	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.5	1888	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Ravel, Maurice	Pavane pour une Infante Défunte	1899	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Debussy, Claude	Images pour orchestre	1908	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Ravel, Maurice	Tombeau de Couperin, Le	1917	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Schoenberg, Arnold	Variations for orchestra	1928	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Britten, Benjamin	Sinfonietta	1932	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Hindemith, Paul	Nobilissima Visione	1938	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	von Webern, Anton	Variations for orchestra	1941	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Bartók, Béla	Concerto for Orchestra	1943	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Copland, Aaron	Variations for orchestra	1945	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Copland, Aaron	Symphony No.3	1946	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Rochberg, George	Zodiac	1964	Kennan & Grantham (2002)

Tutti	Scoring Techniques: Division of Material	Stravinsky, Igor	Variations	1964	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Adams, John	Short Ride in a Fast Machine	1986	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.36	1783	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Nozze di Figaro, Le	1786	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.39	1788	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.39	1788	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.40	1788	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Haydn, Josef	Symphony No.104	1795	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.1	1800	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.5	1808	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.7	1812	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Schumann, Robert	Symphony No.1	1841	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mendelssohn, Felix	Symphony No.3	1842	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Tristan und Isolde	1859	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Berlioz, Hector	Carnival Romain, Le	1868	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.2	1877	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Brahms, Johannes	Symphony No.2	1877	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Tchaikovsky, Pyotr	Symphony No.4	1877	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Franck, César	Symphony	1888	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Mahler, Gustav	Symphony No.4	1901	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Strauss, Richard	Symphonia Domestica	1903	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Debussy, Claude	Mer, La	1905	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Stravinsky, Igor	Sacre du Printemps, Le	1913	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Holst, Gustav	Planets, The	1916	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Milhaud, Daries	Second Symphonic Suite	1919	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Bartók, Béla	Concerto for violin and orchestra	1938	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Bartók, Béla	Concerto for Orchestra	1943	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Milhaud, Daries	Symphony No.2	1944	Piston (1961)
Tutti	Scoring Techniques: Division of Material	Wagner, Richard	Der Ring des Nibelungen	1874	Sevsay (2013)
Tutti	Scoring Techniques: Division of Material	Rimsky-Korsakov, Nicolai	Scheherazade	1888	Sevsay (2013)

Tutti	Scoring Techniques: Doubling	Wagner, Richard	Die Meistersinger	1867	Adler (2002)
Tutti	Scoring Techniques: Doubling	Tchaikovsky, Pyotr	Roméo et Juliette	1880	Adler (2002)
Tutti	Scoring Techniques: Doubling	Mahler, Gustav	Symphony No.4	1901	Adler (2002)
Tutti	Scoring Techniques: Doubling	Brahms, Johannes	Symphony No.4	1885	Blatter (1997)
Tutti	Scoring Techniques: Doubling	Brahms, Johannes	Symphony No.4	1885	Blatter (1997)
Tutti	Scoring Techniques: Doubling	Mozart, Amadeus	Nozze di Figaro, Le	1786	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Doubling	Schubert, Franz	Symphony No.5	1816	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Doubling	Brahms, Johannes	Variations on a Theme by Haydn	1873	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Doubling	Debussy, Claude	Prélude à l'Après-midi d'un Faune	1894	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Doubling	Prokofiev, Sergei	Symphony No.1	1917	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Doubling	Britten, Benjamin	Sinfonietta	1932	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Doubling	Beethoven, Ludwig van	Symphony No.9	1824	Piston (1961)
Tutti	Scoring Techniques: Doubling	Debussy, Claude	Martyre de Saint Sébastien, Le	1911	Piston (1961)
Tutti	Scoring Techniques: Dovetailing	Stravinsky, Igor	Petrouchka	1911	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Dovetailing	Bloch, Ernest	Schelomo	1916	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Reinforcing	Wagner, Richard	Die Meistersinger	1867	Blatter (1997)
Tutti	Scoring Techniques: Reinforcing	Strauss, Richard	Till Eulenspiegel	1895	Blatter (1997)
Tutti	Scoring Techniques: Reinforcing	Schoenberg, Arnold	Five Orchestral Pieces	1909	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Reinforcing	Ravel, Maurice	Bolero	1928	Kennan & Grantham (2002)
Tutti	Scoring Techniques: Voicing	Berlioz, Hector	Symphonie Fantastique	1830	Blatter (1997)
Tutti	Scoring Techniques: Voicing	Ravel, Maurice	Bolero	1928	Blatter (1997)
Tutti	Scoring Techniques: Voicing	Ravel, Maurice	Pictures at an Exhibition (Mussorgsky)	1922	Kennan & Grantham (2002)
Tutti	Technical agility	Kirk, Theron	Vignettes	1956	Kennan & Grantham (2002)
Tutti	Technical agility	Gordon, Phillip	Sleigh Ride, The (Mozart K605)	1977	Kennan & Grantham (2002)
Tutti	Unidiomatic scoring	Malipiero, Gian Francesco	Pause del Silenzio	1917	Casella & Mortari (2004)
Tutti (Unison)	Scoring Techniques: Colour effects	d'Indy, Vincent	Istar	1897	Piston (1961)
Tutti (Unison)	Scoring Techniques: Division of Material	Mozart, Amadeus	Symphony No.40	1788	Adler (2002)
Tutti (Unison)	Scoring Techniques: Division of Material	Beethoven, Ludwig van	Symphony No.9	1824	Adler (2002)
Tutti (Unison)	Scoring Techniques: Division of Material	Smetana, Bedřich	Bartered Bride, The	1865	Adler (2002)
Tutti (Unison)	Scoring Techniques: Division of Material	d'Indy, Vincent	Istar	1897	Adler (2002)





Addendum C Table 25 -- Colour intensity and saliency per orchestral brass instrument (and saxophones) per register (low=1, middle=2, high=3) compared to other instruments. See additional notes.

Register		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3												
Register		Trumpet			Horn			Trombone			Bass trombone			Euphonium			Tuba			Saxophones S+A			Saxophones T+B			Piano/forte			Harp			Violins (bowed)			Violas (bowed)			Violoncellos (bowed)			Double basses (bowed)								
1	Trumpet	<	<	>	=	<	<	<	<	<	<	<	<	<	<	=	<	<	=	<	<	=	<	=	<	>	<	<	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>
2				<	>	>	=	<	=	=	<	=	=	=	=	=	<	<	=	=	=	>	<	=	=	>	=	=	=	>	=	>	=	=	>	=	=	>	=	=	=	>	>						
3					>	>	>	>	>	>	>	>	>	>	>	>	=	=	>	>	>	>	=	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>			
1	Horn				<	<	<	<	<	<	<	<	<	<	<	=	<	<	<	<	<	=	<	<	<	=	<	<	=	<	<	=	<	<	=	<	<	=	<	<	=	<	<	=	<	<	=	<	<
2							<	=	=	=	<	<	<	=	=	>	<	<	<	=	=	>	<	=	<	>	=	=	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
3								=	>	>	=	=	=	>	>	>	<	=	=	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
1	Trombone							<	<	<	<	=	=	=	=	>	<	<	=	=	=	>	=	=	>	=	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
2										<	=	=	=	=	>	>	<	=	=	=	>	>	=	>	>	=	>	=	>	>	=	=	>	>	=	>	>	=	>	>	=	>	>						
3											=	=	=	>	>	>	=	=	=	>	>	>	=	>	>	=	>	=	>	>	=	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
1	Bass trombone									<	>	>	>	<	<	=	<	=	=	>	>	>	=	=	>	=	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
2										<	>	>	>	<	=	=	<	=	=	>	>	>	=	=	>	=	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>						
3											>	>	>	=	=	=	=	=	=	>	>	>	=	=	>	=	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
1	Euphonium									<	<	<	<	<	<	<	=	>	>	=	=	>	>	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>			
2										<	<	<	=	>	>	>	=	>	>	=	>	>	>	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>						
3											<	=	=	>	>	>	=	>	>	=	=	>	>	>	=	>	>	>	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>						
1	Tuba												<	<	<	<	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>			
2													<	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>						
3														>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>						
1	Saxophones S+A															>	>	>	<	=	=	=	=	>	>	>	>	=	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>						
2																	>	=	=	=	=	=	<	>	=	>	=	=	<	=	=	<	=	=	<	=	=	<	=	=	<	=	=						
3																			>	=	=	>	<	=	<	=	=	<	=	=	=	<	=	=	<	=	=	<	=	=	<	=	=						
1	Saxophone T+B																		>	>	>	=	=	>	>	>	>	=	>	=	>	=	=	>	=	=	>	=	=	>	=	=	>						
2																				>	>	>	<	>	=	>	=	=	=	>	>	=	>	>	=	>	>	=	>	>	=	>	>						
3																							<	=	<	=	=	=	=	=	=	<	<	=	<	<	=	<	<	=	<	<	=						



Addendum C Table 26 -- Colour intensity and saliency per string group (including harp and piano) per register (low=1, middle=2, high=3) compared to other instruments. See additional notes.

		Register			1			2			3			1			2			3			1			2			3		
Register		Piano			Harp			Viols (bowed)			Violas (bowed)			Violoncellos (bowed)			Double basses (bowed)														
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3												
1	Pianoforte	<	=	>	>	>	>	>	=	>	>	>	>	>	=	=	>	>													
2		<	<	>	>	=	>	=	=	=	>	>	>	>	=	<	<	=													
3		>	=	=	=	=	=	=	=	=	=	=	>	=	<	<	<	=													
1	Harp				<	<	<	<	<	<	<	<	<	<	<	<	<	<													
2						<	<	=	=	<	=	=	<	=	=	<	=	=													
3								<	>	>	<	>	>	<	>	>	<	>	>												
1	Viols (bowed)							>	>	=	>	>	=	>	>	=	>	>													
2									>	<	=	>	<	=	>	<	=	>													
3										<	<	=	<	<	=	<	<	=													
1	Violas (bowed)										>	>	=	>	>	=	>	>													
2												>	<	=	>	<	=	>													
3													>	<	<	=	<	<	=												
1	Violoncellos (bowed)													>	>	=	>	>													
2															>	<	=	>													
3																>	<	<	=												
1	Double basses (bowed)																>	>													
2																		>													
3																			>												

(continued from page 384) Percussion instruments and the celesta, which are central components of the orchestra, are not described in enough detail in orchestration textbooks to be included in these tables. Furthermore, whereas the strings, woodwinds and brass are regularly described in the context of chord writing and balance, the percussion family is excluded from this.

Lastly, it is important to understand that these tables only combine the descriptions and comparisons of various orchestration textbooks, and especially those found in Read (2004) and Chon et al. (2012). The findings here are therefore not definitive or scientifically discovered. It would likely be possible to undertake an independent study of instrumental blending and saliency to discover more accurate and all-encompassing results.