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THE RELATIONSHIP BETWEEN YOUNG ATHLETES' IMAGERY USE AND MENTAL  
TOUGHNESS

by

Tyler L. Geikie

A Thesis  
Submitted to the Faculty of Graduate Studies  
through the Faculty of Human Kinetics  
in Partial Fulfillment of the Requirements for  
the Degree of Master of Human Kinetics  
at the University of Windsor

Windsor, Ontario, Canada

2016

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The Relationship Between Young Athletes' Imagery Use and Mental Toughness

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May 19, 2016

## DECLARATION OF ORIGINALITY

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## ABSTRACT

This study examined the relationship between young athletes' imagery use and mental toughness. Participants ( $N = 76$ ) included both male ( $n = 28$ ) and female ( $n = 48$ ) athletes ( $M_{\text{age}} = 12.49$ ,  $SD = 1.06$ ). They completed two questionnaires; one measuring the cognitive and motivational functions of imagery, and the other assessing the 4C's of mental toughness. A series of hierarchical multiple regressions revealed that imagery use significantly predicted all 4C's of mental toughness (Challenge, Commitment, Control, Confidence). Specifically, the motivational general-mastery function of imagery emerged as the strongest individual predictor of all 4C's and cognitive general imagery emerged as a significant predictor for Challenge and Confidence. Developmental considerations and applied recommendations are discussed.

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## TABLE OF CONTENTS

DECLARATION OF ORIGINALITY .....	iii
ABSTRACT.....	iv
ACKNOWLEDGEMENTS .....	v
LIST OF TABLES .....	ix
LIST OF FIGURES .....	x
LIST OF APPENDICES.....	xi
RESEARCH ARTICLE.....	1
<i>Introduction</i> .....	1
<i>Method</i> .....	8
<i>Participants</i> .....	8
<i>Measures</i> .....	9
<i>Procedure</i> .....	11
<i>Data Analysis</i> .....	12
<i>Results</i> .....	13
<i>Data Screening</i> .....	13
<i>Descriptive Statistics</i> .....	14
<i>Primary Analysis</i> .....	15
<i>Discussion</i> .....	17
<i>Limitations and Future Directions</i> .....	26
<i>Conclusions</i> .....	29
<i>References</i> .....	30
<i>Tables</i> .....	41
LITERATURE REVIEW .....	46
<i>Introduction</i> .....	46
<i>Imagery</i> .....	47
<i>Imagery Defined</i> .....	47
<i>Theories and Models of Imagery</i> .....	48
<i>Psychoneuromuscular theory</i> .....	48
<i>Symbolic learning theory</i> .....	49
<i>Bioinformational theory</i> .....	49

<i>Triple-code theory of imagery</i> .....	50
<i>Analytic framework of imagery use in sport</i> .....	50
<i>Applied model of imagery use in sport (AMIUS)</i> .....	51
<i>The four W's of imagery use</i> .....	53
<i>Measurement of Imagery Functions in Sport</i> .....	54
<i>The Sport Imagery Questionnaire</i> .....	55
<i>The Sport Imagery Questionnaire for Children (SIQ-C)</i> .....	55
<i>Research Examining Imagery Use in Young Athletes</i> .....	56
<i>Cognitive imagery</i> .....	58
<i>Motivational imagery</i> .....	58
<i>Mental Toughness in Sport</i> .....	60
<i>Mental Toughness Defined</i> .....	62
<i>Theories, Frameworks, and Models of Mental Toughness</i> .....	63
<i>Cattell's theory of personality</i> .....	63
<i>Hardiness theory</i> .....	63
<i>Loehr's conceptualization of mental toughness</i> .....	64
<i>The four C's model of mental toughness</i> .....	65
<i>Measurement</i> .....	66
<i>The Psychological Performance Inventory (PPI) and the PPI-Alternative</i> .....	66
<i>Mental Toughness Questionnaire-48</i> .....	67
<i>Research Examining Mental Toughness in Adult Athletes</i> .....	68
<i>Qualitative research</i> .....	69
<i>Quantitative research</i> .....	71
<i>Research Examining Mental Toughness in Young Athletes</i> .....	73
<i>Qualitative research</i> .....	73
<i>Quantitative research</i> .....	74
<i>Mental toughness interventions</i> .....	77
<i>Youth Sport Demands</i> .....	78
<i>Imagery and Mental Toughness</i> .....	80
<i>Implications of Current Study</i> .....	82
<i>References</i> .....	84



<i>Tables</i> .....	99
<i>Figures</i> .....	101
APPENDICES .....	104
VITA AUCTORIS .....	124

## LIST OF TABLES

Table 1	Means, Standard Deviations, and Internal Consistencies Table.....	41
Table 2	Pearson Product Moment Correlations Table.....	42
Table 3	Hierarchichal Multiple Regression Table.....	43
Table 4	Expanded General Themes of Mental Toughness Characteristics Table .....	99

## LIST OF FIGURES

Figure 1	Revised Analytic Framework of Imagery Effects in Sport .....	101
Figure 2	An Applied Model of Mental Imagery Use in Sport.....	102
Figure 3	A Visual Representation of the 4C's Model of Mental Toughness.....	103

## LIST OF APPENDICES

APPENDIX A	Athlete Demographics.....	104
APPENDIX B	Sport Imagery Questionnaire for Children .....	105
APPENDIX C	Mental Toughness Questionnaire 48 .....	107
APPENDIX D	Parent/Guardian Letter of Information.....	112
APPENDIX E	Parental Consent Form for Child’s Research Participation.....	114
APPENDIX F	Online Landing Page/Letter of Information & Assent form.....	117
APPENDIX G	Introduction to Concepts Page .....	118
APPENDIX H	End Page of Study .....	119
APPENDIX I	Ballot Landing Page.....	120
APPENDIX J	End Page if Athlete Chooses Not to Participate.....	121
APPENDIX K	Recruitment E-mail to Coaches/Organizations .....	122
APPENDIX L	Coach/Organizational Email to be Sent to Parents of Athletes .....	123

## RESEARCH ARTICLE

### **Introduction**

Imagery is a natural ability that begins in the imaginations of young children (Piaget & Inhelder, 1971). Imagery use in younger years is largely for cognitive and skill development purposes (Kosslyn, 1980; Weiss, 1991), and it has shown great utility within the sport environment. Accordingly, imagery is a strategy used by athletes of all ages (Munroe-Chandler, Hall, Fishburne, O, & Hall, 2007), competition levels (Hall, Rodgers, & Barr, 1990), and across various sports, by both individuals and teams (Munroe, Hall, Simms, & Weinberg, 1998). It has been generally supported that imagery use in youth sport can increase self-confidence (Munroe-Chandler, Hall, & Fishburne, 2008; Vadocz, Hall, & Mortiz, 1997), abate anxiety (Strachan & Munroe-Chandler, 2006), enhance both self- (O, Munroe-Chandler, Hall, & Hall, 2014) and collective-efficacy (Munroe-Chandler & Hall, 2005), and increase sport performance (Munroe-Chandler, Hall, Fishburne, Murphy, & Hall, 2012). Therefore, imagery is a powerful mental skill and is defined as:

...an experience that mimics real experience. We can be aware of 'seeing' an image, feeling movements as an image, or experiencing an image of smells, tastes, or sounds without actually experiencing the real thing...It differs from dreams in that we are awake and conscious when we form an image. (White & Hardy, 1998, p. 389)

In both adult and youth sport contexts, Paivio's (1985) analytic framework of imagery use has been utilized as the theoretical underpinning. Paivio's framework states that imagery serves both a cognitive and motivational function that operates at a general or specific level. Original understanding of the cognitive and motivational functions of imagery has been elaborated upon by researchers wherein the MG function of imagery was expanded to represent arousal and mastery imagery (e.g., Hall, Mack, Paivio, & Hausenblas, 1998) leading to the five

functions (or types) of imagery and their respective uses. Cognitive Specific (CS) imagery includes images of skill acquisition and execution such as the mechanics of hitting a fade in golf. Cognitive General (CG) imagery entails images of sport specific strategies and routines such as a bunt in baseball to advance a runner to the next base. Motivational Specific (MS) images are goal oriented and involve outcomes such as winning an important match or placing in a tournament. Motivational General-Arousal (MG-A) imagery involves images of arousal and emotion regulation such as calming your heartbeat, and Motivational General-Mastery (MG-M) imagery involves images of confidence, control, and being mentally tough.

With knowledge that imagery is a proven technique in the adult sport context (cf. Hall, 2001; Munroe-Chandler & Morris, 2011), recent consideration has been given to imagery use across the lifespan with focus given to both youth (e.g., Munroe-Chandler, Hall, Fishburne, & Strachan, 2007) and older adult populations (e.g., Thøgersen-Ntoumani, Cumming, Ntoumanis, & Nikitaras, 2012). In particular, it was noted that children had the capacity to learn and apply psychological strategies such as imagery, goal setting, and relaxation (Orlick & McCaffrey, 1991); the same skills noted by Williams and Krane (2001) that are used by successful athletes for optimal performance. Li-Wei, Qi-Wei, Orlick, and Zitzelsberger (1992) were some of the first researchers to determine that young table tennis athletes (7-10 years) exhibited positive results when introduced to cognitive imagery training, resulting in improved accuracy and performance when compared to a control group. Further, research has also determined that young athletes use both cognitive and motivational functions of imagery (Monsma & Overby, 2004; Vadocz et al., 1997) and that this population is able to manipulate and improve their imagery with practice (Fishburne, Hall, & Franks, 1987; Wolmer, Laor, & Toren, 1999).

Developmental differences of imagery use in youth sport were first considered by

Munroe-Chandler, Hall, Fishburne, and Strachan (2007). Four distinct age groups were examined (i.e., 7-8, 9-10, 11-12, 13-14) based on the developmental stages outlined by Piaget and Inhelder (1971) and the results showed that all age groups utilized imagery for both cognitive and motivational purposes and at general and specific levels to varying degrees in training and competition. Further, the scope of imagery use and ability increased and broadened with age across the groups – culminating in similar imagery use (in reference to the five functions of imagery outlined by Hall et al., 1998) as adult athletes. The above qualitative findings were informative; however, quantitative studies, using a reliable and valid measure of children's imagery use in sport, were necessary.

Previous imagery research conducted with young athletes often relied on adult imagery measures; however, a recent series of examinations of imagery use in young athletes has led to the design of a youth sport imagery measure titled the Sport Imagery Questionnaire for Children (SIQ-C; Hall, Munroe-Chandler, Fishburne, & Hall, 2009) and has since produced promising research findings. The functions of imagery are of primary focus in research when examining sport outcomes and the development of the SIQ-C allowed for researchers to test imagery's ability to lead to desired outcomes in youth sport. Imagery interventions (cognitive and motivational) aimed at influencing a particular outcome have most often relied on the Applied Model of Imagery Use in Sport (Martin, Moritz, & Hall, 1999), which emphasizes the importance of matching the function of imagery to the desired outcome. Munroe-Chandler, Hall, Fishburne, and Shannon (2005) conducted an imagery intervention focused on various soccer strategies (delivered through a CG imagery script). Despite the study having been conducted prior to the development of the SIQ-C, the findings proved beneficial for young athletes' performance as well as their imagery use of that particular function (i.e., CG). More recently, a

CS imagery intervention focusing on soccer skill execution also proved efficacious in that the CS imagery group quickened their skill execution when compared to a MG-A imagery group, as measured with the SIQ-C (Munroe-Chandler et al., 2012).

With respect to the motivational functions of imagery used by young athletes, focus has been given to the relationship between sport confidence and self-efficacy and the MG-M function of imagery. In an MG-M imagery intervention, youth squash players displayed significant increases in their sport confidence (O et al., 2014), with highest increases in self-efficacy shown by those with the largest increases in MG-M imagery use. It has also been noted that young athletes who report high levels of MG-M imagery use also report high levels of sport enjoyment (McCarthy, 2009). Although causation is indeterminable, this relationship is promising as enjoyment and fun are often cited as main reasons for sport participation and physical activity in youth (Ewing & Seefeldt, 1996). Taken together, these findings provide support for the function-outcome hypothesis in youth, as noted in the Applied Model of Imagery Use in Sport (Martin et al., 1999).

Despite the associations and applied findings above, the relationship between imagery and mental toughness has been relatively overlooked, especially in youth sport. One of the only studies that directly examined the relationship between imagery use and mental toughness (Mattie & Munroe-Chandler, 2012) was with a sample of intercollegiate athletes ( $M_{\text{age}} = 20.70$ ). Results showed that the motivational functions of imagery accounted for a large amount of the variance in mental toughness scores. Specifically, the MG-M function of imagery was the strongest predictor of all four dimensions of mental toughness ( $\beta = .45-.53$ ) as measured by the Mental Toughness Questionnaire-48 (MTQ48), which assesses mental toughness across the subscales of Challenge, Commitment, Control, and Confidence (Clough, Earle, & Sewell, 2002).



Control refers to one's belief that they are influential and powerful in their environment, especially when presented with various stressors. Commitment refers to one's involvement in the process of setting and achieving their goals leading to lessened disengagement when confronted with demands. Challenge refers to seeing changes in one's life as positive opportunities for growth and the ability to thrive and accept change as a healthy aspect of daily experiences. Lastly, Confidence refers to strong self-belief in one's abilities and not being intimidated by others (Clough et al., 2002). Furthermore, Crust and Azadi (2010) found a significant relationship between imagery use and the subscale of Commitment on the MTQ48 in a sample of adult athletes, suggesting imagery can act as a tool to bolster aspects of mental toughness.

Mental toughness is a psychological characteristic that is reflected in the training and competitive environments of an athlete, is recognized as a key factor of athletic success at the highest level (Jones, Hanton, & Connaughton, 2002, 2007), and is higher in athletes when compared to non-athletes (Guillén & Laborde, 2014). Despite the use of mental toughness in the vernacular of athletes, coaches, and sport psychology consultants, the concept is still heavily debated (Connaughton, Thelwell, & Hanton, 2011; Crust, 2007, 2008; Gucciardi, Hanton, Mallett, & Temby, 2015). The diverse and mixed nature of the literature may be due, in part, from the large amount of qualitative research. Generally, however, elite athletes and researchers have identified mental toughness as an innate and developed ability that enables one to persist, excel, and achieve their goals in sport while consistently performing at a competitive level (Jones et al., 2002, 2007). Connaughton et al. (2011) reduced the myriad of characteristics of mental toughness to a set of nine categories of self-belief, coping, motivation, control, focus, resilient attitude, personal values, physical toughness, and sporting intelligence. As such, the definition

put forth by Coulter, Mallett, and Gucciardi (2010) still remains a prominent account of mental toughness across various camps of research and is stated as:

the presence of some or the entire collection of experientially developed and inherent values, attitudes, emotions, cognitions, and behaviors that influence the way in which an individual approaches, responds to, and appraises both negatively and positively construed pressures, challenges, and adversities to consistently achieve his or her goals. (p. 715)

The above definition is inherently multidimensional, interactional in nature, and is focused at the individual level. The attention drawn to the variables influencing how one perceives and handles stressors in an effort to achieve their goals considers the various processes (e.g., intense training and seeing failure as a learning experience) and goal related outcomes (e.g., high competitive performance and success) that are essential to mental toughness.

Research examining youth ( $M_{\text{age}} = 15.6$ ) perceptions of mental toughness across sport, academia, and music (Mahoney, Gucciardi, Mallett, & Ntoumanis, 2014) discovered seven similarities in the characteristics noted by Connaughton et al. (2011). Further, Mahoney et al. (2014) reported an additional four novel characteristics exclusive to the youth athletes, resulting in 11 total mental toughness characteristics in this population (see Table 4). Key points were made by the athletes in that they highlighted the necessity to continue progressing toward ones' goals even when unmotivated or disinterested with a task and that they viewed setback and criticism as positive opportunities for growth; the importance of positive interaction with social networks was also evident (Mahoney et al., 2014). Further support that young athletes understand the importance of mental toughness was revealed in interviews with rugby players ( $M_{\text{age}} = 15.9$ ) competing at a high level wherein they identified, along with mental toughness,

additional useful strategies including imagery and seeing others being successful (Holland, Woodcock, Cumming, & Duda, 2010).

Sport offers a challenging environment for young athletes and is considered a combination of enjoyable, stressful, and character building incidents (Anshel & Delany, 2001; Fraser-Thomas & Côté, 2009). The experience of mastery climates, which focuses on competence and self-referenced achievement (Horn, 2004), is a potential driver of mental toughness at a young age since the process of mastery involves both failure and success. Previous researchers suggest that the use of psychological skills training as well as specific mental toughness training programs can enhance self-perceptions of mental toughness in young athletes (Gucciardi, Gordon, & Dimmock, 2009) as well as account for increases in performance in training and competition (Bell, Hardy, & Beattie, 2013). Given the programs as a whole were assessed, it cannot be determined which specific psychological strategy was more influential than others (e.g., goal setting vs. self-efficacy) in increasing mental toughness. As such, an important avenue yet to be explored is the relationship between imagery use and mental toughness.

In lieu of the many psychological skills available to young athletes, McCarthy, Jones, Harwood, and Olivier (2010) noted that imagery was most appropriately conceptualized and understood by young athletes. Given that imagery is related to mental toughness in intercollegiate athletes (Mattie & Munroe-Chandler, 2012), and the noted lack of the research with young athletes, there is a need to further examine this relationship. Therefore the purpose of the current study was to examine the relationship between young athletes' imagery use and mental toughness using self-report questionnaires. As mental toughness has been found to increase as athletes age and subsequently compete at a higher level (Golby & Sheard, 2004), and

given that young athletes are aware of the concept of mental toughness, it is worthwhile to examine this construct at an age (11-14 years) when most are confronted with increasing stress and demand while also deciding if and how they will continue in sport (Côté & Fraser-Thomas, 2015).

It was hypothesized that imagery use, as measured by the SIQ-C (Hall et al., 2009), would predict mental toughness scores on the MTQ48 (Clough et al., 2002). With the relationship between motivational imagery use and confidence (Munroe-Chandler et al., 2008; O et al., 2014) and specifically the MG-M imagery and mental toughness link (Munroe, Giacobbi, Hall, & Weinberg, 2000; Mattie & Munroe-Chandler, 2012), it is hypothesized that the motivational functions of imagery would predict mental toughness and that MG-M imagery would emerge as the strongest predictor. Further, Cumming and Williams (2013) suggest the cognitive functions of imagery, such as imaging proper skill and strategy execution, may result in motivational outcomes (i.e., confidence). This supports the findings from Mattie and Munroe-Chandler's (2012) study wherein the cognitive functions of imagery were found to predict a small variance of the mental toughness in intercollegiate athletes, and so it was also hypothesized that the cognitive functions of imagery would further predict mental toughness in young athletes, although to a lesser extent than the motivational functions.

## **Method**

### **Participants**

A power analysis to determine the minimum number of participants needed for regression was conducted (Tabachnick & Fidell, 2013;  $N > 50 + 8m$ , where  $m$  is the number of independent variables). The calculation determined 90 participants were needed for adequate power. It is

recognized that the current study did not meet the minimum of 90 participants and will be given consideration in the discussion.

A total of 95 participants completed the questionnaire package; however, 19 were determined to be unusable as they were left blank. Therefore, participants in the current study were 76 competitive athletes from sport organizations in Southwestern Ontario. The sample included both male ( $n = 28$ ) and female ( $n = 48$ ) athletes ranging in age from 11 to 14 years ( $M = 12.49$ ,  $SD = 1.06$ ). Participants were involved in individual and team sport at the time of collection including gymnastics ( $n = 32$ ), hockey ( $n = 21$ ), soccer ( $n = 9$ ), swimming ( $n = 4$ ), baseball ( $n = 4$ ), and dance ( $n = 2$ ). Figure skating, volleyball, weightlifting, and track and field were each represented by one athlete. Athletes indicated competing at local ( $n = 21$ ), regional, ( $n = 26$ ), provincial ( $n = 25$ ), national ( $n = 2$ ), and international ( $n = 2$ ) levels and indicated competing for an average of six years ( $SD = 2.73$ ).

## Measures

**Introduction to concepts and demographic data.** All participants read the introduction to concepts page and indicated their knowledge and understanding of imagery and mental toughness as well as if they had been exposed to imagery or mental toughness training in the past (see Appendix G). As the study took place online and does not offer open opportunity for clarification with participants, it was believed that the simplified introductions to imagery and mental toughness would eliminate any confusion in responses. Participants also completed basic demographic information including age, gender, sport, competition level, position on team, length on current team, and years involved in sport overall (see Appendix A).

**Imagery frequency.** The Sport Imagery Questionnaire for Children (SIQ-C; Hall et al., 2009) is a 21-item inventory, which assesses young athletes' (ages 7-14) frequency of imagery

use. The SIQ-C (see Appendix B) comprises five subscales assessing the cognitive (CS and CG) and motivational (MS, MG-A, and MG-M) functions of imagery. Each item is rated on a 5-point Likert scale where 1 = *not at all*, and 5 = *very often*. Examples of questions on the SIQ-C are “*When I think of doing my skill, I always see myself doing it perfectly*” (CS; 4 items); “*I see myself following the game plan or routine at competitions*” (CG; 4 items); “*I see myself as a champion*” (MS; 4 items); “*When I think of a competition, I imagine myself getting excited*” (MG-A; 4 items); and, “*I see myself being focused in a tough situation*” (MG-M; 5 items). The SIQ-C subscales have displayed internal consistencies ranging from 0.69-0.82 (Hall et al., 2009) as well as adequate fit indices (CFI = .89, RMSEA = .07; Hall et al., 2009) determined through confirmatory factor analysis, thus supporting the use of the five factor model with children.

**Mental toughness.** The Mental Toughness Questionnaire 48 (MTQ48; Clough et al., 2002; see Appendix C) includes 48 items which assess mental toughness across four subscales of Control, Commitment, Challenge, and Confidence. Items are answered on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Sample items include “*I generally feel that I am in control of what happens in my life*” (Control; 14 items); “*I don’t usually give up under pressure*” (Commitment; 11 items); “*I usually enjoy a challenge*” (Challenge; 8 items); and “*I am generally confident in my own abilities*” (Confidence; 15 items). Twenty-two of the items are reversed scored (see Appendix C). The MTQ48 subscales have displayed adequate internal consistencies ranging from .64-.73 in a sample of 11-16 year olds, and adequate fit indices in a subsample of 13-15 year olds (St Clair-Thompson et al., 2015).

In its current form, the questionnaire assesses general mental toughness as well as specific scores as it relates to the four subscales. To garner more accurate information and following amendments made in earlier mental toughness research (e.g., Mattie & Munroe-

Chandler, 2012), the stem “In sport...” was added for each item. In addition, for ease of response, descriptives were added at each point along the scale rather than just at the anchors; 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neither Agree nor Disagree*, 4 = *Agree*, and 5 = *Strongly agree*. Prior to disseminating the survey, the MTQ48 was piloted with three 11 year olds. They were asked to complete the MTQ48 and identify any wording they felt confusing or unclear. With these suggestions in mind, the questions identified were altered slightly (see Appendix C). Flesch-Kincaid readability was calculated for the altered MTQ48 to be 6.5. This was deemed acceptable for the current sample as most Canadian children are between the ages of 10-12 when entering grade 6.

### **Procedure**

Ethics approval was first obtained from the University of Windsor’s Research Ethics Board. Coaches and organizational staff of youth sport teams across Soutwestern Ontario, Canada were contacted to request their interest in participating in the current study (see Appendix K). Upon agreement to participate, coaches/administrators were sent an instructional e-mail that was to be forwarded to the parents, on behalf of the researchers (see Appendix L). The email included a URL that directed the parents to an electronic letter of information (see Appendix D) and an informed consent document (see Appendix E). If the parent(s) agreed to allow their child to participate, they were provided with the study URL to pass along to their child wherein the assent process began (see Appendix F).

Athletes who provided assent were directed to an introduction to concepts page (see Appendix G). If the athlete answered “no” to their understanding of imagery and mental toughness, they continued to complete the questionnaires and had a chance at the end draw, however their responses were excluded from analysis. No athletes reported being uncomfortable

with their understanding of imagery and mental toughness and so no responses were excluded for this reason. Athletes then completed the demographics information (see Appendix A), the SIQ-C (see Appendix B), and the MTQ48 (see Appendix C). No names or other identifying information were gathered in the questionnaire package and as such, the participants' responses remained anonymous to the researchers. Upon completion of the questionnaire package, participants were given the opportunity to enter to win one of ten \$25 dollar Visa gift-cards. A separate landing page for the ballot draw (see Appendix I) was used to collect personal information and as such anonymity was upheld for participant questionnaire responses. Participants (athletes) who did not give assent at the outset were directed to an end page with a brief thank you along with contact information (see Appendix J). A total of 673 parents and athletes were contacted and 95 consent and assent forms were completed representing a 14.12% response rate. The questionnaire package took athletes approximately 25 minutes to complete.

### **Data Analysis**

Prior to conducting the main analysis, all the data were analyzed for data entry accuracy, missing values, and outliers (Tabacknick & Fidell, 2013). Questionnaires were assessed for reliability using Cronbach's alpha coefficients test (Nunnally & Bernstein, 1994). Descriptive statistics were then calculated including means and standard deviations for age, years in sport, and scores on the subscales of the SIQ-C and the MTQ48. Assumptions for a one way analysis of variance (ANOVA), Pearson product-moment correlations, and hierarchical regression were tested and all were satisfied. Hierarchical regression was used to determine whether the functions of imagery predicted mental toughness. Based on results from the one-way ANOVA, previous exposure to imagery was entered first into the regression in order to control for this variable. Given the theoretical and empirical evidence (Mattie & Munroe-Chandler, 2012; Munroe-



Chandler, Hall, Fishburne, & Strachan, 2007), the motivational functions of imagery (MS, MG-A, and MG-M) were blocked together in the second step of the hierarchical regression. As the cognitive functions of imagery may be used for motivational purposes (Cumming & Williams, 2013) and in Varsity athletes (Mattie & Munroe-Chandler, 2012) the cognitive functions predicted a small amount of the mental toughness variance, the cognitive functions (CS and CG) were blocked together in the third step.

## Results

### Data Screening

Prior to analyses, data were first screened for accuracy of data entry, missing values, and outliers (Tabachnick & Fidell, 2013). All variables fell within respected ranges and so a missing data analysis was conducted to determine the extent and pattern of missing data. Less than 1% of the data were missing and data were missing completely at random as indicated by Little's MCAR test ( $p > .05$ ). As such, missing values were replaced using case mean substitution (Fox-Wasylyshyn & El-Masri, 2005; Tabachnick & Fidell, 2013) and were rounded to the nearest Likert point. Univariate outliers were assessed using calculated z-scores  $> 3.29$  (Field, 2013) and identified outliers were winsorized to maintain sample size. Mahalanobis distance with  $p < .001$  (Tabachnick & Fidell, 2013) was used to detect multivariate outliers and none were indicated.

Next, assumptions of univariate and multivariate analyses (i.e., one-way ANOVA, Pearson product moment correlation, and regression) were examined and all assumptions were fulfilled. ANOVAs were used to examine previous imagery training (yes vs. no), differences in imagery use scores on the SIQ-C, and mental toughness scores on the MTQ48. Those who indicated previous imagery training ( $n = 40$ ) scored significantly higher (CS:  $M = 3.94$ ,  $SD = .77$ ; CG:  $M = 3.86$ ,  $SD = .61$ ; MG-A:  $M = 3.79$ ,  $SD = .78$ ; Challenge:  $M = 3.71$ ,  $SD = .43$ ;

Commitment:  $M = 3.93$ ,  $SD = .47$ ) than those who did not report ( $n = 36$ ) receiving previous imagery training (CS:  $M = 3.50$ ,  $SD = .84$ ; CG:  $M = 3.17$ ,  $SD = .74$ ; MG-A:  $M = 3.29$ ,  $SD = .89$ ; Challenge:  $M = 3.45$ ,  $SD = .57$ ; Commitment:  $M = 3.62$ ,  $SD = .52$ ). As such, imagery training was entered into the hierarchical multiple regression models in Step 1 to control for the influence it may have on predicting mental toughness scores through imagery use. No other one-way ANOVAs (i.e., age, gender, sport, competition level, and years in sport) resulted in significance.

Multicollinearity was assessed between scores on the SIQ-C and the MTQ48 subscales using Pearson correlations (see Table 2). Correlation magnitudes were interpreted as,  $\leq .2 =$  weak,  $.3 - .6 =$  moderate, and  $\geq .7 =$  strong (Brace, Kemp, & Snelgar, 2006). The imagery subscales (CS, CG, MS, MG-A, MG-M) displayed significant positive small to moderate correlations with each other. However, the MS subscale did not correlate significantly with the MG-A subscale. Each of the mental toughness subscales (Challenge, Commitment, Control, Confidence) displayed significant positive moderate correlations to one another. When considering correlations between the two questionnaires, the CS, CG, and MG-M subscales displayed significant positive small to moderate correlations with each of the MTQ48 subscales. The MS subscale showed significant small to moderate correlations to Challenge and Confidence but not to Commitment and Control. The MG-A subscale showed significant small to moderate correlations for all MTQ48 subscales with the exception of Commitment. The highest correlation observed between any two subscales was  $.67$  and indicates an absence of singularity and multicollinearity (Tabachnick & Fidell, 2013).

### **Descriptive Statistics**

All subscales were examined for internal consistency using alpha coefficients and scores ranged from  $.59 - .77$  (see Table 1). Cronbach alphas indicated that five of the nine subscales met

the minimum reliability of .70 (Nunnally & Bernstein, 1994), while four fell below. Item 14 on the Challenge subscale of the MTQ48 was removed as internal consistency improved substantially from .62 to .70. Although alpha values below .60 are considered unacceptable, Devellis (1991) suggested that it is not uncommon to see alphas within the .60-.69 range for published scales. Furthermore, Loewenthal (1996) argued that alphas of .60-.69 for small subscales comprised of less than 10 items are deemed acceptable. As such, only one subscale, CG, was considered below standard and will be addressed in the discussion. Means and standard deviations were calculated for males and females, as well as for the total sample on all subscales of the SIQ-C and the MTQ48; age and years involved in sport were also reported (see Table 1).

### **Primary Analysis**

To test the hypothesis that the five functions of imagery use (the independent variables), , can be used to predict the 4C's of mental toughness (the dependent variables), a series of hierarchical multiple regression analyses were conducted. Four separate regression analyses were conducted, one for each of the subscales of the MTQ48. Given the significant differences in imagery use between those who had previous imagery training and those who had none, previous imagery training was entered into block one of the regression (Step 1). The motivational functions were blocked in second order (Step 2), and the cognitive functions in third order (Step 3). The full results of the regression analyses are presented in Table 3 and main findings are outlined in the following sections.

Hierarchical multiple regression assumptions were examined through residual scatterplots and demonstrated normality, linearity, and homoscedasticity. Further, there was no evidence of multicollinearity as indicated by tolerance values greater than 0.1. The Mahalanobis distances and Cooks' test were used to detect multivariate outliers and none were indicated. Independence

of residuals was determined for each dependent variable through the Durbin-Watson statistic and ranged from 1.74 to 1.99. The assumptions of relationships between the independent and dependent variables required were therefore met (Tabachnick & Fidell, 2013).

**Challenge.** With Challenge as the dependent variable, previous imagery training ( $\beta = .31$ ,  $p < .01$ ) entered at Step 1 was significant ( $F(1, 74) = 7.76$ ,  $p < .01$ ) and accounted for 9.5% of the variance. The motivational functions entered in Step 2 significantly improved prediction ( $F(3, 71) = 11.83$ ,  $p < .001$ ) after controlling for previous imagery training and accounted for an additional 31% of the variance in mental toughness scores. MG-M ( $\beta = .49$ ,  $p < .001$ ) was the only significant predictor in Step 2. The cognitive functions entered in Step 3 did not significantly improve prediction ( $F(2, 69) = 9.08$ ,  $p > .05$ ), with a  $\Delta R^2$  of .04. However, CG ( $\beta = .25$ ,  $p < .05$ ) emerged as a significant individual predictor.

**Commitment.** With Commitment as the dependent variable, previous imagery training ( $\beta = .30$ ,  $p < .01$ ) entered at Step 1 was significant ( $F(1, 74) = 7.76$ ,  $p < .01$ ) and accounted for 9.1% of the variance. The motivational functions entered in Step 2 significantly improved prediction ( $F(3, 71) = 7.89$ ,  $p < .001$ ) after controlling for previous imagery training and accounted for an additional 21.7% of the variance. MG-M ( $\beta = .49$ ,  $p < .001$ ) was the only significant predictor in Step 2. The cognitive functions entered in Step 3 did not significantly improve prediction ( $F(2, 69) = 5.53$ ,  $p > .05$ ), with a  $\Delta R^2$  of .02. CS and CG did not emerge as significant individual predictors.

**Control.** With Control as the dependent variable, previous imagery training ( $\beta = .18$ ,  $p > .05$ ) entered at Step 1 was not significant ( $F(1, 74) = 2.44$ ,  $p > .05$ ) and accounted for 3.2% of the variance. The motivational functions entered in Step 2 significantly improved prediction ( $F(3, 71) = 8.22$ ,  $p < .001$ ) after controlling for previous imagery training and accounted for an

additional 28.4% of the variance. MG-M ( $\beta = .55, p < .001$ ) was the only significant predictor in Step 2. The cognitive functions entered in Step 3 did not significantly improve prediction ( $F(2, 69) = 5.55, p > .05$ ), with a  $\Delta R^2$  of .01. CS and CG did not emerge as significant individual predictors.

**Confidence.** With Confidence as the dependent variable, previous imagery training ( $\beta = .10, p > .05$ ) entered at Step 1 was not significant ( $F(1, 74) = .68, p > .05$ ) and accounted for 1% of the variance. The motivational functions entered in Step 2 significantly improved prediction ( $F(3, 71) = 7.67, p < .001$ ) after controlling for previous imagery training and accounted for an additional 29.3% of the variance. MG-M ( $\beta = .43, p < .001$ ) was the only significant predictor in Step 2. The cognitive functions entered in Step 3 did not significantly improve prediction ( $F(2, 69) = 6.39, p > .05$ ), with a  $\Delta R^2$  of .06. However, CG ( $\beta = .29, p < .05$ ) emerged as a significant individual predictor.

### Discussion

The relationship between imagery use and mental toughness has been examined in a sample of intercollegiate athletes (Mattie & Munroe-Chandler, 2012), and noted in a qualitative study with young athletes (Munroe-Chandler, Hall, Fishburne, & Strachan, 2007). Despite these preliminary associations, the relationship between imagery use and mental toughness had yet to be examined quantitatively in a sample of young athletes. As Weiss (2004) outlines, there exist distinct sport and life outcomes as an individual ages that relate to psychosocial, cognitive, emotional, and motivational constructs, thus necessitating the need for developmental sport psychology.

Given that mental toughness shares many elements of the motivational functions of imagery (e.g., regulating stress, enhancing confidence, and goal attainment), it was hypothesized

that the motivational functions (MS, MG-A, MG-M) of imagery would emerge as the strongest predictors of mental toughness scores. More specifically, with consideration given to Martin et al.'s (1999) Applied Model of Imagery Use in Sport wherein it is recommended that the function of imagery match the desired outcome, and considering previous relationships established between MG-M imagery and mental toughness (Mattie & Munroe-Chandler, 2012; Munroe et al., 2000; Munroe-Chandler, Hall, Fishburne, & Strachan, 2007), it was hypothesized that MG-M would emerge as the strongest predictor of mental toughness. Further, it was hypothesized that the cognitive functions of imagery would add, albeit slightly, significant variance in predicting mental toughness beyond the motivational functions. The cognitive functions have been shown to contribute or lead to motivational outcomes such as increased confidence (Cumming & Williams, 2013; Nordin & Cumming, 2008) and account for a small amount of variance of mental toughness in intercollegiate athletes (Mattie & Munroe-Chandler, 2012). Therefore, the cognitive functions were included in the analysis to determine if the same cognitive imagery effect on mental toughness is seen in young athletes.

The first hypothesis was supported in that the motivational functions significantly predicted mental toughness. After examining the individual contribution of each motivational function, MG-M imagery was found to be the only significant predictor and thus our hypothesis that MG-M would be the strongest individual predictor was supported. The cognitive functions of imagery did not add significant predictive ability to the models beyond the motivational functions for any subscale of mental toughness and so our second hypothesis was not supported. Nonetheless, CG was a significant individual predictor for both Challenge and Confidence.

The strong individual contribution of MG-M imagery when examining the 4C's of mental toughness was not surprising. MG-M imagery refers to images pertaining to confidence, control,

mental toughness and managing adversities (Hall et al., 1998; Munroe et al., 2000). Associated outcomes of MG-M imagery use for young athletes include both higher self-confidence (Munroe-Chandler et al., 2008; O et al., 2014), collective efficacy (Munroe-Chandler & Hall, 2005), and lower cognitive and somatic anxiety (Strachan & Munroe-Chandler, 2006), which are important aspects of mental toughness (Clough et al., 2002; Crust, 2008). To illustrate, MG-M items largely reflect each of the 4C's of mental toughness; the item *"I imagine myself being confident in competition"* reflects the MTQ48 Confidence subscale and further, *"I see myself being in control in tricky situations"* reflects the Control subscale. The connections between MG-M imagery and mental toughness, combined with the findings within this study, may also help explain why younger athletes enjoy sport to a higher degree when compared to those that use less MG-M imagery (McCarthy, 2009). Young adolescent athletes with high levels of mental toughness report greater harmonious passion (Gucciardi, Jackson, Hanton, & Reid, 2015) reflecting greater intrinsic motivation and enjoyment. Thus, athletes who frequently use MG-M imagery may be unknowingly and naturally developing their mental toughness levels and are thereby more equipped to deal with the demands of sport.

The MS and MG-A functions of imagery did not emerge as individual predictors of any of the 4C's of mental toughness. MS imagery refers to goal-oriented images and MG-A imagery refers to images of anxiety and arousal control. In a sample of intercollegiate athletes (Mattie & Munroe-Chandler, 2012), MS imagery, similarly, did not significantly predict any of the 4C's of mental toughness. Even though young athletes displaying mental toughness are highly goal driven (Gucciardi, 2010), MS imagery items reflect outcome or performance oriented statements (e.g., *"I see the audience cheering for me"*, *"I see myself as a champion"*) whereas mental toughness items are largely process oriented (e.g., *"I can generally be relied upon to complete*

*the tasks/jobs I am given*”). To better determine the inherent differences in the goal orientation of items on the SIQ-C and the MTQ48, future researchers can examine the relationship to performance- and mastery-approach goals (Elliot & McGregor, 2001). Mastery-approach goals reflect the many elements of mental toughness and are demonstrated in the MTQ48 items (e.g., *“I can generally be relied upon to complete the tasks/jobs I am given”*) reflecting the need for mastery to complete given tasks, especially if such tasks are sport specific skills. Further, a mastery-approach orientation has been demonstrated to a great degree in young athletes with high self-reported mental toughness (Gucciardi, 2010). Nonetheless, these same athletes were also found to use a moderate level of performance oriented goals suggesting young athletes employ both types of goals represented by the SIQ-C and MTQ48. Therefore, the lack of significance between MS imagery and mental toughness may be due to the conceptual differences in goal orientation as well as the potential greater use of mastery over performance goals during adolescence.

Although MG-A imagery was not significant, it was revealed in the regression analyses that it was inversely related to the Commitment subscale. This is opposed to the findings of Mattie and Munroe-Chandler (2012) wherein they found that MG-A imagery was significantly inversely related to Control, Challenge, and Confidence, but not Commitment. Research has demonstrated that adolescents who display high levels of mental toughness experience less stress and depressive symptoms (Gerber, Brand, et al., 2013), and cope more effectively with stress and challenging situations when they do occur (Gerber, Kalak, et al., 2013). The relationship between MG-A imagery and mental toughness highlights the notion that young athletes who demonstrate high levels of mental toughness may naturally manage the stressors of the sport environment and experience less stress from sport itself (e.g., Gerber, Brand, et al., 2013). An example item of the



Commitment subscale on the MTQ48 is “*when faced with difficulties I usually give up*”. Athletes who agree with this statement may perceive the demands of the sport environment as anxiety evoking and utilize MG-A imagery to relax and control their emotions. On the other hand, athletes who are higher in mental toughness would likely see these difficulties and challenges not as threats but as opportunities for growth (Clough et al., 2002; Mahoney et al., 2014) and therefore remain committed to sport in general. Thus, young athletes who exhibit mental toughness may perceive difficulties as facilitative and not debilitating and therefore do not rely heavily on the use of MG-A imagery. Future examination with a larger sample size would prove beneficial to uncover any true relationships.

Together, the cognitive functions did not add significant variance to the regression model beyond the motivational functions. Nonetheless, CG emerged as a significant individual predictor of Challenge and Confidence. In a sample of intercollegiate athletes, the CG function of imagery emerged as a significant predictor of Control, Commitment, and Confidence (Mattie & Munroe-Chandler, 2012) but not Challenge. The variation in findings may highlight the developmental differences between the two samples (i.e., 11-4 vs. 18-27) stemming primarily from the physical, psychological, social, and emotional challenges young adolescents face as they mature in and outside of sport (Weiss, 2004; Wiese-Bjornstal, LaVoie, & Omli, 2009). Further, the fact that CG was predictive of Challenge and Confidence in sport during early adolescence but not for Control and Commitment is in line with general developmental research which suggests adolescents are exploring their own identities and competencies, developing new relationships with family and friends, and are faced with increasing demands from school and sport (Weiss, 2004) all the while learning the coping strategies to manage their changing environments (Williams & McGillicuddy-De Lisi, 1999). As such, images relating to control of

strategies and routines may provide a sense of confidence in overcoming challenging training and competition environments. Moreover, due to the high degree of change during adolescence, it is not surprising that the Control subscale was lowest for the current sample and that CG did not significantly predict Control, as it reflects a time of uncertainty in and out of sport.

Furthermore, CG was not a significant predictor of Commitment and may be due to the timing of the participants in their respective sports; age 11-14 is when athletes often make the transition from sampling to specializing (Côté & Fraser-Thomas, 2015) and the occurrence of sport dropout is highest at this stage. In addition, CG does not inherently represent many aspects of the Commitment subscale of the MTQ48.

Lastly, CS imagery (skill acquisition and development) was not found to be a significant predictor of any of the 4C's of mental toughness. In previous research with intercollegiate athletes, CS emerged as a significant predictor of Confidence, which reflects the characteristics of adult mental toughness research wherein athletes mention the importance of cognitive control, attentional focus, and the requirement of expert sport specific skills (Coulter et al., 2010; Jones et al., 2007). In contrast, athletes in the current study are still progressing through their sport and are learning the necessary and requisite skills to become expert performers. Developmental researchers have noted that young adolescents (age 11-14) are still determining their level of sport competence at this age (Horn, 2004). Further, the age of the current sample reflects the general range of puberty for males and females (Magill & Anderson, 1996) and therefore athletes may be adjusting to bodily changes such as growth spurts that can influence the skill execution of some individuals. Taken together, young adolescents may experience less confidence at this time while they explore their competencies in and outside of sport and therefore may offer explanation as to why CS imagery does not predict Control in adolescents. Furthermore, the

Control subscale of the MTQ48 reflects that of control over emotions and ability (i.e., “*I can usually control my nervousness*” and “*I usually find myself just going through the motions*”) whereas CS imagery refers solely to control of sport skills (i.e., “*I can usually control how a skill looks in my head*”). Although both reflect elements of control, they are distinct from one another. This is evident in the weak relationship between the items in the correlational analysis (see Table 2).

Overall, sample means for the imagery subscales ranged between 3 and 4 (*sometimes and often use that type of imagery*) and is line with scores of the sample used during the development of the SIQ-C (Hall et al., 2009). Scores in this range suggest the athletes in the current study are indeed utilizing imagery in their respective sports for performance enhancement and at a level that is similar to adults (Hall, Stevens, & Paivio, 2005). Further, results of the current study are not identical to the results found in an intercollegiate sample (Mattie & Munroe-Chandler, 2012) that employed a similar approach to data analysis, therefore reflecting unique uses of imagery during early adolescence outlined previously.

MG-M was the highest of all the subscales measured ( $M = 3.85$ ,  $SD = .65$ ) followed by Commitment ( $M = 3.78$ ,  $SD = .51$ ). Both MG-M and Commitment may be highest due to the large representation of gymnasts within the sample, which is known for long and rigorous practice schedules that require high levels of demand, dedication, and persistence. In an examination of mental toughness development among elite female gymnasts aged 15-22 (Thelwell, Such, Weston, Such, & Greenlees, 2010), athletes noted that the training environment, particularly overcoming obstacles (e.g., learning new and challenging routines) and long hours in the gym allowed them to develop their mental toughness. Moreover, being pushed by coaches and parents in a positive and healthy manner developed their mental toughness levels. Thus, the

high commitment scores of the sample at hand may be due to these considerations. With this in mind, researchers may wish to target sport commitment, as well as the other C's of mental toughness, through the use of MG-M imagery in an effort to provide young athletes increased resources to manage the demands experienced from sport.

Control was the lowest of all the subscales measured ( $M = 3.27$ ,  $SD = .46$ ) and the alpha for this subscale ( $\alpha = .65$ ) was the only one of the 4C's of mental toughness to fall below .70. Other researchers that have used the MTQ48 with adolescent samples have encountered the same results (e.g., St. Clair-Thompson et al., 2015) and the Control subscale has proven problematic overall across research, suggesting a need for the reexamination of the items. Explanation for the lower Control scores can also be offered through the qualitative results of Mahoney et al. (2014) wherein young adolescents neglected to mention control as a dimension of mental toughness at that age; whereas control is repeatedly mentioned in adult samples (e.g., Coulter et al., 2010; Jones et al., 2007). Adolescence is indeed a great time of change (Weiss, 2004) and this likely contributes to the lower feelings of control by young athletes in general.

Given that Control is consistently lower across research with adolescents, researchers should take note of how this aspect of mental toughness can be enhanced. One line of research that promotes control of learning and ability is that of adopting a growth mindset (Dweck, 2007). Individuals with a growth mindset believe that learning and ability is highly controllable and can be improved with effort whereas those who adopt a fixed mindset believe ability is unchangeable. Early research in sport at the intercollegiate level has demonstrated that individuals with a growth mindset and who display higher task than ego orientation reacted more positively to setback and failure (Potgieter & Steyn, 2010), which is known as a key driver of mental toughness in young athletes (Mahoney et al., 2014). This line of research would prove to

be beneficial in a young adolescent sample wherein a growth mindset and mastery climate is promoted and enhanced using MG-M imagery to determine the effect on Control scores over time.

Practically speaking, the results of the study are encouraging. Many young athletes report their sport environment as an opportunity to develop a strong work ethic, commitment, discipline, as well as perseverance and resilience (Fraser-Thomas & Côté, 2009). Despite these benefits, sport places various demands on young athletes which can lead to stress and challenge (Goyen & Anshel, 1998). Individuals high in mental toughness generally perceive stressful environments as opportunities that promote growth (Gerber, Brand, et al., 2013; Mahoney et al., 2014). Given that imagery is a natural ability, is used with relatively high frequency in the current sample, and with the uncovered associations between imagery use and the 4C's of mental toughness, the MG-M and CG functions of imagery prove to be of particular use for young athletes. Mental toughness has also proven developable in young populations (Gucciardi, Gordon, & Dimmock, 2009) making the findings even more encouraging.

The use of imagery to increase mental toughness to mitigate the stress and demand of sport is also a promising outcome for sport proponents that aim to increase sport participation and enjoyment while reducing dropout rates. Findings from a systematic review of reasons for sport dropout among children and youth found that main reasons included lack of enjoyment, low perceptions of competence, social pressures, and physical factors (Crane & Temple, 2015). Greater MG-M use and higher mental toughness result in greater sport enjoyment, higher competence and confidence, and the ability to cope with the various demands of sport. The findings of the current study that MG-M enhances all 4C's of mental toughness and the impact of MG-M imagery use to positive outcomes within sport is promising for continued participation

across the lifespan. Weinberg, Butt, Knight, Burke, and Jackson (2003) suggested that imagery is most effective when it is planned or deliberate and provide direction to the next steps of testing MG-M and CG imagery interventions. Recognizing that the findings of the current study are limited by the self-report and cross-sectional nature and that we cannot conclude that imagery is the sole contributor of mental toughness scores, the results do however suggest imagery is being utilized effectively by the 11-14 year old sample. Therefore, it is important that athletes, coaches, and applied sport psychology consultants are aware of the potential of MG-M and CG imagery to enhance mental toughness in young athletes.

### **Limitations and Future Directions**

The current research is not without limitations. Although researchers use the term ‘predict’ and its various forms when referring to regression, it cannot be said with certainty that there is a causal relationship between the five imagery functions and the 4C’s of mental toughness. Rather, the relationships are correlational. Additionally, other factors not controlled for such as upbringing, personality, and other psychological skills use (e.g., goal setting, attentional control) may wholly or partially account for the athletes’ mental toughness scores. Additionally, the current study did not meet the recommended minimum number of participants of 90 to ensure adequate power (Tabacknick & Fidell, 2013) and so results should be interpreted with caution. The high number of questions on the MTQ48 that were required to be reversed scored is also a limitation with young samples. Research suggests clarity in item development with young participants as to not confuse what is being asked (Borgers, Hox, & Sikkel, 2003) and research with young respondents stresses the use of positively worded items over negatively worded items (Borgers, de Leeuw, & Hox, 2000). Support for these considerations is found in research by Eys, Loughead, Bray, and Carron (2009) wherein the authors determined in the

development of a group cohesion questionnaire for children, greatest internal consistency was found when items were positively worded. Future research, then, should consider a positively worded version of the MTQ48 when using children as the sample.

To comment more on psychometrics, as the development and use of reliable and valid measures is one of the cornerstones of psychological research, it is worthwhile to address the CG subscale within the SIQ-C. In the development of the SIQ-C (Hall et al., 2009), the Cronbach reliability coefficient of the CG subscale was found to be .69 – similar to the current study. An examination of the items of CG imagery may explain the lower internal consistencies. Although the questions as a whole assess imagery related to strategies and routines, young athletes may rely heavily on the coach to take command of the strategy and routine involved in sport (Cardinal & Rivet, 2010) and so use it to a lesser extent during adolescent years. This may also offer explanation as to why CG was the least used function in our study as well as in previous studies (e.g., Hall et al., 2009; Munroe-Chandler et al., 2008). The items themselves were developed to be vague as to be inclusive of all sports. This non-direct method of assessing strategy and routine may impact responses. Sport specific examples may increase internal reliability in the future and is worth examining.

The nature of the data collection (i.e., self-report) is also a noted limitation and may have led to biases in responses, such as the social desire to appear mentally tough. Social desirability is highly relevant in the context of sport as coaches are often quoted to support mental toughness and athletes often conform to meet these demands. There is a misguided conception beyond academia that mental toughness encompasses a brave individuality that allows an athlete to persist despite the various demands of sport (Andersen, 2011), including pain and injury. What is comforting is the findings from young athletes, scholars, and musicians (Mahoney et al., 2014)

wherein mental toughness was characteristic of seeking support from the various social resources available and being attentive to ones own and others' affective needs. This healthier understanding of mental toughness needs to be managed and conveyed through better communication between researchers and the average consumer of information. Research promoting the various benefits of mental toughness that include unseen factors such as greater developmental assets (Gucciardi & Jones, 2012), coping, stress management, enjoyment, and the 4C's is more valuable than the often illustrated physical rough and tumble expression of mental toughness.

A shift toward greater understanding of mental toughness is also taking place in that researchers have begun to conceptualized mental toughness in light of different psychological theories (e.g., self-determination theory, self-concept theory). Moreover, other psychological theories such as grit (Duckworth, Peterson, Matthews, & Kelly, 2007), and self-regulation (Behncke, 2002; Kirschenbaum, 1984) which, simply, is the personal management of ones own thoughts, behaviors, and feelings to achieve a goal, may prove to be useful in understanding mental toughness at any stage across the lifespan. Grit is considered an individuals' persistence toward achieving long-term goals, as well as the ability to manage setbacks and failures along the way toward goal achievement (Duckworth et al., 2007) and is similar to mental toughness. Findings of grit research extend to greater self-control (Duckworth et al., 2007), persistence in challenging tasks (Lucas, Gratch, Cheng, & Marsella, 2015), and greater self-regulation (Wolters & Hussain, 2015). There is little research on grit in sport; however, young adolescents involved in elite soccer who displayed high levels of grit received more playing time and practiced for longer overall than players with less grit (Larkin, O'Connor, & Williams, 2016). These outcomes overlap with mental toughness findings in sport and considering the short length of the Grit Scale



(8 items; Duckworth et al., 2007), it may be worthwhile to measure both mental toughness (MTQ48) and grit to assess any commonalities and differences among the two. In sum, it can be seen that mental toughness still suffers from its grand capture and will be taken in many different directions before becoming a single theory that describes human excellence; nonetheless, the innovative research being conducted only proves to cement mental toughness as a construct that is worth studying across professional, educational, and sport domains.

### **Conclusion**

The finding that MG-M imagery was a significant and individual predictor of the 4C's of mental toughness in young athletes adds to Martin et al's. (1999) Applied Model of Imagery Use in Sport in that for the greatest results, the function should indeed match the intended outcome (i.e., MG-M for all aspects of mental toughness). However, the finding that CG imagery was an individual predictor of Challenge and Confidence supports the notion, as Cumming and Williams' (2013) suggest, that cognitive functions of imagery may contribute to motivational outcomes, although with lesser effectiveness. This is illustrated in the current results in that CG only significantly predicted two of the 4C's of mental toughness. Nonetheless, both MG-M and CG imagery can be used in concert or individually for mental toughness purposes that extend to Challenge, Commitment, Control, and Confidence. These findings are slightly different than those found in a intercollegiate sample and so also reflect the consideration of age into the model of imagery use. Future research can employ the use of MG-M imagery scripts to enhance adolescent mental toughness extending to the positive outcomes across sport and life discussed throughout. Using our understanding of imagery coupled with the findings within the study, athletes would theoretically benefit from imaging challenging environments that require mastery to overcome obstacles and setback toward goal achievement. Indeed, such an avenue of research is an exciting and promising endeavor worth examining for sport and greater life outcomes.

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Table 1

*Means and Standard Deviations of Demographic Information and SIQ-C and MTQ48 Subscales with Alpha Coefficients*

Variable	Male ( <i>n</i> = 28)		Female ( <i>n</i> = 48)		Total Sample ( <i>N</i> = 76)		$\alpha$
	M	SD	M	SD	M	SD	
Age	12.68	1.12	12.38	1.02	12.49	1.06	
Years Played	6.32	2.24	5.89	2.99	6.04	2.73	
SIQ-C							
CS	3.78	.81	3.71	.85	3.73	.83	.73
CG	3.50	.81	3.55	.73	3.53	.76	.59
MS	3.61	.85	3.71	.75	3.67	.79	.61
MG-A	3.42	.95	3.64	.81	3.56	.87	.66
MG-M	4.01	.55	3.75	.68	3.85	.65	.72
MTQ48							
Challenge*	3.79	.52	3.68	.58	3.59	.51	.70
Commitment	3.87	.45	3.73	.54	3.78	.51	.77
Control	3.30	.40	3.25	.47	3.27	.46	.65
Confidence	3.54	.49	3.48	.48	3.50	.48	.74

*Note.* SIQ-C = Sport Imagery Questionnaire for Children; CS = Cognitive Specific; CG = Cognitive General; MS = Motivational Specific; MG-A = Motivational General-Arousal; MG-M = Motivational General-Mastery; MTQ48 = Mental Toughness Questionnaire 48; M = Mean, SD = Standard Deviation,  $\alpha$  = Cronbach's reliability coefficient. The SIQ-C is rated on a 5-point Likert scale where 1 = *not at all* and 5 = *very often*. The MTQ48 is rated on a 5-point Likert where 1 = *strongly disagree* and 5 = *strongly agree*.

\*Item 14 was removed from the Challenge Subscale

Table 2

*Pearson Bivariate Correlations Between Subscales of the SIQ-C and the MTQ48*

Subscale	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. CS	-								
2. CG	.24*	-							
3. MS	.35**	.31**	-						
4. MG-A	.40**	.34**	.20	-					
5. MG-M	.46**	.41**	.39**	.39**	-				
6. Challenge	.33**	.50**	.26**	.39**	.59**	-			
7. Commitment	.27*	.39**	.22	.17	.51**	.67**	-		
8. Control	.25*	.33**	.21	.24*	.56**	.60**	.66**	-	
9. Confidence	.23*	.43**	.37**	.24*	.52**	.57**	.58**	.63**	-

*Note.* CS = Cognitive Specific; CG = Cognitive General; MS = Motivational Specific; MG-A = Motivational General-Arousal; MG-M = Motivational General-Mastery.

\*  $p < .05$  level . \*\*  $p < .01$  level.

Table 3

*Summary of Hierarchical Regression Analyses for Imagery Functions Predicting Mental Toughness*

		Mental Toughness						
Model	Variable	B	SE B	$\beta$	<i>t</i>	<i>R</i> <sup>2</sup>	<i>Adj. R</i> <sup>2</sup>	$\Delta R^2$
Challenge								
Step 1	Imagery Training	.34	.12	.31	2.79**	.095	.083	-
Step 2	Imagery Training	.19	.11	.17	1.78	.400	.366	.305
	MS	.01	.07	.02	.17			
	MG-A	.09	.07	.14	1.37			
	MG-M	.43	.10	.49	4.61***			
Step 3	Imagery Training	.09	.12	.08	.75	.441	.393	.041
	MS	-.02	.07	-.02	-.23			
	MG-A	.07	.07	.11	1.05			
	MG-M	.37	.10	.43	3.82***			
	CS	.01	.07	.01	.10			
	CG	.19	.08	.25	2.25*			
Commitment								
Step 1	Imagery Training	.31	.11	.30	2.72**	.091	.079	-
Step 2	Imagery Training	.24	.11	.23	2.26*	.308	.269	.217
	MS	.01	.07	.02	.17			
	MG-A	-.06	.07	-.09	-.85			
	MG-M	.39	.09	.49	4.29***			

Step 3	Imagery Training	.17	.12	.17	1.48	.325	.266	.017
	MS	-.01	.07	-.01	-.11			
	MG-A	-.07	.07	-.12	-1.05			
	MG-M	.35	.10	.44	3.58***			
	CS	.02	.07	.04	.29			
	CG	.11	.08	.16	1.32			
Control								
Step 1	Imagery Training	.16	.10	.18	1.56	.032	.019	-
Step 2	Imagery Training	.07	.09	.08	.73	.316	.278	.284
	MS	-.01	.06	-.01	-.13			
	MG-A	.00	.06	.01	.04			
	MG-M	.38	.08	.55	4.80***			
Step 3	Imagery Training	.03	.10	.04	.32	.325	.267	.009
	MS	-.02	.06	-.03	.32			
	MG-A	-.00	.06	-.00	-.03			
	MG-M	.36	.09	.53	4.25***			
	CS	-.01	.06	-.02	-.18			
	CG	.07	.072	.11	.92			
Confidence								
Step 1	Imagery Training	.09	.11	.10	.83	.009	-.004	-
Step 2	Imagery Training	-.02	.10	-.02	-.21	.302	.262	.293
	MS	.12	.07	.19	1.75			
	MG-A	.03	.06	.05	.42			



Step 3	MG-M	.32	.09	.43	3.74 <sup>***</sup>			
	Imagery	-.11	.11	-.12	-.107	.357	.301	.055
	Training							
	MS	.09	.07	.15	1.4			
	MG-A	.01	.06	.02	.21			
	MG-M	.28	.09	.38	3.11 <sup>**</sup>			
	CS	-.03	.07	-.04	-.37			
	CG	.18	.08	.29	2.37 <sup>*</sup>			

*Note:* B = Unstandardized beta (regression) coefficient; SE B = Standard error of B;  $\beta$  = Standardized beta (regression) coefficient;  $t$  =  $t$ -statistic;  $R^2$  = Total variance accounted by model; *Adj. R<sup>2</sup>* = adjusted total variance accounting for small sample size;  $\Delta R^2$  = change in variance for each model; MS = Motivational Specific; MG-A = Motivational General-Arousal; MG-M = Motivational General-Mastery; CS = Cognitive Specific; CG = Cognitive General.

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

## LITERATURE REVIEW

### **Introduction**

As the concept of mental toughness becomes increasingly widespread in the literature, including academia and popular culture (e.g., sports, business, medicine), it is important to identify potential strategies to aid in its understanding and development. One strategy that has shown increasing promise is imagery (Mattie & Munroe-Chandler, 2012). Despite imagery being heralded as one of the most widely used and applicable sport performance enhancement strategies for athletes of all ages and levels of ability, across differing sports (cf. Munroe-Chandler & Morris, 2011), its utility has been relatively overlooked in relation to mental toughness.

Mental toughness is a psychological construct comprised of general traits such as hardiness, resiliency, and confidence that manifest outwardly as performance outcomes (see Crust, 2007 for a review). Given that imagery is something of which we are all capable, and that it has proven successful in improving motor learning (Driskel, Copper, & Moran, 1994), increasing self-efficacy (Munroe-Chandler, Hall, & Fishburne, 2008; O, Munroe-Chandler, Hall, & Hall, 2014), and sport confidence (Callow, Roberts, & Fawkes, 2006), as well as abating competitive anxiety levels (Hale & Whitehouse, 1998), it is only fitting that preliminary evidence has shown a relationship between imagery use and mental toughness in intercollegiate athletes. Demonstrating the same relationship in a youth sport sample would allow for specific imagery interventions aimed at enhancing mental toughness.

There is a plethora of studies analyzing and describing what mental toughness is in adult athletes (Connaughton, Thelwell, & Hanton, 2011; Crust, 2007), but few researchers have chosen to focus on mental toughness in youth athletes. Further, only one study has directly examined imagery use and its relationship to mental toughness (Mattie & Munroe-Chandler,

2012). As such, the subsequent literature review will follow the main headings of 1) imagery, 2) mental toughness, and 3) the relationship between imagery use and mental toughness in sport.

## **Imagery**

### **Imagery Defined**

Many definitions of imagery have been offered in the sport psychology literature. Initially, the understanding of imagery as it relates to sport emerged from early psychological theory – both psychophysiological and cognitive (Morris, Spittle, & Watt, 2005). This approach was useful in our understanding of imagery but lacked a specificity that is required for a sporting context: an environment that is fluid and ever changing. A popular definition offered by Vealey and Greenleaf (2010) wherein imagery is described as the process of “creating or recreating a skill or situation/experience in one’s mind” (p. 268) is often cited for clarity and sufficiency. Morris et al. (2005), however, offer a more comprehensive and working definition that envelops the full nature of imagery, as it exists in sport:

Imagery, in the context of sport, may be considered as the creation or recreation of an experience generated from memorial information, involving quasi-sensorial, quasi-perceptual, and quasi-affective characteristics, that is under the volitional control of the imager, and which may occur in the absence of the real stimulus antecedents normally associated with the actual experience. (p. 19)

Importantly, to be most effective, imagery should involve all of one's senses (Vealey & Greenleaf, 2010) so to match the physical performance environment, be it practice or training. Another important consideration that comes from the definition offered by Morris et al. (2005) is the fact that imagery is under full control of the individual performer, allowing one to choose what to focus on, and when. This implies that with enough mental practice, both psychological

and physical skills may see improvement if the imager sees value in them (Martin, Moritz, & Hall, 1999). To be most impactful, imagery requires the use of past information, suggesting that the more familiar a concept is to an individual, the more powerful the images may become and this offers explanation as to why elite athletes utilize imagery more skillfully than novice and amateur athletes (Hall, Mack, Paivio, & Hausenblas, 1998). The multidimensional and interactional nature of imagery as discussed above will be covered in more detail below through the examination of the theories and models of imagery.

### **Theories and Models of Imagery**

As imagery research has long existed before the emergence of sport psychology, there are various leading theories from differing fields of study that attempt to offer explanation for the utility of imagery as a method of mental practice (Hall, 2001); with special attention given to the imagery and motor performance relationship. As Morris et al. (2005) suggest in their review, imagery may be a function of several individual or combined processes, including psychoneuromuscular explanations, as well as cognitive and neuroscientific theories.

**Psychoneuromuscular theory.** Carpenter (1894) was the first to propose the psychoneuromuscular theory of imagery through the ideomotor principle. Carpenter postulated that mental imagery of a movement activates the imaged muscles in a similar fashion (although lesser in magnitude or reaction) that would reflect real physical practice. In theory, the stronger the connection built through imagery, the greater the muscles will fire when physically called upon. Early support for this claim first emerged through the work of Jacobson (1931). More recently, researchers (e.g., Wilson, Smith, Burden, & Holmes, 2010) have also noted similar findings while monitoring muscle activity using electromyography during an imagery session.

**Symbolic learning theory.** Sackett (1934) was the first to introduce a cognitive explanation for imagery in which he proposed that the brain acts as a coding system that processes movements symbolically into a mental blueprint. Movements and patterns become engrained into the central nervous system and thus become automatic over time. As the theory is largely cognitive, the focus lies in the technical aspects of performance such as sequencing, timing, and specific movement patterns (Morris et al., 2005). As images are represented as sequences of movements, symbolic learning theory is primarily used in the effort to learn new skills and enhance the ones already obtained; making it useful in explaining imagery's ability to benefit both beginner and advanced athletes. There is support suggesting that mental rehearsal of a skill can improve performance of cognitive tasks (Feltz & Landers, 1983; Sackett, 1934).

**Bioinformational theory.** Lang's (1979) work in the field of imagery was propelled by an information processing approach. In this theory, knowledge is represented as information units that are stored in memory. The stimulus proposition is the image itself and is often created with information stored and retrieved from an individual's long-term memory. The response proposition is the various emotional-affective and physiological responses such as increased heart rate from anxiety, or tensing of the muscles from being nervous. Lang (1985) proposed that imagery is most powerful and effective in strengthening behavior when it mimics the real world and holds meaning to the imager; a finding that has been supported using targeted imagery scripts (Smith, Holmes, Whitemore, Collins, & Devonport, 2001). Further, research supporting the bioinformational theory (e.g., Smith & Collins, 2004) has found that imagery, when involving aspects of stimulus, response, and meaning, may strengthen both cognitive and physical performance.

**Triple-code theory of imagery.** Ahsen's (1984) triple-code theory introduced three key elements of imagery for consideration that offer explanation in relation to performance, between and within individuals. The three elements include the image itself, the somatic response elicited by the image, and the meaning of the image ascribed by the individual imager. Ahsen's model begins similarly when compared to other theories (e.g., bioinformational theory) in that an image is produced and solicits stimulus-response activation within the mind and body. Where this theory differs from others, and puts heavy focus on, is the meaning of the image (Gould, Damarjian, & Greenleaf, 2002).

To Ahsen (1984), the unique perspective each individual produces for an image is paramount, as one image may produce different interpretations and thus his model is able to account for the slight variations inherent in imagery across individuals. The triple-code theory has real world application in the realm of sport psychology and is addressed in a model presented by Murphy, Nordin and Cumming (2008) wherein they placed importance on the meaning of the image to the individual. This focus on the possible differences between the way in which individuals interpret an image takes into consideration the work of Ahsen (1984) as it relates to sport and exercise.

**Analytic framework of imagery use in sport.** Paivio's (1985) analytic framework of imagery use in sport focused on the multidimensional (cognitive and motivational functions) nature of imagery. The framework also noted the functions of imagery can operate on a specific or general level. As such, the Cognitive Specific (CS) function of imagery represents images of specific sport skills and acquiring levels of proficiency in a sport. An example of CS would be hitting a draw in golf; the athlete would focus on certain cues such as the path of the swing and the positioning of their feet that would allow them to execute the desired outcome. The Cognitive

General (CG) function of imagery represents images of strategies and routines specific to an athletes' sport. The usefulness of such imagery, like imagining a corner kick in soccer and how to defend or attack in this scenario, is likened to that of the mechanism described in symbolic learning theory (Sackett 1934). The Motivational Specific (MS) function of imagery entails goal-oriented images such as placing in an important competition, thus driving an individual to attain a future target, requiring the delay of gratification. The Motivational General (MG) function of imagery, as construed by Paivio, involves the arousal and affect associated with performance.

Much of the imagery research in the past decades has been guided by Paivio's (1985) conceptualization of imagery, but not without additional reform along the way. Hall et al. (1998) extended Paivio's framework by separating MG imagery into MG-Arousal (MG-A, similar to the previous MG including arousal and anxiety) and MG-Mastery (MG-M, imaging oneself appearing confident, in control, and mentally tough) (see Figure 1). Despite the framework's strengths, shortcomings remain, including that an individual's interpretation of the image and the individual's ability to image stands unaccounted for and there may be additional functions of imagery not covered in the framework; however, much of this is remedied by the use of additional imagery measures that extend beyond frequency of imagery use.

**Applied model of imagery use in sport (AMIUS).** With the previous limitations of Paivio's (1985) framework in mind and through a review of the literature, Martin et al. (1999) addressed the various gaps in the understanding of imagery use as it relates to the sporting environment. The ultimate goal, as stated by the authors, was to better understand imagery and account for the cognitive, affective, and behavioral outcomes within various sports. The AMIUS (see Figure 2) combines many existing theories and understandings of imagery including bioinformational theory (Lang, 1979), triple-code theory (Ahsen, 1984), and Paivio's analytic

framework of imagery use in sport (1985; also known as the types or functions of imagery). The model also takes into consideration other factors such as the sport situation or environment, imagery ability, and specific outcomes. Such a model allows for athletes and practitioners to better understand where and how athletes can use imagery and for what reasons.

Within the model, the sport situation includes training, competition, and rehabilitation environments, thus accounting for three main situations in which an athlete may utilize imagery. Imagery type is the next area covered in the model and is the primary focus as it is the main antecedent to sport outcomes and posits that dependent on what an athlete chooses to focus on this will in turn influence the cognitive, affective, and behavioral outcomes seen. It is here that Martin et al. (1999) incorporate Paivio's (1985) functions of imagery in their model to account for how athletes use imagery. Although athletes may utilize alternative functions of imagery outside the ones covered in the model (Hall et al., 1998), the five functions (or types) of imagery provide a foundation for athletes to focus on and offers empirical evidence for the effectiveness of imagery. Martin et al. (1999) suggest that the types of imagery may be utilized independently or in conjunction with one another to achieve specific outcomes.

Next, imagery outcomes as seen in the model are similar to those detailed in Paivio's (1985) analytic framework for imagery use. Hence, outcomes include both cognitive and motivational aspects such as skill acquisition, regulation of arousal and anxiety, and modification of cognitions. Where the model adds to the overall understanding of imagery is the consideration of imagery ability. Individual ability (i.e., kinesthetic and visual) acts as a moderating variable between type and outcomes of imagery. Kinesthetic and visual imagery have proven effective in enhancing performance on differing tasks (Glisky, Williams, & Kihlstrom 1996; Hardy & Callow, 1999).



Since its conceptualization, the AMIUS has driven sport imagery research through the examination of the existing and untapped relationships between the environment, imagery type, abilities, and related outcomes (Cumming & Ramsey, 2009). Nordin and Cumming (2008) tested the ability of the five imagery types to lead to specific outcomes as outlined in Hall et al.'s (1998) operational framework. In general, the five functions of imagery were used as they are described in the literature, some more effective than others (e.g., CG, CS, and MG-M) and athletes with higher imagery ability benefited most from imagery use when compared to individuals with low imagery ability (Nordin & Cumming, 2008). With over a decade of research guided by the AMIUS, Cumming and Williams (2013) offered a revised model of deliberate imagery use that builds on Martin et al.'s (1999) original model.

The revised model includes considerations such as age, gender, competition level, personality, experience, and the meaning of the image, which may influence and explain differing outcomes of imagery, within and between individuals. Cumming and Williams (2013) also note that the types of imagery are often combined to achieve a specific goal that falls within several categories (e.g., MG-M utilized to get psyched up (MG-A) and be mentally tough for competition (MG-M)) and thereby offered a more flexible framework when considering the function-outcome relationship. As the understanding of imagery continues to progress, so too will the models of imagery use.

**The four W's of imagery use.** Munroe, Giacobbi, Hall, and Weinberg (2000) utilized in-depth interviews with elite athletes to further the understanding of athletes' imagery use, with specific attention given to highlighting the four w's of *where*, *when*, *why*, and *what* athletes image. Instead of focusing on what researchers and sport psychologists considered important in relation to imagery use, Munroe et al. allowed athletes to identify these aspects, thus allowing

novel information to be added to the sport imagery literature. The findings were represented in a hierarchical tree.

The first level considers *where* imagery is used. Athletes reported using imagery most during training and competition. This is expanded upon further in level 2 that covers *when* imagery is used. The five categories of during practice, outside of practice, pre-competition, during competition, and post-competition were most frequently mentioned in the interviews and were subsequently included in the framework. Level 3, consisting of *why* (functions) and *what* (content) athletes image, is expanded upon in greater detail in levels 4, 5, and 6. Similar to Paivio (1985) and Hall et al. (1998), Munroe et al. (2000) found that athletes image the five functions of imagery with an additional flow function (imagining oneself in an optimal performance state).

Further elaboration was also made on each of the five functions of imagery such that CS was further classified into skill development and skill execution. CG was also further divided into strategy development and execution. Additional understanding of the motivational functions of imagery was also acquired in that athletes reported using MS imagery (goal oriented/outcome imagery) for individual and team purposes. Munroe et al. (2000) also revealed through their analysis that excitement, control, and relaxation were main characteristics utilized in MG-A imagery. The MG-M function of imagery of mastery and challenge was expanded to include confidence, positivism, focus, and mental toughness. Other important findings include the content of athletes' imagery such as the nature of imagery (i.e., positive and negative images, as well as accuracy), the surroundings (i.e., competition location, crowds), and the type (i.e., visual, auditory, olfactory, and kinesthetic). Overall, the four w's of imagery use by Munroe et al. propelled imagery research and furthered the field's understanding of athletes' imagery use.

### **Measurement of Imagery Functions in Sport**

**The Sport Imagery Questionnaire.** Hall et al. (1998) developed the Sport Imagery Questionnaire (SIQ), which is a 30-item questionnaire measuring the frequency of adult athletes' use of the five functions of imagery (CS, CG, MS, MG-A, & MG-M). Items are scored on a 7 point Likert scale where 1 represents "*rarely use that function of imagery*" and 7 represents "*often use that function of imagery*". The reliability and validity of the questionnaire has undergone extensive examination and re-examination with various populations. In particular, factorial validity, through the use of confirmatory methods, was established in its original conception by Hall et al. (1998) but also by Hall, Stevens, and Paivio (2005). Acceptable reliability estimates for the five functions of imagery, ranging from .70 to .88 (Hall et al., 2005), have been noted.

**The Sport Imagery Questionnaire for Children (SIQ-C).** Given the SIQ (Hall et al., 1998) had been developed to measure the frequency of adult athletes' imagery use, Hall, Munroe-Chandler, Fishburne, and Hall (2009) developed a similar instrument to assess children's use of imagery (7-14 years). In the development of the SIQ-C (Hall et al., 2009), a multiple phase approach was taken; wherein a 21-item questionnaire was developed and tested for factorial validity during the first phase. During the second phase, the factorial validity via model fit was reassessed on a new sample. CFI approached satisfactory levels at .89, the GFI was equal to .91 indicating good model fit, and the RMSEA was equal to .06, below the recommended .08 (Tabachnick & Fidell, 2013). Major changes took the form of simplified language, the deletion of nine unnecessary items, and a narrower rating scale (a 5-point Likert scale as opposed to a 7-point scale) with specific descriptives for the five points. Adequate Cronbach alpha coefficients of .70 or above (Kline, 2005) were met for CS, MS, MG-A, and MG-M, while the CG subscale showed satisfactory reliability for a new scale ( $\alpha = .69$ ).

## Research Examining Imagery Use in Young Athletes

Although adult athletes' imagery use has always been an area of interest to researchers (cf. Hall, 2001), and remains to be, there has been a recent surge of studies examining child and youth athletes' use of imagery. It is important to understand age and developmental differences when considering imagery use and the related functions (Munroe-Chandler, Hall, Fishburne, O, & Hall, 2007), as imagery interventions may require modification with younger populations.

In the past, research with youth took a back seat in comparison to research with adult and elite athlete populations. A few key studies, however, emerged in the early years of sport imagery research. Li-Wei, Qi-Wei, Orlick, and Zitzelsberger (1992) conducted a 22-week imagery program with Chinese youth table tennis players (7-10 years old). Individuals were separated into three groups: (1) a video observation, mental imagery, and relaxation group, (2) a video observation group, and (3) a control group. The findings indicated that the video observation, imagery, and relaxation group made significant improvements in performance in the form of increased quality and accuracy of shots when compared to the other groups: a promising beginning indicating that young athletes respond well to mental strategies such as imagery.

With respect to where athletes use imagery, Rodgers, Hall, and Buckolz (1991) found that figure skaters ( $M_{age} = 13.7$ ) utilized imagery most often prior to and during competition and less so in practice. Other early research assessed the type of imagery utilized by youth athletes. Specifically, Vadocz, Hall, and Moritz (1997) and Monsma and Overby (2004) found that youth roller skaters and ballet dancers (12-21 years), respectively, utilized both cognitive and motivational functions of imagery. Several others also noted that children utilize and improve on visual and kinesthetic imagery as they age and are able to control their images with practice (e.g., Fishburne, Hall, & Franks, 1987; Wolmer, Laor, & Toren, 1999). As such, beginning

understandings of youth sport imagery were restricted to the knowledge that it was being used cognitively and motivationally, visually and kinesthetically, and was able to produce performance enhancement. More recent research has taken steps to further understand and assess imagery in youth sport.

As fundamental developmental differences exist between not only adults and youth, but also between the differing stages of youth (Piaget & Inhelder, 1971), Munroe-Chandler, Hall, Fishburne, and Strachan (2007) qualitatively examined, through the use of focus groups, imagery use across four distinct age groups (i.e., 7-8, 9-10, 11-12, 13-14 years). The study was the first of its kind to consider age differences in relation to imagery ability/use in youth sport. One of the main findings of the study was that children of all ages utilized the five functions of imagery to a varying extent. Of interest to the current study however, was that few athletes (1 female and 0 males) reported using MG-M imagery to enhance mental toughness. The authors offer the explanation of social desirability, in that young athletes, particularly male athletes, may not report imaging being mentally tough as they wish to be perceived as already mentally tough. Also, mental toughness is a largely misunderstood concept (Connaughton et al., 2011) and therefore may not be easily understood by youth athletes without introduction to the concept.

In an extension to Munroe-Chandler, Hall, Fishburne, and Strachan's (2007) study, Munroe-Chandler, Hall, Fishburne, O, and Hall (2007) investigated the content of young (7-14 years) athletes' imagery use. Through focus groups, five categories emerged: imagery session, effectiveness of imagery, the nature of imagery, the surroundings, and the type of imagery used. Although the younger age groups (7-10) did not report utilizing all five of the aforementioned categories of imagery, the older cohorts (11-14) did (with some gender differences in capability being noted). Similar to how imagery progresses through childhood and adolescence (Piaget &

Inhelder, 1971), this finding supports the notion that imagery differs and progresses through a young athlete's lifespan. Results also indicated that children as young as 11 have similar developed imagery skills to their adult counterparts. Further, participants reported utilizing imagery spontaneously and naturally, supporting the claim that imagery is a simple and powerful tool for youth to employ.

From the work of Munroe-Chandler, Hall, Fishburne, O, et al. (2007) it is evident that children as young as seven report the use of the five functions of imagery. The following section will cover the research associated with various cognitive and motivational outcomes with adolescent and/or youth populations.

**Cognitive imagery.** One of the first CS intervention studies conducted by Li-Wei et al. (1992) examined children's (7-10 years) table tennis performance and found that an increased focus of CS imagery significantly improved the athletes' accuracy and technical quality. Further, in a study designed to improve soccer strategies (e.g., direct free kicks – attack and defending, as well as defending a corner kick) utilizing a CG imagery script, Munroe-Chandler, Hall, Fishburne, and Shannon (2005) found that athletes ( $M_{age} = 12.54$ ) improved their performance slightly when defending corner kicks. More recently, Munroe-Chandler, Hall, Fishburne, Murphy, and Hall (2012) conducted a CS vs. MG-A design utilizing imagery scripts with youth soccer players (7-14 years). The CS group displayed faster skill execution when compared to the MG-A group, and the 7-8 year olds showed an increase in CS imagery use over time.

**Motivational imagery.** As Martin et al. (1999) proscribe in their applied model of imagery use, the function of imagery should match the desired outcome. The function of imagery most theoretically related to confidence and self-efficacy is MG-M imagery, which involves images of being confident, in control, and mentally tough (Munroe et al., 2000). Much of the

motivational imagery research with youth has focused on the MG-M function as there are ties to Bandura's (1997) self-efficacy (i.e. situation specific confidence) theory wherein vicarious experience or seeing others or yourself accomplish a task offers heightened perceptions of self-efficacy on said tasks. MG-M imagery has been associated with higher levels of self-confidence (Munroe-Chandler et al., 2008; O et al., 2014) and lower levels of cognitive and somatic anxiety in a youth sport setting (Strachan & Munroe-Chandler, 2006); MG-A imagery has been found to be a significant predictor of cognitive anxiety (Vadocz et al., 1997). Additionally, younger athletes who display the highest levels of sport confidence use more MG-M imagery when compared to athletes with less sport confidence (Moritz, Hall, Martin, & Vadocz, 1996).

Strachan and Munroe-Chandler (2006) examined developmental differences (7-11 and 12-15 age groups) with respect to the association between imagery use, self-confidence, and anxiety. In general, for both age groups, imagery use predicted self-confidence and anxiety at significant levels; however, the imagery function-outcome findings differed between groups suggesting that athletes at different levels of ability and competition level, during adolescence, utilize imagery for different reasons. Elsewhere, Parker and Lovell (2009) found that youth recreational athletes reported using MG-M imagery most frequently while MG-A imagery was used least often. Elite youth athletes reported utilizing MS imagery (goal attainment) most frequently (Parker & Lovell, 2009).

In one of the early motivational imagery intervention studies with young athletes, Munroe-Chandler and Hall (2005) examined the impact of MG-M imagery scripts on a youth soccer team's reported levels of collective efficacy across three groups (forwards, midfielders, and defense/goal keeper). Two of the three groups displayed increases in collective efficacy in both training and competition. To further test the theoretical consideration that MG-M could be

used to enhance confidence and self-efficacy, Munroe-Chandler et al. (2008) examined the relationship between imagery use, self-confidence, and self-efficacy in both youth recreational and competitive soccer players aged 11 to 14. A significant amount of the athletes' self-confidence and self-efficacy was accounted for by MG-M imagery (40% to 57%; highest for recreational athletes) reflecting the power of MG-M imagery as a tool to enhance both general and specific sport confidence. MS imagery was also shown to be a significant predictor of confidence in recreational athletes but not competitive athletes.

More recently, O et al. (2014) utilized individualized MG-M imagery scripts to enhance the self-efficacy of youth squash players ( $N = 5$ ;  $M_{\text{age}} = 10.80$ ). Over the course of the intervention, three participants showed increases in their self-perceptions of self-efficacy, and generally, MG-M imagery increased over time. Those who displayed the highest increases in MG-M imagery use also displayed higher levels of self-efficacy, supporting the function-outcome relationship proposed by Martin et al. (1999). In a different approach, McCarthy (2009) utilized an MG-M imagery intervention to improve the affective responses (positive and negative) of three youth swimmers, two 15-year old females and one 13-year old male. The participants attended imagery sessions and were instructed to practice MG-M imagery in one to two minute bouts whenever they could and before bed each night. Significant increases in positive affect were found in all participants suggesting that MG-M imagery may be utilized for other outcomes such as enjoyment for sport.

### **Mental Toughness in Sport**

Although the concept of mental toughness is not new to the general sport literature (e.g., Loehr, 1986), there seems to be little consensus given it has been researched from many different perspectives (Connaughton et al., 2011; Crust, 2007, 2008). Much of the uncertainty can be



attributed to the high frequency in which mental toughness is credited for athletic success and what it allows athletes to do (e.g., Jones, Hanton, & Connaughton, 2002, 2007), without much consideration given to what exactly mental toughness is. While mentally tough individuals certainly have a desire to win and often achieve success, it is not what defines mental toughness. Mental toughness is how an athlete responds, not only in the face of setback and adversity, but also how one responds when things are going well; how one remains motivated to work toward accomplishing their goals (Coulter, Mallett, & Gucciardi, 2010).

Historically, early reports of mental toughness emerged anecdotally from coaches' and sport psychologists' experiences with elite level athletes. Most notably, Loehr (1986, 1994) identified mental toughness to be one of the most important characteristics that separates elite from non-elite athletes. Through his observations and interactions with athletes and coaches, Loehr (1994) maintained that the mentally tough athlete displayed four emotional qualities of flexibility, responsiveness, strength, and resiliency. These qualities contributed to a balanced athlete with the ability to perform, focus, persist, and cope with any pressures presented to them. In a similar fashion, Bull, Albinson, and Shambrook (1996) considered mental toughness a collection of six attributes including a strong desire to succeed, positivity in the face of adversity and challenge, controlling what one can control and not worrying about what is uncontrollable, high commitment to sport, high self-belief, and positive body language. Other names in the field were seemingly in agreement at the time (e.g., Goldberg, 1998). As such, mental toughness was viewed as a key factor of athletic prowess, not necessarily dependent on physical ability. From this, it can be noted that beginning understandings of mental toughness emerged from observations and descriptions of high caliber athletes. The investigation on mental toughness continued in such a fashion for several decades wherein researchers tended to describe what

mental toughness was from the perspective of athletes, as it existed in an elite context (e.g., Fourie & Potgieter, 2001). However, researchers acknowledged the lack of theory and rigor – the roots of any lasting concept or idea – and so more recent research has taken steps to approach mental toughness from many standpoints and has produced intriguing findings (see Gucciardi & Gordon, 2011).

### **Mental Toughness Defined**

Despite the many definitions of mental toughness and the fact it is a developing topic, there remains no universally accepted definition. There is, however, a general sense of what mentally tough performers possess – dedication, determination, persistence, resilience, focus, and so forth; the list is too extensive to exhaust here (Connaughton et al., 2011). Early definitions were dependent on one's opponent (e.g., Jones et al., 2002), which limits applicability across sport as not all competitive environments have athletes directly facing against one another (e.g., gymnastics). A recent combination of qualitative and quantitative research, however, has led to an effortful account of mental toughness. Coulter et al. (2010) define mental toughness as:

the presence of some or the entire collection of experientially developed and inherent values, attitudes, emotions, cognitions, and behaviors that influence the way in which an individual approaches, responds to, and appraises both negatively and positively construed pressures, challenges, and adversities to consistently achieve his or her goals.  
(p. 715)

Many of the characteristics described in the definition encompass topics such as self-confidence and self-efficacy, emotion and attention regulation, optimism, and a goal-oriented attitude (Connaughton et al., 2011). As such, mental toughness can be viewed as a dynamic arsenal of psychological skills that allows one to exceed physically and often achieve excellence

in the form of goal attainment, thus including the processes and outcomes of being mentally tough.

### **Theories, Frameworks, and Models of Mental Toughness**

The following overview of the theories and models of mental toughness will provide more depth to the components that form mental toughness.

**Cattell's theory of personality.** The Sixteen Personality Factor Questionnaire (16PF; Cattell, Eber, & Tatsuoka, 1970) is based on the theory that there are 16 major personality traits. Each factor has two spectrums representing two differing levels of the trait. For *sensitivity*, those who score low display behaviors that are utilitarian, unsentimental, and rough. Further, these individuals are objective, tough-minded, and extremely self-reliant. On the other end, those who score high on *sensitivity* are described as intuitive, sentimental, tender-minded, and so forth. Loosely, the description of *sensitivity*, especially those who score low on this trait, captured many aspects of mental toughness in its early form. This rigid perception has since been elaborated upon.

**Hardiness theory.** Kobasa (1979) was one of the first to scientifically examine the notion that personality – specifically hardiness and resiliency – may act as a buffer against illness caused through repeated life stressors. Kobasa outlines hardiness as three distinct characteristics that individuals possess. *Control* is the extent to which an individual believes they can influence the world around them; *commitment* refers to the active engagement one has in their daily life; and *challenge* refers to an individual's perception of change as a positive opportunity for personal growth. Kobasa notes that *control* gives an individual a sense of power and control over their lives, and the ability to interpret situations positively acts as a buffer against illness. *Commitment* offers an individual a solid foundational belief and in turn, an equally supportive

social network to use when needed. *Challenge* offers flexibility in one's approach to life that allows for smooth adaptation that a rigid stance does not allow. Accordingly, individuals who enjoy challenge and change are naturally exposed to a greater range of difficulties and the various means required to manage them (i.e., effective coping strategies), internally and externally. Being confident in oneself to manage change with one's own resources as well as utilizing resources offered outside the self is characteristic of a hardy individual (Kobasa, 1979). Generally, there is support showing that individuals who display higher levels of hardiness enjoy less stress and illness (Kobasa, 1979) and show higher ability to perform under pressure (Golby, Sheard, & Lavalley, 2003; Maddi & Hess, 1992; Sheard, 2009).

**Loehr's conceptualization of mental toughness.** Through exposure, observation, and interaction with elite athletes and coaches alike, Loehr (1986) proposed a psychological framework comprising the essential mental skills that are the foundations of mental toughness. These include, attention control, positive and negative energy, motivation, attitude control, as well as visual and imagery control. With this, Loehr (1994) defined mental toughness as the "ability to consistently perform toward the upper range of your talent and skills regardless of competitive circumstances" (p. 5) and went on to identify four emotional aspects of mentally tough athletes including emotional flexibility, emotional responsiveness, emotional strength, and emotional resiliency, representing an athlete who can cope at a higher and more successful rate when compared to their competitors. From his observations and writings, Loehr (1986) formulated the Psychological Performance Inventory (PPI; see the measurement section for more information) to assess mental toughness in high-level athletes. A positive attribute that emerged from the formulation of the PPI was the introduction of mental toughness into the sport literature as well as the emergence of the meaning and use of visualization and imagery to an elite,

mentally tough, athlete.

**The four C's model of mental toughness.** From hardiness, an adapted theory of mental toughness (Clough, Earle, & Sewell, 2002) emerged. The Four C's (4C's) Model of Mental Toughness (see Figure 3) builds from the first three dimensions (Control, Commitment, and Challenge) of a hardy personality described by Kobasa (1979) with an added fourth dimension, Confidence, making the 4C's model a mental toughness theory with specific focus on individual personality. Based on interviews with high level athletes and coaches, Control was determined as the ability to manage one's reactions to varying athletic environments and contexts, focusing heavily on impending performance variables, as well as the ability to cope with the immediate surroundings. Commitment was determined as a drive in practice and training toward set goals and managing victory and defeat. Challenge was determined as the ability to manage injury and the day-to-day routines of being an athlete. Confidence was referred to valuing your position on the team, including one's own capabilities, regardless of inter-team conflicts or dips in performance. The theme of Confidence was recurrent throughout the interviews and since its inception has been described as the essence of mental toughness according to the authors: the ability to perform under pressure and thrive through adversity. Two of the 4C's (Control and Confidence) were later expanded to reflect emotional control and life control as well as confidence in abilities and interpersonal confidence, but can be collapsed to represent general Control and Confidence.

Support for the 4C's model has been established through the use of the Mental Toughness Questionnaire 48 (MTQ48). In a sample of three varying degrees of competition of rugby (International, Super League, and Division One) it was found that the athletes at the highest level of performance (i.e., International) displayed significantly higher levels of Commitment, Control

and Challenge while also displaying significantly greater negative attention control, and greater overall attentional control (Golby & Sheard, 2004). Other positive relationships have been established such that athletes with higher mental toughness reported the use of positive coping strategies as opposed to negative strategies (Nicholls, Polman, Levy, & Backhouse, 2008), as well as greater performance on cognitive and fatigue related tasks (Clough et al., 2002).

### **Measurement**

Mental toughness researchers are still in debate on the dimensionality and structure of the construct, especially as it should be represented through measurement (Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015; Gucciardi, Mallett, Hanrahan, & Gordon, 2011); however, most measures offer a total mental toughness score while also offering several subscale scores that proposition distinct dimensions of mental toughness.

**The Psychological Performance Inventory (PPI) and the PPI-Alternative.** The Psychological Performance Inventory (PPI; Loehr, 1986) is a 42-item questionnaire measuring seven constructs (Attention Control, Positive and Negative Energy, Motivation, Attitude Control, as well as Visual and Imagery Control) on a 5-point Likert scale, ranging from 1 = “*Almost Never*” to 5 = “*Almost Always*”. A major drawback of this inventory is its lack of theoretical rigor (Gucciardi et al., 2011). The initial construction was largely subjective and utilized anecdotal information. Although there is merit in this approach as a first step in the development of a questionnaire, factorial validity has not been achieved by various researchers using elite samples (Golby, Sheard, & van Wersch, 2007; Middleton et al., 2004).

More recently, a revised version, the PPI-Alternative (PPI-A), was proposed by Golby et al. (2007) utilizing principal components analysis in an attempt to reduce the original questionnaire to a more appropriate factor model. This was followed by a confirmatory factor

analysis, wherein factorial validity was established for a four-factor model. The authors identified a 14-item model consisting of four underlying components of: (a) Determination, (b) Self-Belief, (c) Positive Cognition, and (d) Visualization. Internal consistency has been established (Golby et al., 2007; Sheard, 2009), but the use of the original PPI items to formulate a revised version is problematic (Gucciardi et al., 2011). Nonetheless, the examination of the PPI and PPI-A has piqued the interest of many academics and has since driven researchers to take steps to approach mental toughness through a science-practitioner lens; leading to the creation of several inventories with theory, past research, and psychometrics in mind.

**Mental Toughness Questionnaire-48.** The MTQ48 (Clough et al., 2002) is a 48-item questionnaire measuring mental toughness consisting of the subscales of Challenge, Commitment, Control, and Confidence. Each question is answered on a five point Likert scale where 1 = “*strongly disagree*” and 5 = “*strongly agree*”. The authors (Clough et al., 2002) support the use of the four-factor model (Challenge, Commitment, Control, and Confidence) and statistical support has been noted (Perry, Clough, Crust, Earle, & Nicholls, 2013). The MTQ48 was also designed to produce a single overall measure of mental toughness (Clough et al., 2002). Test-retest reliability has been reported as .90 (Clough, Perry, Strycharczyk, & Earle, 2015). Internal consistency for the subscales are all above the recommended minimum of .70 (Kline, 2005). A confirmatory factor analysis with 8207 participants consisting of sub-samples of senior manager, lower and middle management, clerical/administrative, students, and athletes (athlete subsample:  $n = 442$ , male = 320, female = 122,  $M_{age} = 24.21$ ,  $SD = 9.12$ ) displayed satisfactory results overall (Perry et al., 2013).

Although strengths of the questionnaire have been noted, several drawbacks of the MTQ48 have surfaced; the main one being that the model may not be different enough than

hardiness theory to be considered a stand-alone theory/model of mental toughness (Andersen, 2011). Other drawbacks include the limited statistical rigor in the research literature to assess the validity and reliability of the scale (Gucciardi, Hanton, & Mallet, 2012). This is likely a result of the general focus of the mental toughness literature being on understanding mental toughness and what it allows athletes to do, and not on the theoretical underpinnings – especially the utilization of both qualitative and quantitative methods to formulate a working model that can be tested. However, recent research is emerging that supports the validity and reliability of the MTQ48 across many domains, including sport and is outlined in a continuously updated online manual (Clough, Perry, Strycharczyk, & Earle, 2015).

Furthermore, research has also shown support for the use of hardiness in understanding the mentally tough athlete (Gucciardi, Gordon, & Dimmock, 2009a; Jones et al., 2007), and with the unique characteristic of confidence the 4C's model remains a useful measure of mental toughness in sport (Golby & Sheard, 2004). Further, confidence in ones self and in ones ability is repeatedly cited as one of the main aspects of mental toughness in high-level athletes, from the beginning of the concepts inception into academia (e.g., Jones et al., 2002). Ultimately, the main strength of the questionnaire is its ability to distinguish varying levels of mental toughness (Clough et al., 2002; Clough et al., 2015) and past concerns are being continually assessed and addressed with positive findings supporting the MTQ48 as a viable option for mental toughness researchers (e.g., Clough et al., 2015; Perry et al., 2013).

### **Research Examining Mental Toughness in Adult Athletes**

The majority of mental toughness research in youth athletes has been driven by findings within adult athletes; especially at the elite level. Consequently, the following subsections



covering the literature within adults allows for a greater understanding of the research conducted with youth – the main focus of the current study.

**Qualitative research.** In lieu of the abundance of the many characteristics noted to encapsulate mental toughness, the following review of the qualitative research will be synthesized in a similar manner as was done by Connaughton et al. (2011). Nine general characteristics (belief, coping, motivation, control, focus, resilient attitude, personal values, physical toughness, and sporting intelligence) were identified to encompass the mental toughness research and so have been utilized for comparison here. Additional categories (from Mahoney, Gucciardi, Mallet, & Ntoumanis, 2014; support seeking, forethought, social intelligence, and motivational and supportive climate) have been included in the table to reflect research conducted with youth, which will be described in more detail in the youth section, thus representing 13 general characteristics (see Table 4).

Fourie and Potgieter (2001) as well as Jones et al. (2002) were the first sport psychology researchers to implement a qualitative approach in an effort to better understand mental toughness in elite performers. Fourie and Potgieter elicited written responses from hundreds of expert coaches and elite athletes, resulting in 12 attributes of mental toughness. The attributes have been reduced to their respective categories in Table 4. Fourie and Potgieters' study was one of the first to examine mental toughness systematically from a specific population; however, the study lacked theoretical considerations in which to ground their 12 attributes. Subsequently, through focus groups and interviews with 10 elite-international level athletes, Jones et al. (2002) sought to operationalize mental toughness through the use of personal construct psychology (Kelly, 1991), which is an individual perspective of how one perceives and reacts to their environment. Jones et al. defined mental toughness as:

...having the natural or developed psychological edge that enables you to:

1. Generally, cope better than your opponents with the many demands that sport places on a performer;
2. Specifically, be more consistent and better than your opponents in remaining determined, focused, confident, and in control under pressure. (p. 209)

Importantly, athletes agreed that mental toughness was an attribute that could be developed over time in addition to the fact that one could be naturally mentally tough – a key finding to the research at the time. As did their predecessors, Jones et al. (2002) also found 12 major characteristics that fall into the general categories that can be seen in Table 4.

Jones et al. (2007) interviewed Olympic and world champions, coaches, and sport psychologists on the definition of mental toughness and its attributes. The definition formulated by Jones et al.'s (2002) earlier study was supported by those interviewed (Jones et al., 2007). Thirty attributes that comprised mental toughness were identified, forming four dimensions of (a) attitude and mindset, (b) training, (c) competition, and (d) post-competition. The categories wherein the 30 attributes fell can be seen in Table 4. The classification of mental toughness being applicable to training, competition, and post-competition was an important addition to the understanding of when and how mental toughness is used and in what context. The expansion of the 12 previously mentioned attributes also contributed to a greater understanding of mental toughness in elite athletics.

Several other studies have examined the key characteristics of a mentally tough elite level athlete and have reported similar findings to those previously mentioned. Elite soccer players (Thelwell, Weston, & Greenlees, 2005) conceptualized mental toughness similarly to those sampled in Jones et al.'s (2002) study; however, these players considered it important to always outperform one's opponent. Elite cricketers (Bull, Shambrook, James, & Brooks, 2005) and

Australian Footballers (Gucciardi, Gordon, & Dimmock, 2008) also conceptualized mental toughness similarly to previous accounts (see Table 4), suggesting consistency across sport type.

In addition, a few studies involving expert athletes and coaches, not represented in Table 4, highlighted the importance of developmental factors such as positive and supportive networks (e.g., family, friends, coaches, sport environment) and a motivational but challenging training climate (Connaughton, Hanton, & Jones, 2010; Cook, Crust, Littlewood, Nesti, & Allen-Collinson, 2014; Thelwell, Such, Weston, Such, & Greenlees, 2010; Weinberg, Butt, & Culp, 2011). Finally, a negative training and coaching environment has been found to subtract from mental toughness in athletes (Gucciardi, Gordon, Dimmock, & Mallett, 2009). Much of the above findings emerging from interviews with elite athletes and coaching staff share similarities, regardless of sport, including the idea that one must perform at a higher level than ones opponent, be committed to one's sport, have a supportive network, be driven toward achieving personal and team goals, and display an attitude and mindset of determination, resiliency, and persistence despite the stressors present in one's personal and professional life. Currently, researchers have come to agree that mental toughness is largely individual and both inherent and developed over time (Connaughton et al., 2011).

**Quantitative research.** Recent attention has been given to the relationship between mental toughness and constructs such as stress, coping, hardiness, and achievement level, as well as variables such as gender, age, experience, and differences within and across sport. In one of the few studies that directly examined stress and coping and its relationship to mental toughness in athletics, Kaiseler, Polman, and Nicholls (2009) found that athletes with high levels of self-reported mental toughness displayed the greatest use of problem-focused coping strategies and less use of emotion-focused and avoidance coping when compared to athletes who scored lower

on mental toughness. Higher total mental toughness also acted as a buffer against stress, as stress was perceived to be not as detrimental or serious within these individuals. Feelings of control were also higher, allowing the more mentally tough athletes to persist toward their goals regardless of stress (Kaiseler et al., 2009). Further, Nicholls, Polman, Levy, and Backhouse (2009) found no differences in levels of mental toughness across competition levels (e.g., international, national, university, club, and recreational); however, the elite sample was rather small compared to the rest of the samples and may account for why no differences emerged. Furthermore, males reported significantly higher levels of total mental toughness, Challenge, Control of emotions and life, and Confidence in ability, as measured by the MTQ48, than females. Age was also a determinant of higher levels of mental toughness, as the older athletes in the sample reported higher levels of mental toughness, supporting the notion that experience within sport may lead to higher levels of mental toughness (Connaughton, Wadey, Hanton, & Jones, 2008; Golby & Sheard, 2004).

Nicholls et al. (2009) also noted that there were no differences in reported levels of mental toughness when looking at team and individual athletes or those who are in contact vs. non-contact sports. The authors suggest this offers support that mental toughness is a relatively stable personality trait; not dependent on sport type or situation. Elsewhere, Guillén and Laborde (2014) sought to examine whether mental toughness levels differ between athletes vs. non-athletes. To measure mental toughness, questionnaires assessing hope, optimism, perseverance, and resilience were used. This approach was taken as most mental toughness measures were created with the context of sport in mind. As non-athletes were being sampled, as well as athletes, the four constructs mentioned were used to represent mental toughness to reduce

measurement bias. Athletes displayed higher levels in all four constructs when compared to non-athletes and this again was not dependent on team or individual sport.

These examinations of the qualities and characteristics of mental toughness mentioned by high-level athletes prove a worthy approach to offer theoretical and quantitative support for past qualitative research. The outlined findings will propel future mental toughness research and provide a clearer understanding of the mental toughness construct.

### **Research Examining Mental Toughness in Young Athletes**

Connaughton et al. (2008) touched on the importance of mental toughness across an athlete's lifespan. Retrospective findings garnered from a sample of elite adult athletes noted early experiences (as young as seven) as important to the development of a strong belief in oneself and a desire to succeed. The following section will cover the general landscape of the mental toughness research done with youth athletes.

**Qualitative research.** In similar fashion to previous researchers who conducted interviews with elite adult athletes (e.g., Jones et al., 2002, 2007), Holland, Woodcock, Cumming, and Duda (2010) interviewed 43 male youth rugby players ( $M_{age} = 15.9$ ) on their perceptions of the mental qualities and techniques needed to succeed and remain competitive in sport. Eleven higher order themes were identified; of note were the emergence of adaptability, determination, confidence, proper attentional focus, and mental toughness; qualities that reflect those found in a review of the general mental toughness literature by Connaughton et al. (2011) where it was determined that mental toughness could be reduced to a specific set of characteristics, noted earlier. Further support for the notion that mental toughness in youth is characteristic of persistence, effort, and resiliency was offered by Gucciardi, Peeling, Ducker, and Dawson (2016) wherein Australian footballers ( $M_{age} = 16.86$ ) who exhibited the highest

levels of mental toughness displayed greater ability to work harder toward their goals than those who had lower levels of mental toughness.

To better understand adolescent athletes' (ages 13-17) perception of mental toughness in relation to the aforementioned attributes (Connaughton et al., 2011), Mahoney, Gucciardi, et al. (2014) conducted interviews with 18 mentally tough adolescents from three distinct contexts: sport, academia, and music. The authors approached their examination and analysis of mental toughness from a developmental perspective using Bronfenbrenner and Morris' (2006) bioecological model in the context of youth and contended that both nature and nurture influence one's level of mental toughness. Despite the many similarities with the findings from Connaughton et al. (2011), control and physical toughness were not mentioned among the adolescent athletes, which may be a result of the continuously changing nature of adolescence (Mahoney, Gucciardi, et al., 2014). Key elements not touched on by adult populations, such as forethought (commitment and organization of demands), social intelligence (the ability to work and interact with others in a positive way), and support-seeking behaviors/attitudes (the willingness to ask for help) emerged within the adolescent population (see Table 4). Another notable finding that emerged from the interviews was the opportunity for early success and failure, with key focus on the drive to continually learn and improve from one's experiences, while maintaining an openness to learn autonomously through self-exploration, and from others. Mental toughness at a young age seemingly depends on supportive familial and social ties, critical incidences for success and failure, and a general confidence to explore challenging situations.

**Quantitative research.** In a sample of elite adolescent ( $N = 347$ ,  $M_{\text{age}} = 13.93$ ) tennis players, Gucciardi, Jackson, Hanton, and Reid (2015) found athletes displaying the highest levels

of mental toughness reported being inspired on a regular basis and exhibited harmonious passion, which is characteristic of an autonomous internalization or choice for participation in sport that results in a general pleasure for the individual (Vallerand, 2012). Conversely, individuals with high levels of fear of failure and obsessive passion – an external drive or pressures from outside the self that pushes a person to participate and compete that can often conflict with internal thoughts and feelings of an individual (Vallerand, 2012), displayed lower levels of mental toughness when compared to the harmonious passion group. Research has also found that young athletes with high levels of mental toughness are also likely to adopt a mastery-approach when working toward their goals (Gucciardi, 2009), a behavior that exhibits a high level of autonomy and competence. Autonomy within young athletes emerged as important for not only enjoyment of sport but for ones mental toughness as well. In addition, openness to success and failure offers the opportunity to develop resiliency and mental toughness (Gucciardi, Jackson, et al., 2015), which supports the findings from Mahoney, Gucciardi, et al.'s (2014) study that viewed failure as a critical incidence for growth.

Considering autonomy is one of the basic psychological needs, Mahoney, Ntoumanis, Mallett, and Gucciardi (2014) proposed self-determination theory and specifically basic psychological needs theory (Deci & Ryan, 2002) as a framework for understanding mental toughness in a youth population. The theory of basic psychological needs details that for ideal human functioning to occur, three needs must be met (Deci & Ryan, 2002): autonomy (the belief that one has control over their choices and actions), competence (the belief that one can achieve a desired outcome), and relatedness (the belief that one is meaningfully involved in a social network; one being sport). Participants included 221 cross-country runners ( $M_{age}=14$  years ). Results indicated that individuals high in positive affect, high in psychological needs satisfaction,

low in psychological needs thwarting, and those who received a motivational coaching climate display the highest levels of mental toughness. Research involving self-determination theory and basic needs theory is in its infancy and proves as a promising avenue of examination. Future research will better indicate the efficacy of this approach in understanding and developing mental toughness in youth athletes.

To assess the mental toughness profiles of adolescent cricketers ( $M_{\text{age}} = 14.41$  years), Gucciardi and Jones (2012) examined the presence of developmental assets and negative emotional states. A key finding was that participants who reported high levels of mental toughness also reported more developmental assets and lower levels of negative emotional states when compared to individuals lower in mental toughness. Those high in mental toughness also displayed higher levels of affective intelligence – being in tune with ones own and others' emotions and moods –, a high desire to achieve ones goals, greater resiliency, heightened attentional control, and higher self-belief. Additionally, in a study assessing the relationship between global mental toughness and both positive and negative youth experiences in a sample of young adult athletes, Jones and Parker (2013) found that 14% of the variance in mental toughness was explained by positive youth experiences. Gucciardi (2011) similarly examined mental toughness as it relates to both positive and negative youth experiences and found that the presence of both positive and negative experiences related to higher levels of mental toughness and accounted for 40% of total mental toughness. As research with youth suggests that overcoming obstacles and challenges results in heightened mental toughness (Mahoney, Gucciardi, et al., 2014), the findings by Gucciardi (2011) support the necessity of a young athlete's ability to manage setbacks and criticism and view these experiences as a positive opportunity for growth.



**Mental toughness interventions.** In one of the few studies that tested the efficacy of a mental toughness-training package in a youth population, Gucciardi, Gordon, and Dimmock (2009b) utilized psychological skills training (PST) as well as a specific mental toughness training program with three youth (15 years and under) football teams in Australia. Teams were assigned to one of three groups, (a) a control group receiving no PST, (b) a traditional PST group focusing on self- and arousal regulation, mental rehearsal, attentional control, self-efficacy, and ideal performance states, and (c) a mental toughness training group focusing on key aspects of mental toughness (e.g., resiliency, self-belief, motivation). The PST and mental toughness groups displayed higher self-reported ratings of resilience, flow state, and mental toughness itself, when compared to the control group. This is an important finding, in that young athletes respond well to PST in general and can develop mental toughness. Although the mental toughness-training group was expected to see the highest changes in mental toughness, the PST group displayed similar changes in their mental toughness levels when compared to the mental toughness training group; a finding that may be explained by the overlapping similarities of the two programs (Gucciardi et al., 2009b). This overlap in results also sheds light on the many potential psychological strategies that make up and possibly enhance mental toughness.

As a follow up to the aforementioned PST study (Gucciardi et al., 2009b), Gucciardi, Gordon, and Dimmock (2009c) interviewed the athletes, coaches, and parents involved on the effectiveness and benefits of participating in the PST and mental toughness training programs. Overall, the most prevalent perceived benefits from all parties included the importance of mental preparation before training and competition, team cohesion in the form of feedback that aligned the goals of the individuals on the team, a determined work ethic that resulted in increased effort, openness to criticism, the ability to perceive criticism in a way that promotes positive

development, and the development of a 'never give in' attitude. The athletes also reported on the benefits of becoming self-aware – of ones strengths, weaknesses, likes and dislikes – and tracking progress toward their goals was also seen as a positive outcome of participating in the programs. Ultimately, exposure to the myriad of psychological skills presented to the athletes increased their awareness of the steps that can be taken to enhance the mental aspects of sport, and in the process enhanced the physical aspects as well. Mental toughness again proved itself as a learnable skill in young athletes.

In another mental toughness intervention program (Bell, Hardy, & Beattie, 2013), which occurred over the course of two years, the aim was to enhance the ability of young (16-18 years) emerging professional cricketers to achieve their goals and perform in the face of pressure and stressors. Bell et al. (2013) incorporated constructive punishment and a positive, motivational atmosphere that promoted growth through challenge, which was simulated through stressful practice and training environments. Compared to the control group who did not receive the mental toughness training, the mental toughness group displayed in general, significant increases (medium to large effect sizes) in all areas measured (i.e., coach rated mental toughness, skill assessment, game performance, and fitness) except for one physical measure (vertical jump). Bell et al.'s findings support the claim that mental toughness can indeed lead to enhanced mental and physical performance.

### **Youth Sport Demands**

Inherent in the 4C's model is the experience of and adaptation to challenging environmental and situational factors. In other words, adversity and overcoming setbacks has been identified as one of the key building blocks of mental toughness at any level of athletics (e.g., Crust & Clough, 2011). It is necessary then to identify the demands faced by young

athletes and their perceptions of their environment to determine if the challenges that drive mental toughness development as identified by adults, retrospectively, are present in a youth sport environment.

Fun is one of the primary reasons for sport participation amongst young athletes, along with developing physical skills and making friendships (Weiss & Williams, 2004). Despite this, stress and challenge are inherent aspects of the sport environment, even at a young age (Goyen & Anshel, 1998). Sport is a context that young people view as a significant part of their life (Coakley, 2011) and coupled with the fact that sport is the most popular extracurricular activity of youth (Guèvremont, Findlay, & Kohen, 2008) it is not surprising the importance that is given to sport by youth. This is often due to the pressures that parents and coaches place on winning and performing at a high level (Smoll & Smith, 1996).

Indeed, performance environments evoke stress due to the demands placed on individuals and teams. When examining pathways to success in sport, Gullich and Emrich (2006) found that athletes who experienced more hardships and adversity were more likely to manage and excel at an elite level when compared to athletes that experienced smooth developmental pathways to success. This is in line with suggestions from Crust and Clough (2011) wherein they describe the necessity of experiencing challenges in the sport environment for mental toughness development. Further, young adolescent athletes have touched on the importance of overcoming setback and failure as an important facet of mental toughness and its development (Mahoney, Guccirardi, et al., 2014) Experiencing adversity and hardship then is not necessarily a drawback, for many it is these moments that build the tenacity to continue to achieve in sport (Connaughton et al., 2008).

Support for the sport environment as a context to build mental toughness also comes from a sample of young competitive swimmers who reported their sport environment as a catalyst to

develop a strong work ethic, discipline, resilience, commitment, and perseverance (Fraser-Thomas & Côté, 2009); all aspects that promote mental toughness. On the other hand, the same athletes reported that swimming was a great source of stress which emanated from parents, coaches, and high expectations of themselves. Most participants also reported feeling unable to cope psychologically as they felt isolated in their experiences. Given that sport can lead to such mixed experiences, it is certainly an environment ripe for mental toughness development at a young age, especially with the proper support from parents and coaches. Further, young field hockey players ages 10-12 reported various sources of acute stress in sport that included making physical errors, bad calls from game officials, pain of injury, and overall negative comments from others (Anshel & Delany, 2001). These same field hockey players were also prone to negatively appraise the various sources of acute stress noted and engaged in avoidance coping strategies (Anshel & Delany, 2001); an often deleterious style of managing stressors. As such, the sport environment even at a young age offers a combination of challenging variables that promote the natural development of mental toughness. However, a missing link in the literature are strategies or approaches that enable young athletes to manage the demands of sport and develop positively by building personal strengths such as those encompassed within mental toughness. In line with the hypotheses of the current study, bringing attention to ones mental toughness through imagery use is one potential method for young athletes to employ in efforts to ensure that youth are well equipped to thrive through the ups and downs of sport.

### **Imagery and Mental Toughness**

The notion that imagery and mental toughness are interrelated stems back to Loehr's (1986, 1994) observations that mentally tough performers utilize imagery during their training and in competition. Further, in the development of the SIQ (Hall et al., 1998), it was noted that

the MG-M function of imagery, which focuses on confidence and control, also involved images associated with mental toughness. Further support for this observation came when adult athletes reported that the MG-M function of imagery was related to mental toughness, focus, confidence, and positivity (Munroe et al., 2000). The MG-M function of imagery has also been shown to significantly predict self-confidence and self-efficacy in young (age 11-14) recreational and competitive athletes (Munroe-Chandler et al., 2008). Moreover, MG-M imagery also accounted for 40 to 57% of the variance in self-confidence and self-efficacy – a significantly large amount (Munroe-Chandler et al., 2008). As confidence and self-efficacy are attributes of mental toughness, the relationship between imagery, especially the motivational components, and mental toughness is clear. Youth as young as 11 years have also reported imaging themselves as mentally tough (Munroe-Chandler, Hall, Fishburne, & Strachan, 2007).

In a sample of intercollegiate athletes, Mattie and Munroe-Chandler (2012) examined the relationship between athletes' imagery use and mental toughness. The motivational functions of imagery significantly correlated with and predicted mental toughness scores on all four dimensions of the MTQ48 (Clough et al., 2002; Control, Commitment, Challenge, Confidence) and specifically, the MG-M function of imagery was the strongest individual predictor for all dimensions of mental toughness, supporting the theoretical tie between MG-M and mental toughness. In addition, Crust and Azadi (2010) found that imagery use is moderately correlated to mental toughness utilizing the MTQ48. The athletes sampled ranged from recreational to national level athletes thus representing a broad range of ability. Self-talk, emotional control, and relaxation were the three psychological skills most significantly and positively related to mental toughness. As imagery is used for all three of these skills, it is not surprising to suggest that imagery may be a powerful tool to enhance or develop mental toughness.

Lastly, the use of psychological skills training (PST) among youth athletes has been supported for some time (Tremayne & Tremayne, 2004). To assess the efficacy of a PST program in relation to performance and psychological development in adolescent swimmers ( $M_{\text{age}} = 13.9$ ), Sheard and Golby (2006) utilized goal setting, imagery, relaxation, concentration, and thought stopping to enhance various psychological constructs of the athletes. Of the psychological constructs measured, mental toughness, confidence, and imagery are noteworthy. Participants showed the highest increase in scores of mental toughness, self-confidence, negative energy and attention control, and as well as imagery. Results support the use of PST with young competitive athletes and the increases displayed in imagery use and mental toughness are encouraging. Such findings bring attention for the need to assess the specific relationship between imagery use and mental toughness, in a young competitive sport sample.

### **Implications of Current Study**

As the utility of imagery in youth athletes has been consistently noted, the examination of the relationship between imagery use and mental toughness in youth sport is warranted. Given mental toughness is a mixture of psychological constructs that lead to positive outcomes for sport and day-to-day activities for youth (Mahoney, Gucciardi, et al., 2014), the link and potential future applicability of imagery use, as has been demonstrated in athletes young and old, to bolster mental toughness may play a positive role in developing a buffer against stressors and demands across the lifespan. Moreover, sport is one of the largest organized activities in which youth participate (Larson & Verma, 1999) and the importance of understanding and promoting positive youth experiences and development within the sporting context has not been lost on the research community. With 2 million (51%) or so Canadian children, aged 5-14 partaking in organized sport (Clark, 2008), the opportunity for positive youth experiences is substantial.

Canadian sport participation rates show a general decline across the lifespan (Canadian Heritage, 2013), which inadvertently affects the physical activity levels of Canadians. The natural, spontaneous, and purposeful use of imagery along with the learnability of mental toughness presents itself as a promising avenue of research.

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## TABLES

Table 4

*Expanded General Themes of Mental Toughness Characteristics.*

Mental Toughness Characteristics	Adult Participants							Youth Participants
	Fourie & Potgieter (2001)	Jones et al. (2002)	Bull et al. (2005)	Thelwell et al. (2005)	Jones et al. (2007)	Gucciardi et al. (2008)	Coulter et al. (2010)	Mahoney, Gucciardi, et al. (2014)
Belief	✓	✓	✓	✓	✓	✓	✓	✓
Coping/Handling Pressure	✓	✓	✓	✓	✓	✓	✓	✓
Focus/Commitment	✓	✓	✓	✓	✓	✓	✓	✓
Motivation	✓	✓	✓	X	✓	✓	✓	✓
Control	X	X	✓	✓	✓	X	✓	X
Sporting Intelligence/Knowledge	✓	X	✓	✓	X	✓	✓	✓
Tough/Resilient Attitude	✓	✓	✓	✓	✓	✓	✓	✓
Personal Values	X	X	✓	X	X	✓	✓	✓
Physical Toughness	X	X	X	X	✓	✓	✓	X
Support Seeking	X	X	X	X	X	X	X	✓
Forethought	X	X	X	X	X	X	X	✓
Social Intelligence	X	X	X	X	X	X	X	✓
Motivational and Supportive Climate	✓	X	X	X	X	X	X	✓

*Note.* Check mark indicates the attribute was mentioned in the study interviews whereas an X indicates an absence of this attribute. Adapted and modified from “Mental toughness development: Issues, practical implications and future directions” by D. Connaughton, R. Thelwell, & S. Hanton, (2011), In D. F. Gucciardi & S. Gordon (Eds.), *Mental toughness in sport: Developments in theory and research* (pp. 140-141). Abingdon, Oxon: Routledge.



## FIGURES

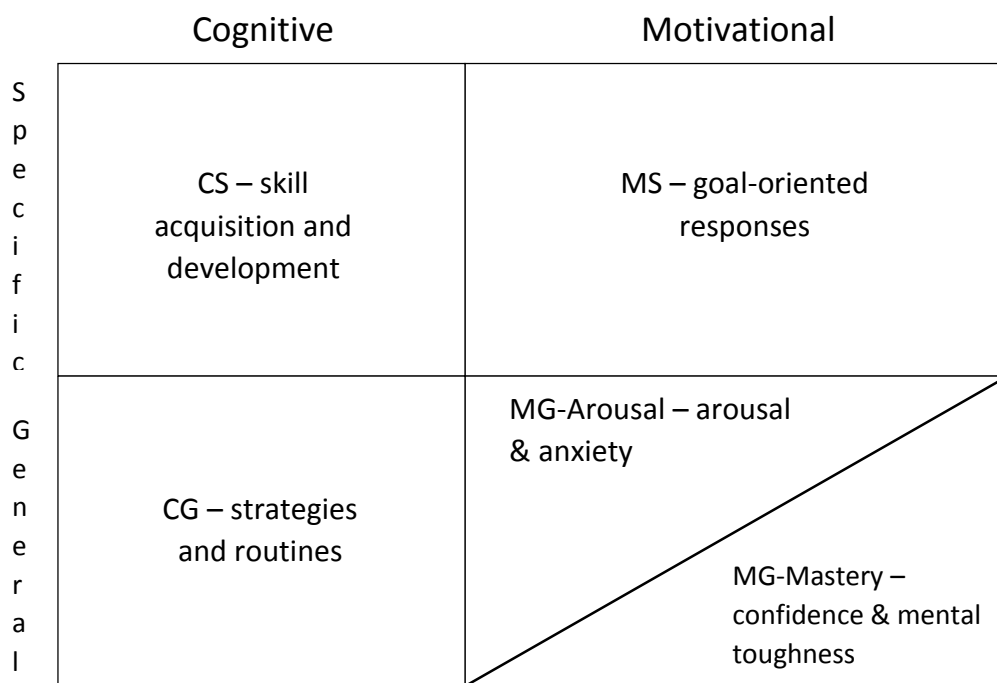


Figure 1. Revised analytic framework of imagery effects in sport. Adapted from “Imagery use by athletes: Development of the Sport Imagery Questionnaire” by C. R. Hall, D. E. Mack, A. Paivio, & H. A. Hausenblas (1998), *International Journal of Sport Psychology*, 29, p. 74.

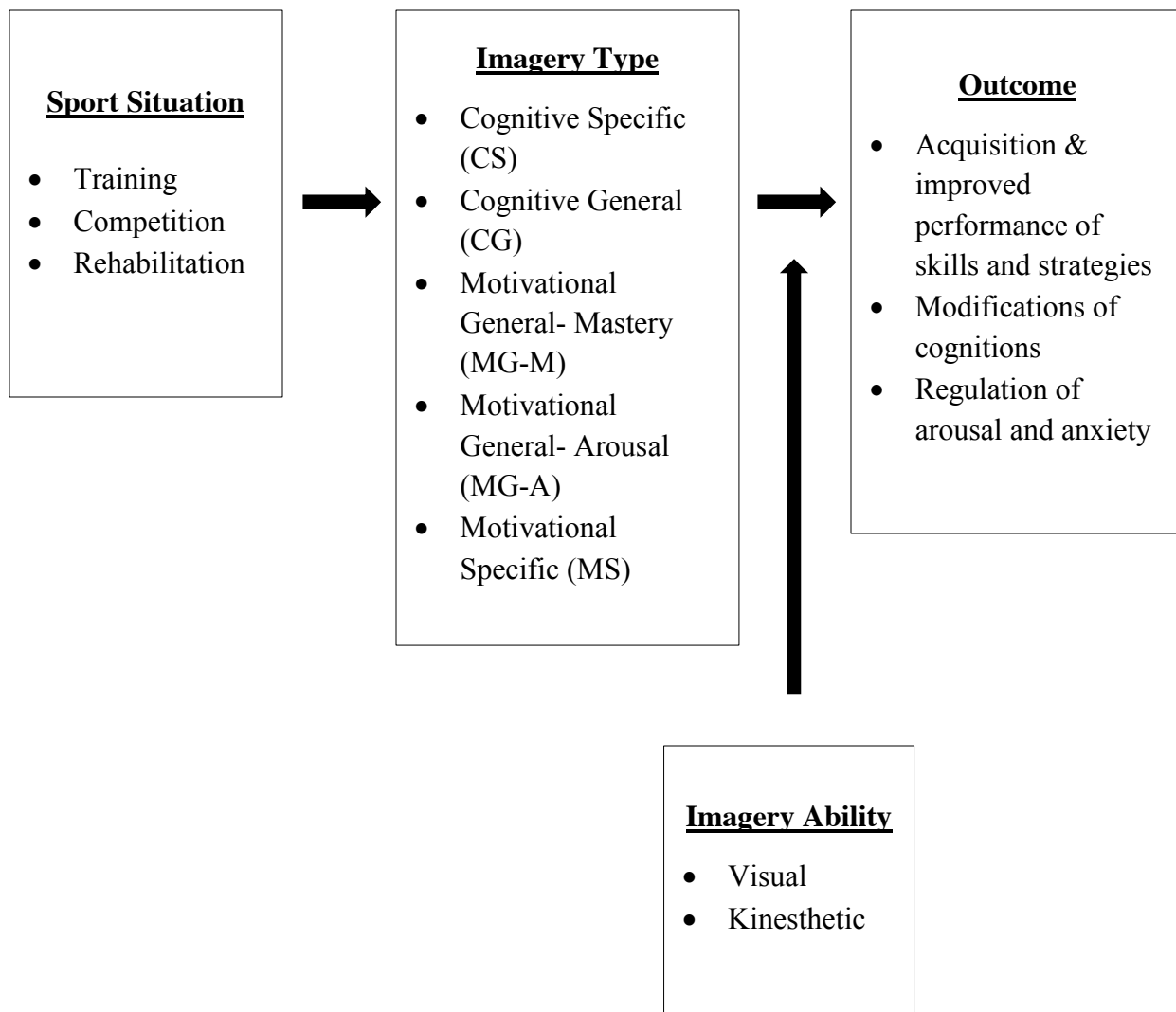


Figure 2. An Applied Model of Imagery Use in Sport. Adapted from “Imagery Use in Sport: A Literature Review and Applied Model” by K. A. Martin, S. E. Moritz, and C. R. Hall (1999), *The Sport Psychologist*, 13, p. 248.

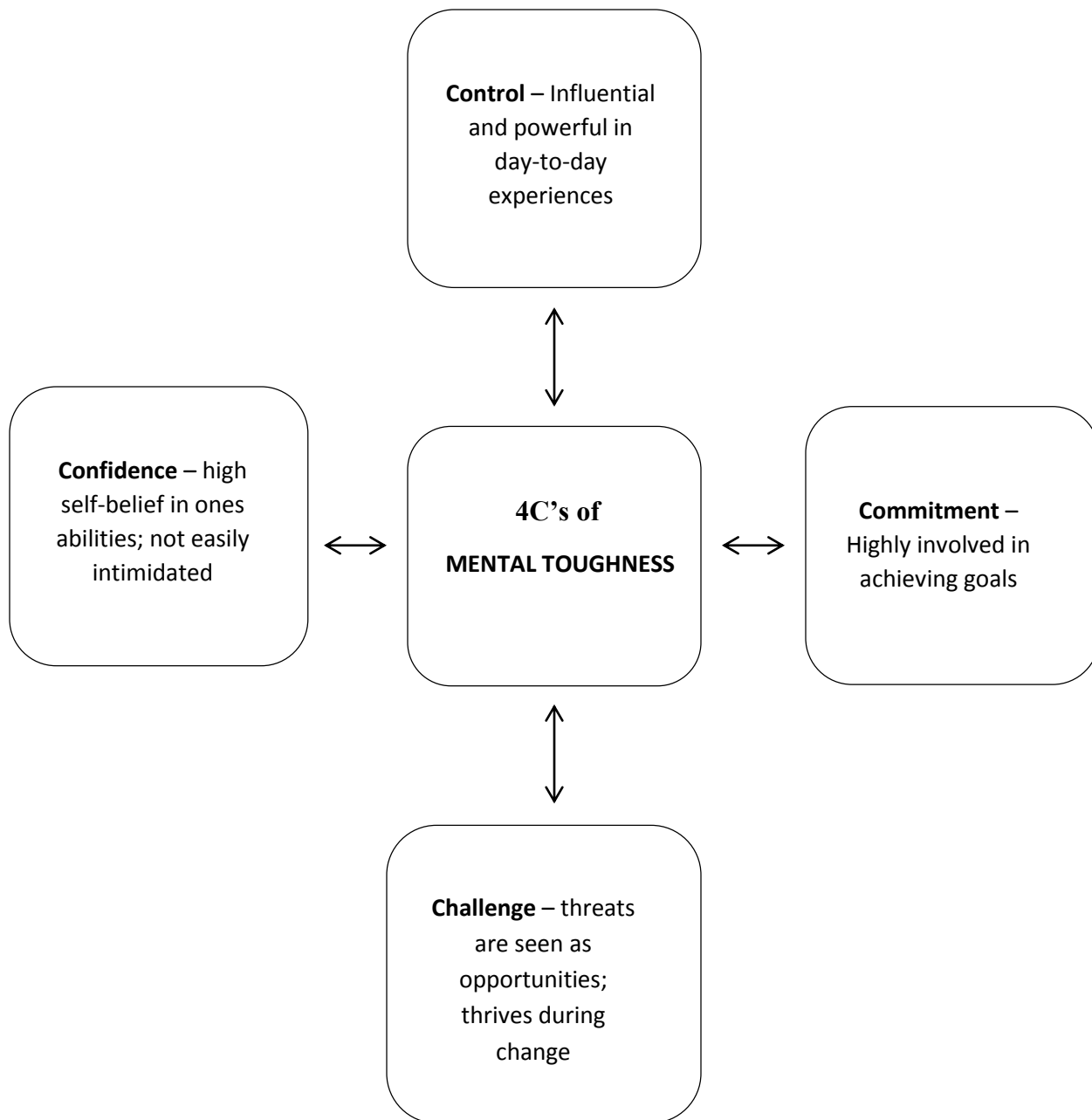


Figure 3. A visual representation of the 4C's model of mental toughness. Adapted from "AQR Innovatons in Improving Performance: Mental Toughness – MTQ48" by P. J., Clough, K. Earle, & D. Sewell, retrieved from <http://aqr.co.uk/page/mtq48>, Copyright 2011 by AQR

## APPENDICES

## APPENDIX A

## Athlete Demographics

Age: \_\_\_\_\_ yrs. (choose from options)

Gender: Open response \_\_\_\_\_

Please indicate/type below the main sport that you participate in (e.g., soccer, hockey, football, etc.): “Type here”

Please indicate/type below the level at which you or your team competes: “Type here”

What position do you play on your team “Type here”

How long have you been playing on your current team? \_\_\_\_\_ yrs. (choose from options)

How many years have you been involved in your sport? \_\_\_\_\_ yrs. (choose from options)

## APPENDIX B

## Sport Imagery Questionnaire for Children

(Hall, Munroe-Chandler, Fishburne, &amp; Hall, 2009)

**Directions:**

Imagery is when you create a picture in your mind. Athletes use imagery in practices and in competition and in everyday life. Imagery can be used to see different skills in your head and can also be used to help with your confidence and nervousness. This questionnaire measures how you are using imagery. Any question that explains an imagery situation that you use often should be given the appropriate answer of often. Please remember- there are no right or wrong answers. If you do not wish to answer a particular question, simply leave it blank.

1. I make up new game plans or routines in my head.	Not at all	A little bit	Sometimes	Often	Very Often
2. I see myself doing my very best.	Not at all	A little bit	Sometimes	Often	Very Often
3. I imagine myself being confident in competition.	Not at all	A little bit	Sometimes	Often	Very Often
4. In my head, I imagine how calm I feel before I compete.	Not at all	A little bit	Sometimes	Often	Very Often
5. I see what I would do if my game plans or routines do not work out.	Not at all	A little bit	Sometimes	Often	Very Often
6. I imagine myself staying calm in competitions.	Not at all	A little bit	Sometimes	Often	Very Often
7. I imagine other people telling me that I did a good job.	Not at all	A little bit	Sometimes	Often	Very Often
8. I can usually control how a skill looks in my head.	Not at all	A little bit	Sometimes	Often	Very Often
9. I see the audience cheering for me.	Not at all	A little bit	Sometimes	Often	Very Often
10. When I think of doing my skill, I always see myself doing it perfectly.	Not at all	A little bit	Sometimes	Often	Very Often
11. I imagine continuing with my game plan or routine even if it is not going well.	Not at all	A little bit	Sometimes	Often	Very Often

12. When I think of a competition, I imagine myself getting excited.	Not at all	A little bit	Sometimes	Often	Very Often
13. Before trying a skill, I imagine myself doing it perfectly.	Not at all	A little bit	Sometimes	Often	Very Often
14. I see myself being mentally strong.	Not at all	A little bit	Sometimes	Often	Very Often
15. I imagine how exciting it is to be in a competition.	Not at all	A little bit	Sometimes	Often	Very Often
16. I see myself as a champion.	Not at all	A little bit	Sometimes	Often	Very Often
17. I see myself being focused in a tough situation.	Not at all	A little bit	Sometimes	Often	Very Often
18. When learning something new, I see myself doing it perfectly.	Not at all	A little bit	Sometimes	Often	Very Often
19. I see myself being in control in tricky situations.	Not at all	A little bit	Sometimes	Often	Very Often
20. I see myself following the game plan or routine at competitions.	Not at all	A little bit	Sometimes	Often	Very Often
21. I see myself getting through tough situations with good results.	Not at all	A little bit	Sometimes	Often	Very Often

## APPENDIX C

## Mental Toughness Questionnaire 48

(Clough, Earle, &amp; Sewell, 2002)

Please read and answer the following items carefully, thinking about how you are in your sport. Answer the questions honestly, and do not spend too much time on any one item. If you do not want to answer a particular question, leave it blank.

In sport...

1. I usually find something to motivate me.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
2. I generally feel in control.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
3. I generally feel that I am a worthwhile person.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
4. Challenges usually bring out the best in me.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
5. *When working with other people I am usually quite influential/inspiring.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
6. *Unexpected changes to my schedule generally throw/bother me (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
7. I don't usually give up under pressure.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
8. I am generally confident in my own abilities.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
9. I usually find myself just going through the motions (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

10. At times I expect things to go wrong (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
11. "I just don't know where to begin" is a feeling I usually have when presented with several things to do at once (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
12. I generally feel that I am in control of what happens.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
13. However bad things are, I usually feel they will work out positively in the end.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
14. I often wish it was more predictable (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
15. *Whenever I try to plan something, unforeseen/unexpected factors usually seem to wreck it (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
16. I generally look on the bright side.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
17. I usually speak my mind when I have something to say.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
18. At times I feel completely useless (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
19. *I can generally be relied upon to complete the tasks/jobs I am given.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
20. *I usually take charge of a situation when I feel it is appropriate/needed.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree



21. I generally find it hard to relax (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
22. *I am easily distracted from tasks/jobs that I am involved with (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
23. *I generally cope/deal well with any problems that occur.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
24. *I don't usually criticise/blame myself even when things go wrong.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
25. I generally try to give 100%.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
26. When I am upset or annoyed I usually let others know.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
27. I tend to worry about things well before they actually happen (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
28. I often feel intimidated (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
29. When faced with difficulties I usually give up (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
30. I am generally able to react quickly when something unexpected happens.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
31. *Even when under considerable/much pressure I usually remain calm.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

32. If something can go wrong, it usually will (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
33. Things just usually happen to me (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
34. I generally hide my emotions from others (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
35. I usually find it difficult to make a mental effort when I am tired (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
36. When I make mistakes I usually let it worry me for days after (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
37. When I am feeling tired I find it difficult to get going (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
38. I am comfortable telling people what to do.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
39. *I can normally sustain/keep high levels of mental effort for long periods.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
40. I usually look forward to changes in my routine.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
41. I feel that what I do tends to make no difference (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
42. *I usually find it hard to summon/create enthusiasm for the tasks/jobs I have to do (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

43. If I feel somebody is wrong, I am not afraid to argue with them.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
44. I usually enjoy a challenge.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
45. I can usually control my nervousness.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
46. In discussions, I tend to back-down even when I feel strongly about something (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
47. *When I face setbacks I am often unable to persist/keep with my goal (R).	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
48. *I can usually adapt/prepare myself to challenges that come my way.	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

*Note.* Starred items (\*) indicate an altered item for ease of comprehension for 11-14 year olds; (R) indicates that the item should be reverse scored.

## APPENDIX D



## Letter of Information for Consent to Participate in Research

Thank you for showing interest in the study that will examine the relationship between imagery use and mental toughness in a youth competitive athlete population. You have been directed here from your child's sport organization on behalf of myself, Tyler Geikie (current M.HK student) and Dr. Krista Chandler (Ph.D, Faculty of Human Kinetics). We are Sport & Exercise Psychology researchers from the University of Windsor, Ontario, Canada and appreciate your time and consideration.

Please read through the following information by clicking on the 'next' button below. Take your time and if you have any questions or concerns, contact information is provided in the following documents. Feel free to contact us and ask any questions you may have. At the end you will be asked if you wish to provide consent for your child to participate in this research. University of Windsor Research Ethics has been obtained.

### **Title of Study: The Relationship Between Young Athletes' Imagery Use and Mental Toughness**

**When reading through the following information please read 'you' as it refers to you and your child.**

You are asked to participate in a research study conducted by Tyler Geikie (H.B.A, M.HK Student) and Dr. Krista Chandler (Ph.D., Faculty Supervisor) from the Department of Kinesiology at the University of Windsor (Ontario, Canada). This study has received University of Windsor Research Ethics Board clearance. The results of this study will contribute to the completion of a Masters degree in Sport Psychology. Your participation in this study is completely voluntary and will have no bearing on your on-going participation in your current sport, including the various relationships.

If you have any questions or concerns about the research, please feel free to contact Mr. Tyler Geikie at 519-253-3000 ext. 4058 or by email, [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca); or Dr. Krista Chandler at 519-253-3000 ext. 2446 or [chandler@uwindsor.ca](mailto:chandler@uwindsor.ca).

#### PURPOSE OF THE STUDY

The purpose of the study is to examine the relationship between imagery use and mental toughness in a youth competitive sport environment.

#### PROCEDURES

If you volunteer to participate in this study, you will be asked to:

- Read through a letter of information detailing the study, including a child consent form
- Complete an online questionnaire that may take up to 15-20 minutes to complete. This survey should be completed in a private environment (i.e., at home on a secured internet connection).
- Prior to completing the questionnaires a few questions on your involvement in sport will also be asked and an outline of what imagery and mental toughness sport are as they exist in the sporting environment
- Questionnaires will touch on athletes imagery use in sport and mental toughness

#### POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable psychological or physical risks or discomforts associated with participation in this study.

#### POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

The information gained from this study will help advance knowledge in the field of sport psychology. The results will help to better understand imagery use and its relationship to mental toughness in a youth population. This study will also inform the research community, as well as applied proponents of sport such as coaches, parents, and sport psychology consultants, of

imagery as a potential method of enhancing mental toughness levels in a youth population. This is a worthy cause as previous research has shown that youth high in mental toughness excel in sport, academics, and in their relationships with others since these individuals have the confidence to cope with the demands presented to them.

## COMPENSATION FOR PARTICIPATION

You will not be compensated for your participation in this study. However, if you choose, once you've completed the questionnaire package, you can enter your name into a draw for a chance to win one of ten \$25 Visa gift cards. The information collected for the purposes of the draw will be destroyed after the draw has taken place and the gift cards have been distributed. Data obtained from this entry ballot will in no way be linked to survey responses.

## CONFIDENTIALITY

Responses to the questionnaires will remain anonymous and confidential, as the data contains no identifying information and is to be completed in a private setting with no face-to-face interaction with the researcher. The information obtained for the draw will remain confidential and will be kept separate from questionnaire responses. All data will be kept in a password-protected file, which will only be accessible by the primary researchers outlined above. Potentially, the data may also be utilized for publication and presentation purposes. Data will be kept secured for five years when it will then be destroyed.

## PARTICIPATION AND WITHDRAWAL

Participation in this study is voluntary. If you volunteer to be in this study, you may withdraw at any time while you are completing the surveys up until submission, without consequences of any kind. You may withdraw by clicking the "Discard" button embedded within the survey. However, once you have submitted the completed survey package, this will be accepted as your consent to allow your data to be used and it is not possible to withdraw because the surveys are anonymous. You may also refuse to answer any questions and still remain in the study. If you decide to withdraw from the study you will forfeit the opportunity to be entered into the draw for one of ten \$25 Visa gift cards. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

## FEEDBACK OF THE RESULTS OF THIS STUDY TO THE PARTICIPANTS

The results of the study will be posted at the University of Windsor's Research Ethics Board website by August 1, 2016.

Web address: <http://www1.uwindsor.ca/reb/study-results>

Date when results are available: August 1, 2016

## SUBSEQUENT USE OF DATA

These data may be used in subsequent studies, in publications and in presentations.

## RIGHTS OF RESEARCH PARTICIPANTS

If you have questions regarding your rights as a research participant, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: [ethics@uwindsor.ca](mailto:ethics@uwindsor.ca)

## SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

\_\_\_\_\_  
Signature of Investigator

\_\_\_\_\_  
Date

## APPENDIX E



University  
of Windsor

### Parental Consent Form for Child's Research Participation

**Study Title:** The Relationship between Young Athletes' Imagery Use and Mental Toughness

Principal Investigator: Tyler Geikie, H.BA Psychology; Current M.HK Student: email: geikie@uwindsor.ca, telephone: 519-253-3000 ext. 4058

Research Advisor: Dr. Krista Chandler, chandler@uwindsor.ca, telephone: 519-253-3000 ext. 2446

The purpose of this form is to provide you (as the parent of a prospective research study participant) with information to assist in your decision as to whether or not to let your child participate in this research study. Read the information below and ask any questions you might have (contact information is located below) before deciding whether or not to give your permission for your child to take part in the study. If you decide to let your child be involved in this study, this form will be used to record your permission.

#### **Why are you doing this study?**

Your child is being asked to participate in a research study examining the relationship between imagery use and mental toughness in a competitive youth sport environment.

What is imagery?

*Imagery is often described as an experience in one's mind, or visualization.*

What is mental toughness?

*Mental toughness is often described as an ability to deal with the pressures of sport and everyday life. Individuals displaying mental toughness are more likely to persist toward achieving their goals and continue in the face of challenge, setback, and adversity. This is often due to a heightened sense of confidence and control.*

The purpose of the study is to gain a better understanding of imagery use and mental toughness levels in a youth population. First, as researchers we are interested in whether the link between imagery use and mental toughness exists and to what extent in a younger population. As imagery and mental toughness are key psychological constructs for athletic success in adults, it is worthwhile to examine this potential relationship at an earlier stage. Results may inform the research community, as well as the public, of probable methods that contribute to a well-rounded young athlete and individual, capable of handling the pressures presented to them (characteristic of an individual with developed imagery skills and developed mental toughness/fortitude).

#### **What will my child be asked to do if my child is in this study?**

Due to your child's involvement in competitive sport, he/she is invited to participate in an online questionnaire-based study. If you choose to give consent for your child to participate, they will be directed to a webpage (by the parent) wherein they will complete a survey package. Before beginning the study, however, your child will decide themselves if they would like to participate; this occurs after you type in the key word. To start, individuals will be asked to fill out a demographics questionnaire that gathers

basic information such as age, gender, sport involvement, and so forth. Next, your child will be asked to answer honestly and truthfully questions related to imagery use in sport as well as questions related to mental toughness. It should take approximately 15-20 minutes to complete.

### **Does my child have to participate?**

No, your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusing to participate will not affect their relationship with The University of Windsor or coaches/team members in any way. You can agree to allow your child to be in the study now and change your mind later without any penalty. Your informed consent is required for your child to participate, however your child is also required to decide themselves and this will be addressed once they open the private website.

### **What if my child does not want to participate?**

In addition to your permission, your child must agree to participate in the study. If your child does not want to participate they will not be included in the study and there will be no penalty. If your child initially agrees to be in the study they can change their mind later without any penalty; up until the survey is submitted. Since there is no identifying information it is not possible to remove information once surveys are submitted. However, removing oneself from the study forfeits their name from being included in the draw for the Visa gift card.

### **What are the possible risks or discomforts to my child?**

There are no foreseeable risks or discomforts associated with participating in this research. Your child's participation in this study does not involve any physical or emotional risk beyond that of everyday life.

### **What are the possible benefits for my child or others?**

Your child is not likely to have any direct benefit from being in this research study. However, the possible benefits of participation are a greater understanding of research. You and your child will also become aware of the process of research and as well as an awareness of their own imagery use and you will be introduced to the concept of mental toughness. This study is designed to learn more about psychological skills use in youth sport. The study results may be used to help other people in the future such as researchers, athletes, and coaches. Your child does have an opportunity to win a **25-dollar gift card (10 available)** however as they have the choice to be entered into a random draw once they have completed the online-study. Participation in the draw is voluntary.

### **How will you protect the information you collect about my child, and how will that information be shared?**

Results of this study may be used in publications and presentations. Parties with access to the data include the principal investigator and his research advisor. Names will not be collected and therefore the data will remain anonymous. Data will remain confidential to the researchers, coaches, and team members, as the questions should be completed at home or in a similar private setting.

The data resulting from your child's participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate it with your child, or with your child's participation in any study.

### **Financial Information**

Participation in this study will involve no cost to you or your child. Your child will have the opportunity to **win one of ten 25-dollar** Visa gift cards if they submit the survey package. If your child chooses to withdraw from the study their information will be removed and destroyed and thereby they forfeit the opportunity to enter the draw.

### **What are my child's rights as a research participant?**

Participation in this study is voluntary. Your child may withdraw from this study at any time -- you and your child will not be penalized in any way or lose any sort of benefits (other than the opportunity to win a gift card) for deciding to stop participation. If you and your child decide not to be in this study, this will not affect the relationship you and your child have with your child's team members or coach in any way. If your child decides to withdraw from this study, the researchers will not use the information already collected, as it is not recorded. .

### **Who can I contact if I have questions or concerns about this research study?**

Prior, during, or after your participation you can contact the researchers below **Tyler Geikie** at **519-253-3000 ext. 4058** or send an email to [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca) for any questions you may have. This study has been reviewed and approved by The University Institutional Research Ethics Board.

**Tyler Geikie** - email: [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca), telephone: 519-253-3000 ext. 4058

**Dr. Krista Chandler** - email: [chandler@uwindsor.ca](mailto:chandler@uwindsor.ca), telephone: 519-253-3000 ext. 2446

If you have any questions about your child's rights as a participant in this research, you can contact the following office at the University of Windsor:

Research Ethics Coordinator  
Office of the Research Ethics Board, Lambton Tower, Room 1102 A  
University of Windsor  
401 Sunset Avenue  
Windsor, Ontario N9B 3P4  
Canada  
Phone: 519-253-3000 ext. 3948  
Email: [ethics@uwindsor.ca](mailto:ethics@uwindsor.ca)

### **Parental Permission for Child's Participation in Research**

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact.

I hereby give consent to allow my child to participate in the outlined research above:

Choose from "Yes" or "No"

### **New Page online for "yes" response to parental consent:**

Thank you for agreeing to allow your child to participate in the study. To access the study you will provide your child with the below link. It is requested that your child complete the survey on their own in a private setting. Thank you again for your cooperation.

<https://uwindsor.fluidsurveys.com/s/imagery-mental-toughness/>



## APPENDIX F



University  
of Windsor

### Beginning Landing Page

Welcome to the research study examining imagery use and mental toughness in a youth competitive sport environment. You have been selected for this study because of your involvement in competitive sport and because your parents have given permission for you to fill out the following questions.

However, you have the choice to participate. Please read the following information and then decide if you would like to participate or not to participate.

#### **Letter of Information/Assent for Youth 11-14 Years**

Thank you for giving your time to consider participating in my study. Before you decide I would like you to read over what is below. Once you have, you can go ahead and participate or choose not to. It is your choice and there are no negative outcomes whatsoever.

I am a student researcher at the University of Windsor, Ontario, Canada, and I am doing a study on imagery use in sport and how it is connected to mental toughness. I would like to ask you to participate in my research study. If you choose to participate you will answer various survey questions about imagery and mental toughness. Your responses will be on a scale rating.

When I am finished gathering information from all the athletes who agree to be in my study, I will write a report on what I have learned. My teachers will read it, and it might be put in a book, but no one will know who the kids are that answered my questions.

I want you to know that I will not be telling your coaches, parents, or any other kids what you answer. I promise to keep everything that you tell me private. Your mom and/or dad have said it is okay for you to answer my questions on imagery use and mental toughness in sport. Do you think that you would like to answer them? You won't get into any trouble if you say no. If you decide to answer the questions you can stop answering them at any time, and you don't have to answer any question you do not want to answer. It's entirely up to you. Once you submit your questionnaire, however, you cannot withdraw your information since I do not know which survey belongs to whom.

If you complete the survey package I will give you an opportunity to enter a draw to win a prize for one of 10 \$25 Visa gift-cards. It will take you about 15-20 minutes to complete everything. You can withdraw from the survey at any time up until you submit your responses. It is best if you complete the survey on your own (e.g., in your room, if possible) without your parents or friends around. Would you like to try answering the questions?

If you have any questions before beginning please talk with your parents and as well you can contact myself at geikie@uwindsor.ca, or by telephone - 519-253-3000 ext. 4058. Ask for Tyler.

Please read the following carefully:

I understand what I am being asked to do to be in this study. If I click yes, I confirm that my parents have given me permission to participate in the study by providing me with the website URL, and I agree to be in this study. I understand that I can withdraw at any time up until submission. If I click no, I confirm that I do not want to be in the study.

Check "Yes, I agree to participate"

Check "No, I do not wish to participate"

## APPENDIX G



## Introduction to Concepts Page

Below you will find information on imagery and mental toughness. Read over each carefully and keep it in mind when answering the following questions in the survey.

What is imagery?

*Imagery is often described as an experience in one's mind, or visualization.*

What is mental toughness?

*Mental toughness is often described as an ability to deal with the pressures of sport and everyday life. Mental toughness often allows individuals to continue working toward their goals when they would prefer to stop.*

Do you feel comfortable with your understanding of imagery use and mental toughness? "Yes" or "No"

Have you been exposed to mental skills training in the past? "Yes" or "No"

## APPENDIX H



## End Page of Study

**Thank you for your participation in the study! You have reached the end of the survey – great job.**

If you would like additional information on imagery use and mental toughness in the sport environment, do not hesitate to contact Mr. Tyler Geikie, at [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca)

If you have any questions or comments about this study or questions regarding your rights as a research participant please feel free to contact Mr. Tyler Geikie, at [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca), my supervisor, Dr. Krista Chandler, at [chandler@uwindsor.ca](mailto:chandler@uwindsor.ca), or the Research Ethics Board at [ethics@uwindsor.ca](mailto:ethics@uwindsor.ca)

Would you like to be redirected to a ballot for entry into a draw to win one of ten \$25 Visa gift cards?

Click “Yes”

Click “No”

“Submit Button”

## APPENDIX I



## Ballot Landing Page

Please enter your name, e-mail, and phone number into the draw for a chance to win one of ten \$25 Visa gift cards.

Winners will be chosen randomly and will be contacted after all data has been collected. Thank you.

First and Last name:

Email:

Phone number:

“Submit” button

## APPENDIX J



## End Landing Page if Athlete Chooses Not to Participate

Thank you for your time and consideration.

If you would like additional information on imagery use and mental toughness in sport, please contact Mr. Tyler Geikie, at [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca) or at, 519-253-3000 ext. 4058

If you have any questions or comments about this study, please feel free to contact Mr. Tyler Geikie, at [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca), my supervisor, Dr. Krista Chandler, at [chandler@uwindsor.ca](mailto:chandler@uwindsor.ca), or the Research Ethics Board at [ethics@uwindsor.ca](mailto:ethics@uwindsor.ca), or 519-253-3000 ext. 3948

**Please click the 'Discard' button to exit the study.**

## APPENDIX K



## Recruitment E-mail to Coaches/Organizations

To Whom It May Concern:

My name is Tyler Geikie and I am a master's student (Sport & Exercise Psychology; Department of Kinesiology) at the University of Windsor, Ontario, Canada, and I am working under the supervision of Dr. Krista Chandler (Ph.D, Faculty of Human Kinetics). We will be conducting an online survey in the early months of **2016** that will examine the relationship between imagery use and mental toughness in youth competitive athletes (**ages 11-14**).

Athletes will be asked to complete a brief questionnaire assessing their imagery use as well as questions related to mental toughness in sport. The online questionnaire will take approximately 10-15 minutes to complete. Athletes can complete the questionnaire on their own time in a private setting (e.g., at home in their room). To show appreciation for participation, athletes will have the opportunity to enter a draw to win 1 of 10 \$25 Visa gift-cards. Clearance for this project has been received from the University of Windsor's Research Ethics Board.

If your organization is interested in allowing us to access your athletes, or know of any other teams/organizations that might be interested (ages 11-14), please contact myself (Tyler Geikie) by email at [geikie@uwindsor.ca](mailto:geikie@uwindsor.ca), or by phone at (1)-519-253-3000 ext. 4058, **for further information, or any questions you may have**. Alternatively, you can contact Dr. Chandler – [chandler@uwindsor.ca](mailto:chandler@uwindsor.ca), (1)-519-253-3000 ext. 2446.

Thank-you for your consideration.  
Sincerely,  
Tyler Geikie & Dr. Krista Chandler

## APPENDIX L



Coach/Organizational Email to Send to Parents Once Permission has Been Granted

**Dear parent,**

My name is Tyler Geikie and I am a master's student at the University of Windsor, Ontario, Canada, and I am working under the supervision of Dr. Krista Chandler (Ph.D, Faculty of Human Kinetics). You are receiving this email today from your child's team/coach, on the behalf of Dr. Chandler and myself. I am conducting a project that will examine the relationship between imagery use and mental toughness in a competitive youth athlete population (ages 11-14). Your child's coach/organization has agreed to allow me to contact you today. Please follow the supplied URL wherein you will read through the Letter of Information and Parental Consent forms. After doing so you will be asked whether you wish to provide consent for your child to participate.

**The current study has received clearance from the University of Windsor's Research Ethics Board.**

URL for information on the study and the parental consent form:

<http://uwindsor.fluidsurveys.com/s/imagery%2Bmentaltoughness%2Bparentinformation4consent/>

**Thank you for your time and consideration.**

**Sincerely,**

**Tyler Geikie & Dr. Krista Chandler**

## VITA AUCTORIS

NAME: Tyler Geikie

PLACE OF BIRTH: Charlottetown, Prince Edward Island, Canada

YEAR OF BIRTH: 1992

EDUCATION: St. Joseph–Scollard Hall Catholic Secondary  
School, North Bay, ON, 2010

University of Windsor, B.A (Hons)  
Psychology, Windsor, ON, 2014

University of Windsor, M.H.K., Windsor, ON,  
2016