The Impact of Soundtrack Congruency on the Aesthetic Experience of Contemporary Dance: Exploring Aesthetic Interaction in Terms of Arousal and Enjoyment Ratings in Three Audio Settings

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ABSTRACT

Often music is used to emphasize particular dance gestures, or dance can be used to illustrate particular passages of music. While each form relies on different sensory modalities, previous studies have demonstrated the ability to deduce the common structures between music and dance, even when each form is presented independently. However, from an aesthetic perspective, music and dance are not always used congruently, to emphasize or complement each other, but are sometimes used in competition, or conflict with each other to emphasize the narrative (Fogelsanger & Afanador, 2006). With this deliberate shift in congruency between stimuli, this begs the questions as to whether congruence between stimuli enhances aesthetic judgements for contemporary pieces, in line with the congruence association model. This study aims to empirically test the assertions that altering the congruency between a contemporary dance and soundtrack leads to a different aesthetic perception of the presentation. Thirty-four participants, were randomly assigned to watch a recorded dance performance in a theatre setting, with either the original soundtrack, no soundtrack or the original soundtrack reversed. Aesthetic interaction was measured in terms of continuous enjoyment ratings using an ASUS tablet, and physiological arousal was measured using Empatica 4 wristbands. Granger Causality analysis indicated that rate of visual change of the stimulus granger caused electrodermal activity, for the congruent and incongruent sound conditions, but not for the silent condition. Group enjoyment scores did not mirror group physiological responses; in that they were not predicted by visual change of the performance. Additionally, the silent and congruent conditions were rated as less enjoyable as the incongruent condition. Qualitative data demonstrated that participants found the congruent and silent conditions boring, while they found the incongruent condition unpleasant.

I.   INTRODUCTION

Music and dance are two art forms that each exist independently, but are frequently presented simultaneously in an audio-visual format (Hagendoorn, 2006). Music and dance can emphasise or complement each other, or compete with each other to emphasise a narrative (Fogelsanger & Afanador, 2006). The relationship between music and dance has been a constant topic of interest for composers and coreographers alike (Cunningham, 1982; Hagendoorn, 2006). In the present study, we examine the the role of movement and sound congruency during aesthetic perception of contemporary dance, as proposed by the congruence association model (CAM).

CAM has previously been used to examine the impact of congruency on aesthetic judgements, primarily in relation to the congruency between music and film (Cohen, 2016). Previous studies have found that congruency between music and film or other forms of multimedia tend to enhance self-reported aesthetic perception (Cohen, MacMillan, & Drew, 2006; Cohen & Siau, 2008; Bolivar, Cohen, & Fentress, 1994) . Purportedly because congruent activity between sound and the visual image leads to subsequent prioritizing of that piece of visual information into the working narrative, which in turn leads to an enhanced conscious experience of the media presentation (Cohen, 2016). While these results are confined to a film stimulus, the CAM can be applied to dance cognition (Cohen, 2016). Previous studies have demonstrated that people can recognise temporal structures between music and dance intended to go together, even when each form is presented independently (Krumhansl & Schenk, 1997), and can differentiate between dance choreography and music that are intended to match or not (Mitchell & Gallagher, 2001).

More recently the CAM has been expanded to understand the relationship between music and movement where congruency isn't necessarily desired as an aesthetic outcome (Fogelsanger & Afanador, 2006). Fogelsanger and Afanador (2006) acknowledge intrinisc and extrinsic choreomusic parallels between music and dance such as intertwining rhythms or other temporal accents, but also focus heavily on instances where music and dance are not intended to go together (Fogelsanger & Afanador, 2006). This acknowledges contemporary performances seen more in the 20th century where dance and music are performed alongside one another, but remain independent (Cunningham & Lesschaeve, 1985). Fogelsanger and Afanador (2006) claim that cross-modal incongruence is often difficult to achieve, because each medium has hooks that grab elements of the other medium so that even conincidental events seem complementary, in line with the Gestalt principles of perception (Sloboda, 1985). In effect this can lead to a sense of 'capture', where one element affects how the other element is percieved (Mitchell & Gallaher, 2001; Fogelsanger & Afanador, 2006).

In this study we will examine the relationship between music and contemporary dance outlined in CAM (Fogelsanger & Afandaor, 2006). Congruency between a contemporary dance performance and its soundtrack should impact on aesthetic audience responses; with the CAM predicting increased aesthetic pleasure and spectator arousal for congruent as opposed to incongruent presentations (Cohen 2016). It is also possible that incongruent presentation will lead to a sense of capture (Mitchell & Gallaher, 2001; Fogelsanger & Afanador, 2006), and it is not yet clear which would lead to higher aesthetic rating from the audience. To account for the dynamic experience of the performing arts (Orgs, Caspersen, Haggard, 2016), we use continuous rather than discrete measures to capture audience engagement as the performance unfolds (Stevens et. al., 2009; Schubert, Vincs, & Stevens, 2013). This method is considered suitable to

evaluate audience agreement in response to disrupted audio-visual components of dance performance (Cohen, 2016).

II. METHOD

A. Participants

Thirty-Four participants, (9 male, 25 female), ranging in age from 18-51 years ($M = 27.41$; $SD = 7.3$), volunteered to take part. Musicality ranged from 48-100 on the Gold-MSI musicality scale, ($M = 74.71$; $SD = 17.85$), and 52.9% of participants had previous formal dance training, but none were professional dancers. See table 1 for demographic breakdown by group.

Table 1. Demographics

	Congruent (N = 10)	Silent (N = 14)	Incongruent (N = 10)
Gender	F = 5	F = 11	F = 9
Age	$M = 29.6$, $SD = 12.1$	$M = 26.0$, $SD = 2.9$	$M = 26.2$, $SD = 4.6$
Gold MSI score	$M = 78.2$, $SD = 13.1$	M = 73.9, SD = 8.5	$M = 80.3$, $SD = 16.2$
Watch recorded dance at least once a month	30.0%	28.6%	20.0%
No. included in enjoyment analyses	8	10	8

Notes. SD = Standard Deviation, M = Mean

Participants were recruited to a time slot depending on their availability, and each group was randomised to watch one of the three conditions; the dance performance either with a congruent soundtrack in which the sounds and movements were not altered, the same contemporary dance performance with an incongruent soundtrack or the same contemporary dance performance presented in silence as a control condition.

B. Materials

1)   Stimuli. To maximise ecological validity, the stimuli for this study was a full length video recording of a contemporary dance performance, developed by a choreographer, Matthias Sperling (Jola & Christensen, 2015). The performance was called 'Group Study' and had a running time of 33 minutes 54 seconds. The choreography was based on a contemporary dance style that consisted of a series of group movement tasks. In addition to the rhythmical sounds asscoiated with these movements, the score specifed vocalisations with a similar, rule based structure. The score was performed without externally imposed music, to remove the potential bias from externally imposed timing. Participants were asked to read a short paragraph of information about the performance and choreographic style before watching the video stimuli to increase their understanding of the piece.

2)   Soundtracks. The original soundtrack, used in the congruent condition was comprised of the original sounds created by the dancers according to the choreography of the dance. This including breathing, humming, slapping noises, and running noises, which were rhythmic for some parts of the dance and were not rhythmic at other parts of the dance, depending on how synchronous or asynchronous the movements were in time. The power of the soundtrack at each time point was analysed using the miraudio toolbox for Matlab (Lartillot, Toiviainen, & Eerola, 2008). The reversed soundtrack used in the incongruent condition, used a completely reversed version of the original soundtrack, such that the end of the soundtrack was played first, and all the corresponding sounds were played backwards in reverse order, to disrupt the temporal congruency of the music and dance presentation, while maintaining all lower level acoustic features of the soundtrack.

3)   Questionnaires. The paper version of the Goldsmiths Musical Sophistication Index v1.0 (Gold MSI; Müllensiefen, Gingras, Musil, & Stewart, 2014) was used to measure participants' general music ability, before the presentation of the dance stimuli. A pre dance questionnaire completed before the performance measured participants previous dance experience. A post-dance questionnaire, asked participants for written comments in response to the performance.

4)   Apparatus. Asus tablets running 'open sesame' (Mathôt, Schreij, & Theeuwes, 2012) were used to collect continuous enjoyment ratings ranging from from 'Enjoy this alot' to 'Enjoy Very Little', (see figure 1). Participants were instructed to drag their finger towards the top of the screen if they were enjoying the performance, and to drag their finger towards the bottom of the screen if they were not enjoying their performance. Participants were given an opportunity to practice using the continuous rating scale in a demo version of the experiment directly before the performance started. Enjoyment data was collected at a rate of 25 samples per second. Ten Empatica E4 wristbands (Empatica, 2015; see figure 1) were used to collect the physiological variables of blood volume pulse, from which heart rate was derived using empatica software (Empatica, 2015); and electrodermal activity (EDA); which is indicative of sympathetic neural activity and thus an indirect measure of arousal, and engagement (Potter & Balls, 2012).

C. Procedure

Every performance was shown in a large dimly lit lecture theatre with tiered seating and a large projector screen. These were specifically chosen to mimic the conditions of a theatre in which people would normally observe dance to maximise the likelihood of immersion in the performance (Jola & Christensen, 2015). As participants arrived they were shown to a seat and asked to complete the written consent form, the Gold-MSI (Müllensiefen et al., 2014) and pre-dance questionnaire. Participants were seated adjacent to each other in rows of 3 or 4 participants. Once seated, participants were fitted with a wrist sensor on their left wrist and instructed to keep that arm as still as possible to minimise movement artefact (Picard, Fedor, & Ayzenberg, 2015). Then participants were asked to read a piece of information about the study that described where the performance was recorded, the name of the choreographer and the underlying principles of the performance (See Appendix 2). Next participants were each given an ASUS tablet, with the 'open sesame' programme loaded and instructed to hit OK once they had read the first set of instructions which brought them to a demo version of the measure It was emphasised to participants that they should only pay minimal attention to the tablet, so that they could focus on the performance. Once everyone was

comfortable with handling the tablet, particpants watched the enire performance video without further interruption. As soon as the performance ended participants completed a brief follow-up questionnaire assessing their summative aesthetic judgement. Particpants were debriefed at the end of the experimental session.

III. RESULTS

A. Granger Causality Analysis

Granger causality analysis requires stationary and normally distributed time series. Accordingly, the normality of each dataset was checked for normality using the explore function on SPSS (PASW, 2013). Box-Cox transformations were performed to correct the normality of data (Osborne, 2010). In total 15 granger causality analyses were conducted and a Bonferroni correction was applied so 0.003 was used as the level of significance, see table 2 for results of bivariate GC analysis. GC analysis indicated that visual change of the stimulus granger caused EDA, at the Bonferroni corrected significance level of 0.002 alpha level for the congruent sound condition ($F = 10.49$, $p = 0.00125$), and the incongruent condition ($F = 9.99$, $p = 0.00163$), but not in the silent condition ($F = 1.19$, $p = 0.27$). No other significant granger causal relationships were found at the Bonferroni corrected alpha level of 0.002.

Table 2. Results of Granger Causality Analysis

	Y	Heart Rate		EDA		Enjoyment	
X		F	p	F	p	F	p
Congruent Sound	Visual Change	1.24	0.26	10.49	.00125*	0.01	0.92
	Power of Soundtrack	0.68	0.41	0.77	0.38	0.15	0.69
Incongruent Sound	Visual Change	6.43	0.01	9.99	.00163*	0.08	0.77
	Power of Soundtrack	4.50	0.03	0.26	0.61	5.25	0.02
Silence	Visual Change	2.93	0.09	1.19	.27	0.75	0.38

Notes. p = significance level, Bonferroni corrected at the alpha = .003 level, F = Fischer's F; *analysis is testing whether X predicts Y.

B. Enjoyment

The frequency distribution of group mean enjoyment scores indicates that participants were in agreement that they did not enjoy the congruent sound condition or the silent condition (see figure 2a and 2b, respectively). An agreement analysis was performed on the enjoyment data as outlined by Schubert, Vincs, and Stevens (2013). This analysis demonstrated that participants in the congruent condition were in agreement as to whether or not they enjoyed the video 71.73% of the time, whereas the silent and incongruent conditions were in agreement, 67.41% and 68.52%, respectively. Looking to the means, it is evident that people actively disliked the congruent and silent conditions which had mean enjoyment scores of -79.27 (SD = 46.75) and -75.45 (SD = 46.93), respectively. However people were less negative about the incongruent condition which had a mean enjoyment score of -4.6 (SD = 1.18).], and spent more time liking the video with the reversed soundtrack (see figure 2c), compared to the silent or congruent sound conditions.

C. Qualitative Responses

Participants were asked to 'please make a comment' after the performance and thirty three participants decided to do so. Although comments tended to be brief, a summative content analysis was performed (see table 4 for summary) in line with recommendations from Hseih and Shannon (2005). Several categories were repeated across comments including; boredom, searching for meaning, physical movement, sound,, patterns, enjoyment, and unpleasant. Notably participants did not mention boredom or searching for meaning in response to the incongruent stimuli, but did report unpleasant which was not mentioned in response to the silent or congruent conditions.

IV. DISCUSSION

The aim of this study was to explore the impact of the interplay between music and movement in contemporary dance on physiological arousal and aesthetic judgements, in relation to the congruence association model and the theory of kinaesthetic empathy. The results demonstrate that electro-dermal arousal was predicted by visual change of the stimulus in both sound conditions, but not by aesthetic ratings, suggesting that EDA response is mediated by soundtrack versus silence. However, the fact that the soundtrack did not directly predict EDA itself suggests that it may be due to an interactive effect of the audio-visual media as opposed to a direct audio response. This is underlined by participant reports that their engagement with piece was reliant on sound, and suggests that arousal moderates absorption, rather than aesthetic ratings. This places a higher emphasis on the soundscape in relation to sense of physical presence than previously accounted for in previous studies (Reason, Jola, Kay, Reynolds, Kauppi, Grobras, Tohka, & Pollick, 2016), and may point to evidence of auditory entrainment or beat induction as the basis for a heightened sense of physical presence.

Additionally looking at the frequency distribution of mean enjoyment scores, people were more negative in response to the silent and congruent conditions compared to the incongruent condition. Suprisingly the incongruent condition was associated with a more positive aesthetic response than in the congruent conditions, meaning that enjoyment increased when the soundtrack was no longer coupled to the actions directly. Overall the performance was not enojoyed, perhaps because participants found it boring as indicated in the qualitative report. Similar to Reason and others (2016) novice participants did not enjoy the sounds of movements in the absence of music. Perhaps decoupling sound and movement turns the live video recording into something else. Rather than simply showing what happened on stage, it adds another layer to the performance. This turns the sounds the performers

make into a composition more similar to music which increases enjoyment relative to the other two conditions. These results are in line with the findings of Reason and others (2016).

In the context of the congruence association model, soundscapes are considered to direct viewing patterns with an increased spread of visual attention for incongruent soundscapes (Cohen et.al., 2006; Cohen & Siau, 2008). It may be that this wider spread of visual attention enabled a greater global perception of the performance, leading to a greater appreciation. In contrast boredom may have arisen from heavily focussed attention on individual movements. Accordingly, these results show that an incongruent sound stimulus can compensate for negative affective responses to watching dance movement. In the context of contemporary dance, direct congruency of sound and movement may be boring. This contrasts to alternative multimedia presentations where increased congruency has been found to enhance aesthetic judgements (Cohen, MacMillan, & Drew, 2006; Cohen & Siau, 2008; Bolivar, Cohen, & Fentress, 1994).

Although this study attempted to disrupt the temporal congruency between the soundtrack and the visual dance, it seems that participants had similar patterns of arousal to both the incongruent stimuli and congruent stimuli. In line with Fogelsanger and Afanador (2006) it seems that in practice, multi-modal incongruence is difficult to achieve because it is hard to keep the reception of each stimulus separate, which has led to a sense of auditory capture since the visual stimulus is perceived differently when combined with the auditory stimulus (Mitchell & Gallaher, 2001; Fogelsanger & Afanador, 2006). Each instance of coincident movement and sound is perceived as a perceptual unity, in line with gestalt principles of perception (Sloboda, 1985). This is similar to what is seen in the McGurk effect (McGurk & McDonald, 1976), where people blend the audio stimulus of a person saying 'Ga' with a visual stimulus of a person saying 'Ba' and feel that they have seen and heard a person saying 'Da'. Support for this phenomenon lies in the fact that one participant reported a sense of congruency in the incongruent condition, and a similar outcome has been reported in previous studies (Bolivar, Cohen & Fentress 1994; Iwamiya, 1994; Lipscomb & Kendall 1994). It seems that the presence of seemingly arbitrary relationships between sound and music increased enjoyment perhaps 'they seemed to make sense' or produced surprising combinations. In effect, the incongruent sounds were immersive and strange, with less obvious relationships, similar to the effect of an external soundtrack. Previous studies have also identified perceived matching between music and dances, not intended to go together (Mitchell & Gallagher, 2001) which implicates a top down process of meaning making or pattern synthesising irrespective of stimulus features. In contrast the congruent condition was immersive but created an experience that was too intimate (Reason et al., 2016), and the silent condition was less immersive and likely perceived as boring.

A major strength of this study is that it provides empirical support for extension of the congruence association model to contemporary dance settings, which until now was not empirically investigated (Cohen, 2016). This was achieved by applying advanced methodological approaches to the study of aesthetic responses to dance. In line with Jola and Christensen

(2015) this study used a full-length video recording of a dance performance designed by a dance professional, presented in a theatre setting. This not only enhances the ecological validity because the context of the dance moves are within a complete narrative, but also maintains scientific rigour as all groups of participants were exposed to exactly the same dance movements. This contrasts with Reason and others (2016) who had varying performance duration for each condition and failed to control for order effects of stimulus presentation. A further strength of this study is the fact that it included continuous enjoyment ratings as well as self-report accounts which gives a more complete picture of enjoyment rating (Schubert et. al., 2013), compared to previous studies that tend to solely rely on post-hoc accounts (Reason et.al., 2016; Kirsch, Drommelschmidt, & Cross, 2013). Nevertheless, there are some weaknesses that must be addressed. Using GC analysis should be applied with caution to indirect relationships such as audio-visual perception and physical hand movement (Friston, Moran, & Seth, 2013). However, since this experiment was controlled with different experimental conditions the likelihood of making false inferences is reduced (Friston, et.al., 2013). Second, while the sample used was comparable in size to those used in the published literature (Reason et.al. 2016; Cross, Kirsch, Ticini, Schütz-Bosbach, 2011) a larger, gender balanced sample would help to verify the external validity of these results. Finally, future studies should include a wider range of spectator experiences, fro example the Sense of Presence Inventory questionnaire (Lessiter, Freeman, Keogh, & Davidoff, 2001). However, this measure is not specific to dance performances, and would need to be adjusted from its current form.

Future studies should actively try to understand the different conditions in which the visual or auditory elements will dominate, and assess which combination is perceived as the most enjoyable, and integrate with current models of dance aesthetics. Additional research should focus on the extent to which perceptual congruence formed by capture are higher order versus automatic cognitive processes.

V. CONCLUSION

The relationship between music and dance is incredibly complex, and while participants tend to be good at identifying music and dance that are intended to match (Mitchell & Gallagher, 2001), it almost seems more challenging for people to dissociate dance and music stimuli when they are presented simultanesouly. This may be due to evolutionary development, encouraging the brain to automatically search for meaning of a combined stimulus. It may also be because the 20th century has seen an increasing aesthetic tendency towards dance compositions where sound and movement tend to be more complementary, or in direct competition (Fogelsaner & Afanador, 2006), where each source is perceived as two separate stimuli rather than promoting congruency. In this regard more arbitrary combinations of dance and music benefit from being relative abstract, allowing people to project their own interpretation onto the performance. Contrary to initial iterations of the congruence association model (Cohen, 2008), the current study demonstrates that there are instances in contemporary dance where cross-modal incongruence is

perceived as aesthetically more pleasing. This is likely due to the fact that viewers actively look for cross-modal perceptual congruences formed by capture (Mitchell & Gallaher, 2001; Fogelsanger & Afanador, 2006), where each separate stimulus is perceived to complement the other rather than compete with it.

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