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Construal Levels in the Context of Sport Imagery and Performance

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Abstract

The purpose of this dissertation was to investigate what role abstract and concrete construal levels play in sport imagery and how they impact sport performance outcomes. Another major purpose was to provide an introduction to a new mixed methods data analysis approach and to apply the developed methodology in the context of a qualitative study investigating construal levels in sport imagery. Three studies were conducted with these purposes in mind.

The first study describes a mixed methods analysis of spontaneous sport imagery. 12 elite athletes participated in semi-structured interviews about their experiences with imagery before and during competitive events. Thematic analysis was employed in the qualitative part of the study, and quantitization of co-occurring codes was employed in the quantitative part of the study. Findings from the two data sets were integrated to provide a conclusive whole. Themes that emerged identified athletes' concrete imagery to focus on strategy generation, error correction, technique, and preparation, and athletes' abstract imagery to focus on desirability, symbolic and verbal representations, and psychological regulation. Statistical analyses revealed that experienced effectiveness of imagery significantly differed for task type (i.e., sport tasks performed in reactive environments versus in static environments) and competition times (i.e., day before competition, during competition).

The second and third studies were conducted based on findings from the first study. 30 participants (16 from table tennis and 14 from a track team, i.e., throwers and long jumpers) participated in the second study, a between-within experimental design, executing their tasks after a baseline condition and two construal level conditions which included verbal distance framings to induce low and high construal levels. 32 participants (16 from badminton and 16 from soccer teams) participated in the third study, also a between-within experimental design, executing soccer penalty shots and badminton rallies, with the verbal framing consisting of feasibility/desirability frames. Participants in the latter study also provided imagery recall information that was analyzed for content. Results from both studies supported the hypotheses that construal levels interact with task types to impact performance outcomes, such that table tennis and badminton players (performing their tasks in reactive environments) performed better in the low construal conditions than the high construal conditions, while throwers, jumpers and soccer penalty kickers (performing their tasks in static environments) performed better in the high construal conditions compared to the low construal conditions. Analysis of the imagery reports indicated that construal level frames impacted the content of athletes' imagery (in terms of linguistic make-up as well as distance and detail provided); however, imagery did not act as a mediator as no evidence was found that it subsequently impacted performance outcomes.

Keywords

construal level theory, sport imagery, mixed methods, reactive and static sports, abstraction and concreteness

Co-Authorship Statement

The work presented in this dissertation is original and is primarily the work of the first author. Dr. Craig Hall and Roberto Ulloa served as co-authors in at least one of the papers presented in this dissertation. I would like to thank Dr. Craig Hall, professor at The University of Western Ontario; he contributed his guidance, knowledge and support to all documents related to my thesis. I also would like to thank Roberto Ulloa, Ph.D. student at The University of Western Ontario, for his contributions to the first study in the present thesis. He contributed a second voice for development and data analysis, much critical commentary on all drafts, and his programming skills, which made the development of the new methodology for quantitative analysis of qualitative data possible.

Dedication

From the girl who listens, to the little prince

Because of the color of the wheat fields.

Acknowledgments

A number of people have contributed physically, cognitively and emotionally to the research presented in this dissertation.

I thank my supervisor, Dr. Craig Hall, for facilitating the entire research process behind my thesis by providing life experience, scientific input and good humor, all in great quantities that very few people can claim to possess. But more, I thank Craig for allowing me to grow as a researcher in the particular way that benefits me the most: by supporting my quest for exploration and autonomy and for assisting me unconditionally and without hesitation in all my plans, applications and ideas.

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INTRODUCTION

The here presented thesis follows the integrated article format. I would like to note to readers that, due to the chosen format, redundancies exist in the document, in particular the theoretical background segments of all sections.

The thesis consists of four separate sections: Section 1: Theoretical background; Section 2: Manuscript 1; Section 3: Manuscript 2; Section 4: Summary & Conclusions.

Section 1 of the present thesis gives an overview over the main theories and ideas that informed the research. I outline a brief history of abstraction research and in-depth introduce construal level theory with accompanying literature; then I outline mental imagery research in the context of sport psychology and provide thoughts on how to integrate construal levels into the sport psychological literature as a possible performance intervention mechanism directing spontaneous imagery. I end the section with a purpose statement, where I also give a brief introduction into the development of a methodology for mixed methods analysis, which is another major contribution of the present thesis.

Section 2 and section 3 consist of manuscripts submitted for publication. I present three studies as part of the thesis requirement. Section 2 comprises a manuscript titled "Do athletes imagine being the best, or crossing the finish line first? A mixed methods analysis of construal levels in elite athletes' spontaneous imagery". In it, I present results from conducted semi-structured interviews with 12 elite athletes, illustrating how construal levels are reflected in athletes' recalled spontaneous mental imagery close to and in competition. Additionally, I provide a first application of a methodology I developed for analyzing qualitative data quantitatively and propose a statistical analysis of frequencies of codes across participant groups. Finally, I integrate qualitative and quantitative results to demonstrate how task types and time points before and in competition play a role in athletes' use of their mental imagery.

Section 3 consists of a manuscript titled "Do construal levels affect athletes' imagery and performance outcomes? It depends on the task!". In it, I argue how previous findings from construal level theory can inform the development of a new sport psychological intervention based on abstraction levels, how abstract and concrete construals vary in their impact, and how they interact with different task demands, in particular sport tasks performed in static and reactive environments. I also hypothesize that mental imagery might play the role of a mediator in this regard. I present results from two experimental studies conducted with athletes in simulated competitive environments. Results from these studies provide first support for the hypothesis that construal levels interact with task types to positively impact performance outcomes, while my data do not support the idea of imagery as a mediator.

Finally, the last section of this thesis provides a summary and discussion of the conducted research. I summarize findings from all three studies, and discuss future directions for further studies, which are needed to validate both the proposed methodology as well as the findings of the experimental studies. I also discuss practical implications of the present research. I end with a conclusion, giving a brief overview over contributions of the entire thesis.

THEORETICAL BACKGROUND

Levels of Abstraction in Mental Imagery

The various levels of abstraction with which individuals process their environment have been a topic of discussion among researchers since the earliest studies on mental representations. Locke (1690) first noted a distinction between specific sensory images reflected in our minds, and “ideas of reflection”, which Priestley (1790) then discussed in terms of abstraction. Galton (1883) collected data on mental imagery, concluding that some people experience more symbolic, abstract imagery while others perceive more concrete mental pictures, and though the validity of his particular findings has been challenged (Brewer & Schommer-Aikins, 2006), the general notion persists (Faw, 2009; Isaac & Marks, 1994).

Visual mental imagery has been defined as a quasi-perceptual experience (Hume, 1738), and later as a simulation of perception (Currie, 1995; Hesslow, 2002) or the underlying representation of experience, sidestepping the controversial question of the actual pictorial nature of such representations (Kosslyn, Thompson, & Ganis, 2006). Furthermore, mental imagery can either be thought of as a reconstruction of past experiences (Paivio, 2013), or as an anticipation of future experiences (Addis, Wong, & Schacter, 2007). Current scientific theory on mental imagery considers visual imagery and perception to be of a similar nature in terms of information processing, but lying at opposing ends of the continuum where imagery can be, for example, consciously manipulated and perception cannot (Savage, 1975; Thomas, 2014).

Abstraction and concreteness in mental representations have been considered in the recent literature from two perspectives. The verbal-pictorial dimension was differentiated by Paivio (2013), who argued that mental images can differ in their concreteness and abstraction, where image retrieval is easiest at the concrete end of the spectrum (e.g., *a tennis ball*), at which images can be represented in terms of both pictorial and verbal information (such as a picture of a tennis ball versus the symbolic representation via the word *tennis ball*), whereas highly abstract concepts (such as *victory*) are mostly stored verbally or symbolically. While ease of retrieval was found to increase for pictorial content only when content was presented in relational relationships (Marschark & Hunt, 1989), other evidence has fortified the association of highly concrete concepts with more pictorial information and highly abstract concepts with more verbal information (Amit, Algom, & Trope, 2009; Wang, Conder, Blitzer, & Shinkareva, 2010).

Two other dimensions, generality-specificity and superordination-subordination, are highly related and were proposed based on categorization theory and the cognitive representations of concepts (Medin & Smith, 1984). Theories of categorization suggest that there are lower ordered, subordinate categories and higher ordered, superordinate categories (hierarchical in nature) and that they can be differentiated in terms of their generality and specificity (Rosch, 1975). For example, one can think of *tennis ball* as a lower order category, which is very specific, while *ball* is a higher order, more general, category. A ball belongs to the higher order category of *sport equipment*, which is even more general. The level of abstraction increases the more superordinate the category.

Furthermore, just like objects, actions can be mentally construed in different ways. In 1989, Vallacher and Wegner proposed that actions can be considered in terms of low levels of personal agency (actions in terms of details and mechanics) and high levels of personal agency (actions in terms of consequences) in order to hierarchically proceed from concrete to abstract levels. For example, *making a goal* can be construed at a lower level and subordinate action (e.g., *kicking a ball into the net*), which focuses on the feasibility, the *how* of the behavior. Or it can be construed at a higher level and superordinate action (e.g., *winning the match*), focusing on the desirability, the *why* of the behavior.

Construal level theory (CLT; Trope & Liberman, 2010) integrates the above-mentioned concepts. According to CLT, objects, events and actions are continuously construed by individuals at concrete and abstract levels, and we process information dependent on whether we are in a concrete and abstract state of mind (Liberman & Förster, 2009). Representations at low levels of abstraction contain concrete details about context, actions and objects, while high levels of abstraction imply more about meaning and valence. Thus, CLT also adds the concept of centrality, in which higher levels of abstraction and superordination relate to the impact or meaning of the concept, such that removing a phone's capacity to make calls (high level) impacts the meaning of the concept *phone* more than changing its shape or color (low level).

An individual's construal level is susceptible to external influence and can lead to processing of events in different ways (Liberman, Sagristano, & Trope, 2002). For example, a person might be inclined to process *tennis ball* abstractly (as a means of playing tennis), but when they are instructed to think closely about the details of the ball, they might start imaging the color and ridges and texture, and no longer focus on the bigger-picture, central, abstract concept of ball as *sports equipment*.

CLT states that our construal level is linked with the psychological distance at which we experience events. Dimensions can be based on space (near-far), time (now-past/future), social distance (me-others) and hypotheticality (likely-unlikely), as outlined by Trope and Liberman (2010) in their review of construal level theory literature. A common example is the planning fallacy (Liberman & Trope, 1998). Individuals tend to misjudge events because they do not consider details in the far future as they would do in the present. For example, a student might underestimate how many hours it will take to complete a thesis at the beginning of their doctoral studies; they can estimate this much better when only two months are left until the deadline.

Finally, more abstract mental images are considered more schematic and prototypical than concrete ones; concrete images in turn offer more details and specifics about the context of a representation, though abstract representations are not considered any lesser in clarity or vaguer than concrete ones (James, 1890; Smith, 1998).

The mechanism of CLT are not well-understood. It has been hypothesized that abstract construal levels are a product of mental behavior we exhibit when we lack information, which is then overlearned. Since there is a tendency to have less information about distant places, events, persons or objects (i.e., we typically know less about them), we have to represent them more schematically and abstractly in our minds, or extrapolate construals from proximal sources. We overlearn this process of abstracting and then exhibit it even when distance does not in actuality imply less information (Förster, 2009; Liberman, Trope, & Stephan, 2007).

In terms of applicability, the level of abstraction and concreteness of mental representations provides different benefits (or detriments) when responding to different task demands; cognitive psychologists have investigated large numbers of tasks for which outcomes differ when individuals process them in either an abstract or concrete mindset. Construal levels have been used to explain stereotyping behavior (McCrea, Wieber, & Myers, 2012), have been found to influence moral decision-making (Gong & Medin, 2012) and risk-taking behaviors based on affective or cognitive attitudes (Carrera, Caballero, Muñoz, González-Iraizoz, & Fernández, 2014; Steinhart, Carmon, & Trope, 2013), and they have been shown to impact interpersonal behavior, such as levels of politeness people exhibit (Stephan, Liberman, & Trope, 2010), negotiation outcomes (Wening, Keith, & Abele, 2015) and persuasion success (Katz & Byrne, 2013).

Examples for changes following induced high construal level (abstraction) include children exhibiting more creative behavior (Liberman, Polack, Hameiri, & Blumenfeld, 2012), facilitated spontaneous trait inferences (Rim, Uleman, & Trope, 2009), increased reliance on representativeness heuristics (Braga, Ferreira, & Sherman, 2015), and a focus on global visual processing (Liberman & Förster, 2009). In turn, examples for effects following an induced low construal level (concreteness) mindset include participants taking more risks in loss-situations than in win-situations (Raue, Streicher, Lermer, & Frey, 2015), increased reliance on availability heuristics (Braga et al., 2015), and a focus on local visual processing (Liberman & Förster, 2009)

CLT has also been shown to impact factors that are highly related with performance outcomes, such as self-regulation (Schmeichel, Vohs, & Duke, 2011), self-control (Fujita & Carnevale, 2012; Fujita, Trope, Liberman, & Levin-Sagi, 2006), perception processing

(Förster, Liberman, & Shapira, 2009), decision-making (Fajfar, Campitelli, & Labollita, 2012; Trope & Liberman, 2000), prediction of task duration (Kanten, 2011) and motivation (Davis, Kelley, Kim, Tang, & Hicks, 2015; Vasquez & Buehler, 2007). One study of interest showed that by inducing a high level construal with distance, the perception of difficulty of a task was reduced (Thomas & Tsai, 2012). Another study that measured performance outcomes directly found that levels of construal of a feedback situation impacted participants' performance in a verbal aptitude task (Fajfar et al., 2012). Finally, in one study, researchers employed handgrip, go/no-go task and tracking tasks to establish that why-mindsets (inducing a high level construal) reinforced goal striving when guided by goal intentions, while how-mindsets (inducing a low level construal) reinforced goal striving when guided by implementation intentions, positively affecting performance outcomes in both cases (Wieber, Sezer, & Gollwitzer, 2014).

Mental Imagery in Sport

The suggestion that mental imagery can be understood as a simulation of perception, while not necessarily an advance for understanding the basic functional processes underlying mental imagery, is useful for application purposes (Currie, 1995; Hesslow, 2002). It allows us to better understand how mental imagery works in tandem with sensory, motor and cognitive functions. In particular, for the purposes of use in sport, functional equivalence hypotheses favor the idea that motor imagery is essentially "off-line motor action" (Currie & Ravenscroft, 1997).

Sport psychologists have made use of this idea by proposing theoretical frameworks that integrate the content, function and characteristics of imagery use by athletes (Fournier, Deremaux, & Bernier, 2008; Guillot & Collet, 2008; Holmes &

Collins, 2001; Munroe, Giacobbi Jr, Hall, & Weinberg, 2000; Paivio, 1985) and by implementing imagery interventions for a variety of purposes such as skill rehearsal, psychological state management, problem-solving and injury rehabilitation, most of them with the ultimate goal to improve performance outcomes. Meta-analyses and literature reviews generally find in favor of imagery interventions, though closer differentiations of imagery in terms of task demand (such as motor versus cognitive skill, open-skill/reactive versus closed-skill/static), retention interval (delay between imagery practice and performance), experience (novices versus experts), duration of imagery practice sessions, and imagery perspective (internal versus external) show more variable evidence (for an overview of differences, summaries and effect sizes, see Driskell, Copper, & Moran, 1994; Feltz & Landers, 1983; Hinshaw, 1991; Martin, Moritz, & Hall, 1999; Weinberg, 2008).

Longer retention intervals and longer practice sessions seem to be negatively associated with successful imagery interventions, and in particular, imagery seems to be more helpful in tasks with higher cognitive demands (Driskell et al., 1994). In terms of open versus closed tasks or reactive versus static environments, results are also contradictory. It has been suggested that success of the intervention might depend on task interacting with the perspective of imagery that an athlete uses, and some studies propose it might interact with the expertise of the athlete; in turn, both perspective and expertise of athletes also do not yield any conclusive explanations for performance gains one way or the other (Arvinen-Barrow, Weigand, Thomas, Hemmings, & Walley, 2007; Coelho, De Campos, Da Silva, Okazaki, & Keller, 2007; Highlen & Bennett, 1983; Spittle & Morris, 2007).

Two areas of imagery research that are relevant in the present thesis have been barely investigated in the sport psychology literature. One is the distinction between *rehearsed imagery* (usually long-term practice for a particular purpose), and *spontaneous imagery*, an idea early investigated by Betts (1909) and further developed in particular in clinical and cognitive psychology (Berna, Tracey, & Holmes, 2012; Kosslyn, Segar, Pani, & Hillger, 1990). Many sport imagery interventions focus on mental rehearsal and extensive imagery practice, employing for example imagery scripts (Williams, Cooley, Newell, Weibull, & Cumming, 2013). While this certainly is in line with the idea of functional equivalence between motor imagery and motor execution, there might be instances where long-term preparations with athletes are not feasible (for example, when there is little time left until the competition), or there might be instances where athletes might benefit from on-the-spot interventions that direct their spontaneous mental imagery, which might be debilitative in its own right (Murphy, Nordin, & Cumming, 2008; Wallsbeck, 2010). When spontaneous imagery is investigated in the sport literature, it is typically done within qualitative investigations, and often incidentally, possibly due to the nature of spontaneous imagery, as it cannot be measured or reported simultaneously to its occurrence and by definition cannot be induced (Driediger, Hall, & Callow, 2006; Hanton, Mellalieu, & Hall, 2004; MacIntyre & Moran, 2007; Murphy et al., 2008).

In comparison, short-term framing and brief behavioral interventions attempting to direct spontaneous cognitions are common throughout experimental psychology (Capone & Wood, 2009; Chiou, Wu, & Chang, 2013; Thaler & Sunstein, 2009; Wiebenga & Fennis, 2014), ranging from probability framings (O’Connor, 1989), social norm framings (Wood, Brown, & Maltby, 2012), goal-specificity (Karlan, McConnell, Mullainathan, & Zinman, 2016) and moral persuasion messages (Fellner, Sausgruber, & Traxler, 2013; Torgler, 2004) to some framing interventions that have previously shown positive results in sport, such as the use of priming (Bargh, Chen, & Burrows, 1996; Doyen, Klein, Pichon, & Cleeremans, 2012; applied to sport by Ashford & Jackson, 2010) or regulatory fit frames (Higgins, 2000, applied to sport by Plessner, Unkelbach, Memmert, Baltes, & Kolb, 2009).

The other distinction that has not previously been made in sport is inspired by construal level theory; athletes' use of abstract and concrete imagery has not been investigated; neither how abstraction and concreteness is represented in athletes' imagery nor what function it might serve has been examined. The subsequent line of questioning regarding how abstract and concrete construals might affect sport performance emerges from these considerations and serves as justification for this thesis.

Purpose Statement

As construal level theory is generally investigated in the manner of manipulating momentary cognition, the present thesis merges the two above-mentioned areas of study, that is, directing spontaneous mental imagery in sport and its levels of abstraction. Thus, a first focus, and the topic of Manuscript 1, was the investigation of high and low construal levels in spontaneous sport imagery. The purpose of Manuscript 2 was to experimentally study construal level effects on imagery and sport task outcomes.

An additional purpose of the present thesis (and in large part the topic that Manuscript 1 is devoted to) was the development of a methodology that enables statistical analyses of qualitative data. While several mixed methods researchers have previously suggested approaches to carry out mixed methods analyses, in particular referring to computerized data analysis (Bazeley, 2010; Huber & Garcia, 1991; Kelle, 2004), to our knowledge, no comprehensive and integrative attempt has been proposed that provides both the programming tools and analysis scripts, while also applying the suggested methodology, presenting a unified procedure.

We integrated the idea of co-occurring codes (i.e., overlaps that exist between codes of participants' statements in qualitative transcripts) as previously suggested by Bazeley (2010) and Contreras (2011), with a trend in mixed methods studies towards quantization (i.e., accounting for the frequencies with which categories are mentioned in participants' accounts, see Bazeley, 2010; Sandelowski, Voils, & Knafl, 2009; Tashakkori & Teddlie, 1998; Teddlie & Tashakkori, 2009), and statistically analyzed the data set resulting from the application of our methodology using analyses of variance supplemented by permutation tests (Collingridge, 2013). Manuscript 1 expands upon this procedure by providing the introduction to, and an application of our developed methodology.

Manuscript 1 was submitted to a methodology journal, thus the overall framework of it is dedicated to showcasing the methodology we developed. In terms of content, the manuscript is subdivided into two main sections. The first, qualitative section explores thematic categories underlying athletic abstract and concrete imagery, as reported by 12 elite athletes in semi-structured interviews. The second, quantitative section serves to investigate differences in athletes' subjective, perceived effectiveness of their described abstract and concrete imagery, based on one particular task demand inherent in their sport types (i.e., reactive or static task environment). This was done by analyzing the frequencies of the coded text units statistically between groups, blocked by participant.

Manuscript 2 is also subdivided into two main sections. It covers two experimental studies that were conducted following the findings from Manuscript 1. Results from Manuscript 1 suggested that reactivity of task environment plays an important role in the effectiveness of abstract and concrete imagery that athletes use in competition. Thus, construal level effects were studied across five tasks (table tennis, throws, jumps, badminton and soccer penalty kicks) in staged competitions. Performance outcomes and imagery recall were measured following commonly used construal level verbal framing interventions, with the hypothesis that abstract and concrete construal levels would interact with task demand, and impact imagery, which would in turn explain changes in performance outcomes.

Discussions of Manuscripts 1 and 2 and the general discussion of the thesis center on the utility of the developed methodology on one hand, the practicality and impact of construal level interventions in sport, and their future applicability.

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MANUSCRIPT 1: Do athletes imagine being the best, or crossing the finish line first? A mixed methods analysis of construal levels in elite athletes' spontaneous imagery[1]

Mixed methods research is often defined as the blending of qualitative and quantitative data sets (Johnson, Onwuegbuzie, & Turner, 2007). Beyond this, it is also possible to conduct a mixed methods analysis. Here, transformation procedures are applied to only one type of data. One such procedure, numerical transformation (i.e., transforming collected qualitative data into a quantitative dataset) has often been employed for purposes of result verification or pattern recognition and to complement and enhance qualitative findings (Sandelowski, 2001), for example in inherently mixed approaches (Bazeley, 2012; Tashakkori & Teddlie, 2010; Teddlie & Tashakkori, 2009). Mixed methods analysis will be the focus of the present research.

Furthermore, in order to facilitate qualitative data analysis, various coding methods have been proposed in the mixed data integration and computer assisted content analysis literature. Among them is a coding method in which multiple unique codes are overlapped when applied to the same piece of text, termed *co-occurring codes* (Bazeley, 2010; Contreras, 2011; Huber & Garcia, 1991; Kelle, 2004).

Both, numerical transformation methods and co-occurring code application are scarce in empirical research (Collingridge, 2013; Fakis, Hilliam, Stoneley, & Townend,

[1] A version of this manuscript has been accepted at the Journal of Mixed Methods Research and will be available online once published.

2014; Kelle, 2004). Consulting a recent review (Fakis et al., 2014), and various search engines, we identified few applications of co-occurring coding - for two examples, see Dillworth et al. (2015) and Tyler et al. (2014) -, and none that applied further quantitative analyses to the found co-occurring codes. The closest example to our study methodology is the description of data handling reported by Bazeley (2010). It is a brief overview on how co-occurring codes can be applied in text and then exported to be used with statistical software, but does not provide an in-depth application of this process.

In the present study, we apply our proposed data transformation method to explore how athletes from different sports use concrete and abstract spontaneous imagery (i.e., passive or associative mental representations, Kosslyn, Segar, Pani, & Hillger, 1990). The proposed methodology allows us to analyze how codes interact across different participant groups (i.e. athletes from different sports), and is therefore grounded in code-based analysis as suggested by Kelle (2004), in which a qualitative data set is broken down into quantitatively analyzable data based on the used coding strategy. It facilitates the application of statistical methods such as permutation testing to quantitized data (Collingridge, 2013; LaFleur & Greevy, 2009), and makes their use more intuitively applicable to interested mixed methods researchers.

We have chosen to develop a mixed methods analysis as it allows us to expand on findings that are purely derived from our conducted and thematically analyzed qualitative interviews with elite athletes, where we explore the different levels of abstraction and concreteness they experience. We use our method of numerical analysis of co-occurring codes to gain statistical information about the athletes' perceived effectiveness of abstract and concrete imagery between different types of sports and at different points in time. In this vein, we follow Ercikan and Roth (2006) and integrate qualitative and quantitative methodology to answer important *what*, *why* and *how* questions within the same study. The qualitative analysis provides answers to the questions *how* levels of abstraction appear in imagery and *why*, i.e. their functionality. The quantitative analysis adds information on the *what*, i.e. which abstractions levels are used in what way and when, but also allows for clarification through mixed methods integration, to find *why* some athletes of different sports prefer abstract or concrete imagery.

Construal Level Theory - Concrete and Abstract Mental Representations

We examine the content and function of spontaneous imagery through the lens of construal level theory (Liberman & Trope, 1998). Construal level theory (CLT; for a review, see Trope & Liberman, 2010) is a social psychological framework that illustrates how and why individuals relate levels of abstraction and distance in their minds. The majority of the research in construal level theory is concerned with the way we process information depending on our concrete or abstract state of mind. It is founded upon categorization theories such as Rosch (1975), which postulate that we create lower ordered, subordinate, and higher ordered, superordinate categories for information (e.g., objects and actions). For objects, a volleyball is a lower order category compared to a ball, and a ball is more generally sports equipment. For actions, shooting a goal can be construed at a lower level as *kicking the ball into the net*, which focuses on the *how* of the behavior, or it could be construed at a higher level, such as *winning the match*, focusing on the *why* of the behavior (Vallacher & Wegner, 1989). Lower levels of abstractness contain more concrete details about peripheral context, while higher levels imply more about desirability and valence, often in a central, symbolic way.

CLT proposes further that a person's construal level is susceptible to external influence, in particular through manipulation of distance. Individuals will change the way they process an event or object when the relative spatial or temporal distance is changed (e.g., Liberman & Förster, 2009). Different construal levels have impacted various cognitive and behavioral outcomes. Manipulated with brief framing interventions, they affect visual processing (e.g., the perception of distance; Bar-Anan, Trope, Liberman, & Algom, 2007), local and global processing (Liberman & Förster, 2009), and many other psychological processes such as decision-making (Armor & Sackett, 2006), confidence (Nussbaum, Trope, & Liberman, 2003), self-control and self-regulation (Fujita, Trope, Liberman, & Levin-Sagi, 2006). Spontaneously inducing a more abstract construal has been shown to have a positive effect on motivation (Vasquez & Buehler, 2007; Wieber, Sezer, & Gollwitzer, 2014), and performance in a hand-grip task (Wieber et al., 2014).

The Use of Abstract and Concrete Spontaneous Imagery in Sports

Few interventions in sport have directly targeted spontaneous mental construals by changing individual processing styles, for example with priming (Ashford & Jackson, 2010), by inducing a regulatory fit (Plessner, Unkelbach, Memmert, Baltes, & Kolb, 2009) or to combat destructive spontaneous imagery (Wallsbeck, 2010). Considering the widespread use of imagery in sport contexts, and the before mentioned effects of CLT on cognition, motivation and emotion, the benefit of analyzing levels of construal in spontaneous imagery of athletes (Cummings & Hall, 2002; Kosslyn et al., 1990) could be realized.

We propose a new factor for the existing theoretical foundations of imagery (Bernier & Fournier, 2010; Fournier, Deremaux, & Bernier, 2008; Paivio, 1985). While mental imagery interventions have been concerned with concrete representation of various actions and events (Weinberg, 2008), rarely, the high level, abstract construal has been implicitly (Bernier & Fournier, 2010; Paivio, 1985) or more explicitly (Betts, 1909) mentioned in imagery research. When we look at Paivio's (1985) proposed framework, the motivational general function includes the addition of arousal, affect and mastery, which can be abstract concepts, such as *I can imagine feeling angry* or *Imagine yourself as more confident* (Martin, Moritz, & Hall, 1999; Nordin & Cumming, 2008), and in Fournier et al. (2008), we also find that a part of imagery of golfers can be to see a symbolic line in the sky. Paivio (1985) explains that sometimes, the meaning of images is revealed in a symbolic form, and that the motivational function of imagery can lie "in its capacity to represent […] behavioral situations symbolically or vicariously" (p. 23).

The Use of Imagery in Reactive and Non-Reactive Sports

In addition to exploring construal levels of spontaneous imagery, we investigate whether imagery use differs between athletes who participate in different types of sports. Many sports tasks require different ways of visual processing (e.g., Abernethy, 1991; Wood & Wilson, 2010) and self-regulation (e.g., Chen & Singer, 1992), and we tend to be continually influenced by contextual and situational demands, which affect psychological factors like confidence, affect, self-control and motivation (for an overview, see Ross, Nisbett, & Gladwell, 2011). It is therefore possible that an interaction of task demand and imagery content could be affecting performance outcomes. Paivio (1985) argues that there are different processes at play for tasks that occur in a static versus reactive environments.

Static and reactive here refer to the changeability of the environment in which athletes perform. They follow the logic of the open/closed skill definition (Coelho, De Campos, Da Silva, Okazaki, & Keller, 2007; Yazdy-Ugav, 1988); a reactive environment requires participants to react to changes (open skill), such as opponents or balls, while a static environment is relatively constant and the activity is mostly self-paced, often requiring the execution of only one type of skill (closed skill).

There have been contradictory findings for imagery used by athletes performing in reactive versus static environments. It is unclear whether athletes in both types of sports benefit from imagery (Coelho et al., 2007), and if yes, in what way they benefit from the use of motivational or cognitive, external or internal imagery (Hall, Mack, Paivio, & Hausenblas, 1998; Spittle & Morris, 2007; Watt, Spittle, Jaakkola, & Morris, 2008).

Methodology

We used a phenomenological design and applied thematic analysis in the present study to explore whether athletes differentiate between concrete and abstract imagery. This research was carried out in a university setting and during athletes' competitive seasons. We then quantitatively investigated whether elite athletes reported concrete or abstract imagery to be more helpful before, or during their competitive performances, and whether the task demand would impact the perceived usefulness of imagery construal levels.

Participants Recruitment and Characteristics

Participants qualified for participation if they had at least participated in a national-level competition within their sport within the last five years. After Research Ethics Board approval, various varsity teams at the host university were approached during practice hours, given letters of information, a general overview of the study and encouraged to invite other athletes (i.e., snowball sampling). No further participants were recruited when data saturation was reached (Thomas & Pollio, 2004). Thirteen participants (6 female, 7 male) were recruited in total, with one pilot participant not included in the final data analyses, as interview questions were altered based on her responses (Turner, 2010). On the day of the interview, the letter of information and consent were discussed and signed. Participants were asked to fill out a demographics sheet and then participated in the interview. An audio device was used to record all spoken information, which was later transcribed verbatim by a research assistant and reviewed by the researcher.

Participants ranged from 19 to 29 years (M = 22.69; SD = 3.22) and were of Canadian (N = 7), Chinese (N = 3), Egyptian (N = 1), Indian (N = 1) and German (N = 1) descent. *Table 1* presents a summary of participant information gathered from the demographics questionnaire and their assigned pseudonyms.

The final study participants competed in a variety of sports: track running (N = 3), triple jump (N = 1), discus (N = 1), golf (N = 1), table tennis (N = 4), badminton (N = 1), judo (N = 1) and boxing (N = 1). For the purpose of this paper, we will be grouping these sports using Paivio’s (1984) definition of 'reactive' and 'static'. Hereinafter, for simplicity's sake, track, jump, discus and golf can will be called 'static', whereas table tennis, badminton, judo and boxing will be called 'reactive'.

Table 1 - Pseudonyms and demographic data of participants

Nr.	Name	Sex	Age	Sport	Competition*	Hours**	Years***
pilot	Rose	F	19	table tennis	national	6-8	15
1	Abby	F	22	track	national	10	14
2	Bart	M	27	boxing	national	10	10
3	Steve	M	22	table tennis	national	6-8	10
4	Amy	F	22	track	international	10	13
5	Edward	M	20	track	national	10	6
6	Petra	F	26	judo	international	10	16
7	Ron	M	29	table tennis	national	6-8	12
8	Keith	M	20	table tennis	national	6-8	14
9	Sierra	F	20	discus	national	6-8	6
10	Harry	M	20	triple jump	national	6-8	8
11	Chris	M	26	golf	international	6	15
12	Alana	F	20	badminton	International	8	14

*highest recent competition; **practice hours/week; ***competitive career

Data Analysis

Analysis 1: Qualitative Procedure. Following Patton (2014) and Turner (2010), a general interview guide with predetermined questions was constructed by two of the researchers with previous experience in developing protocols. It allowed for flexibility, while giving the interview structure and direction. The interview development process was supported by an established expert in sport imagery research. We included questions on both the imagery and goal setting applied by participants, but in the present paper only the imagery question subset is relevant and imagery related data items were combined to produce the presented data set (Braun & Clarke, 2006).

The three relevant sections of the interview guide consisted of a) the introduction, in which the researcher learned about the athlete, their competitive career and built rapport, attempting to make participants feel comfortable with being audio-taped; b) the general inquiry in which the researcher learned about the athlete's sport in practice and competition; and c) the time-dimensional imagery use in relation to the distance from their competition (i.e., the day and morning before the competition; at the competition before the sport performance; and at the competition while performing). Example questions for each section can be found in the Appendix, Table A1. In addition to the interview guide, probes were used to remind the participant to stay on topic, and to facilitate additional or more detailed responses (Patton, 2014). Interview duration was on average M = 23min, (SD=5.5). Following the interview, the participants were invited to indicate important missing points, and ask questions about the purpose of the study.

Each audio recorded interview was transcribed into the R package RQDA (Huang, 2014) and analyzed using thematic analysis (Braun & Clarke, 2006). Based on relevant literature on construal level theory (CLT) and previous imagery research, main initial themes (i.e., higher order themes) were first identified and grouped in consultation with colleagues in a deductive manner. The transcribed interviews were read multiple times and patterns identified in relation to the previously identified higher order themes. Variations and consistencies within the data were noted and a first interpretation provided. Codes (short phrases that describe how data segments are meaningful in the theoretical context) were then constructed from the themes and re-checked multiple times against the transcripts. An attempt was made to relate significant patterns, inductively deduced from within data, in a logical manner to previous relevant literature (Patton, 2014).

Each text unit was marked with all the possible codes that applied to it. For example, many text units were coded as the type of imagery used (code:

imagery_concrete), but could also be coded as reported helpful or not (code: effect_helpful). This is consistent with the idea of applying co-occurring codes to qualitative data mentioned in literature on computerized analysis of qualitative data (Bazeley, 2010; Contreras, 2011; Huber & Garcia, 1991; Kelle, 2004).

Two of the researchers analyzed the transcripts after a first coding, discussing the participants' statements, noting patterns and ensuring consistency of codes in relation to the textual content, until consensus was reached. Data was re-coded a second time and checked against the first coding, with further discussion by the two main researchers until consensus was reached. The main focus was high internal homogeneity – ensuring commonalities for all text passages within one code, and high external heterogeneity – distinctive features between codes. For example, text passages coded as abstract could never be coded as concrete imagery and vice versa. Additionally, a research assistant independently coded 10% of the transcripts after a discussion of the existing research on construal level theory and the predetermined thematic structure, in order to ensure high reliability. The overlap of both raters' codes was compared for consistency and re-assessed until inter-rater reliability was judged to be at a very good level (90%). First level codes note the main factors of athletes' imagery use, and second level codes detail exploration of imagery content. A summary of thematic analyses and the categorization tree were sent per email to participants for member checks. Checks were not completed, as none of the athletes responded to the email, however, informal discussions with available athletes did provide validation of content and our proposed categorization tree.

Analysis 2: Quantitative Procedure. We employed numerical data transformation, often termed quantitizing (Sandelowski, Voils, & Knafl, 2009; Tashakkori & Teddlie, 1998, p. 126), to extract numerical data about construal levels, time levels and reported effectiveness of imagery use from the codes created for our qualitative data set, in a code-based analysis suggested by Kelle (2004). Quantitizing qualitative data has been described as a process that adds power, information and a more objective perspective to a researcher's analysis (Bazeley, 2012). In mixed methods research, a representation of the number of times a code appears per interview has been considered a valid methodological approach (Bazeley, 2010; Sandelowski et al., 2009).

Using multiple codes on one text unit (co-occurring codes, as described in analysis 1) allowed us to look at overlap of themes and check the interactions of codes for various competition times and between individual participants and task types. It facilitated a numerical analysis of instances when certain codes coincided (e.g., How many text units show that athletes in reactive sports consider concrete imagery helpful before the competition? How many text units, coded across all participants, support the idea that concrete imagery is helpful?), which we did, taking into consideration the foundational assumptions and compromises inherently present when quantitizing qualitative data (Sandelowski et al., 2009).

Data items, including information on all attributes per code, were taken from the internal RQDA database (a MySQL database, an open-source relational database management system), and Python programming was used to identify combinations of single, pairs or triplets of codes, which were written into tables with the matching specifiers such as participant number and sport type. The statistical software R 3.2.2 (2008) was then used to generate item frequencies for each combination. Tables containing our data sets and related programming which produced these tables can be found at the online file repository GitHub (Ulloa, 2015).

After calculating the frequencies of co-occurring codes, we required blocked analyses of variances in order to explore whether athletes differed in their use of concrete and abstract imagery based on their task demand (i.e., sport type), the time distance to competition, and reported effectiveness. Due to a small sample size often inherent in qualitative research, some have cautioned against using parametric statistical tools on quantitized data, with the suggestion to use permutation testing instead (Collingridge, 2013). Permutation tests are resampling tests, a subset of nonparametric statistics in which a p-value is calculated by checking the original mean difference which is found on the distribution, against a high number of further mean differences that are calculated when resampling. If $p < .05$, this means that there is a less than 5% chance that the original mean difference arose by chance (Good, 2000; Kherad-pajouh & Renaud, 2015).

We applied the ezPerm function from the R package 'ez', which yields significance results for mixed measures variance tests, thus avoiding possible violations of parametric assumptions. As no permutation test exists for our mixed design that would yield a reportable statistic, we report both, the F-statistic and p-value from parametric ANOVAs, and for each result, a p-value in brackets, which reflects the significance reported by permutation tests. Additionally, we report tests of normality and homogeneity of variances in the Appendix, Table A2.

The confidence intervals shown in our results graphs were calculated with the R function ezBoot of the 'ez' package, which applies bootstrapping to create parameter-free predictions. These are, in the case of small samples, preferable to commonly reported error bars. Significances can so be meaningfully extracted from the figures, i.e. confidence intervals that do not overlap have been previously shown to be significant at the .01 alpha level, whereas proportion overlap of 50% of the bar is significant at the .05 level (Cumming & Finch, 2005). Further figures that represent our results but are not included in the results section, can be found in the Appendix, Figures A1-A5.

Results

A total of 579 meaning units relating to imagery were coded throughout the transcripts; of these, 265 related to imagery construal level and were clustered into concrete imagery (135) and abstract imagery (130). Other coding units related to imagery distance (186) and imagery valence (including emotional imagery, 164). We coded these text units as we perceived that they were an important part of the athletes' experience; however, they are not further discussed in the present paper. Additionally, some text units included were participants' descriptions of having experienced no imagery (18). Lower-order themes were assigned with textual support in an inductive manner to the theoretically supported themes. Figure 1 provides a visual representation of the structure of the codes, with numbers in brackets reflecting their frequency in the text.

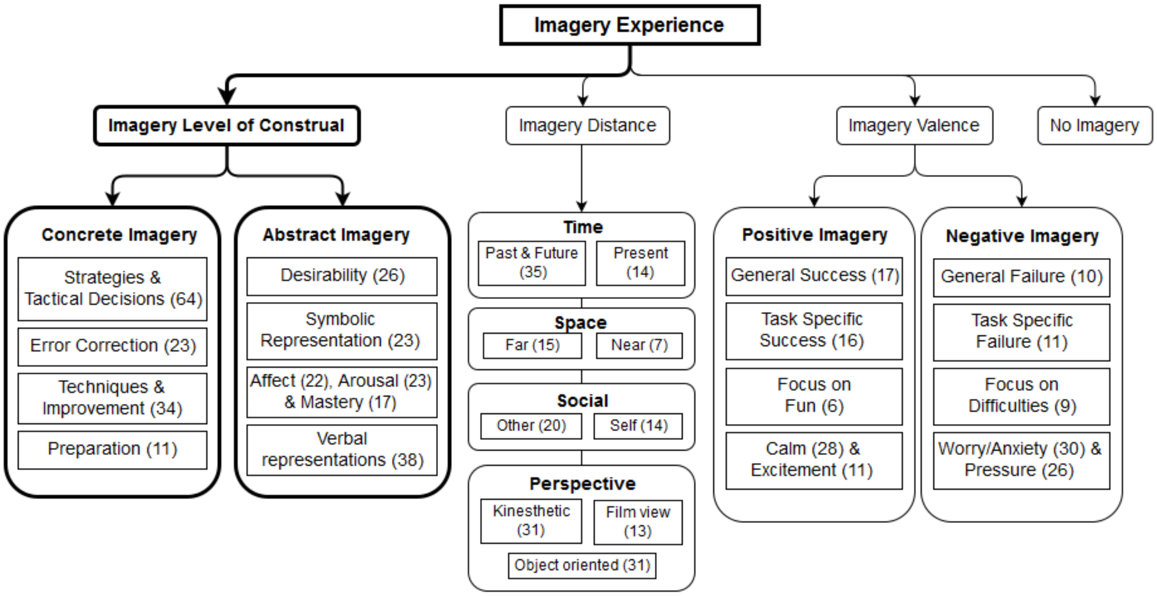

Figure 1 - Classification tree of athletes' imagery experiences. Heavier outlined categories and sub categories are further discussed in the present paper, while lighter outlined categories are not. The number of coded text units in any given category is noted in brackets.

Analysis 1: Qualitative Results

For the qualitative results, we present the two categories found under *Imagery Construal Level*, and some chosen text units that are representative of the coded data, to illustrate how coding was applied to match the deducted higher-order themes, and how lower-order theme commonalities were inductively established.

Concrete imagery.

Strategies and tactical decisions. The most frequently mentioned concrete imagery is related to the mental rehearsal of, or decision-making about strategies and tactics. Keith [table tennis] described using imagery during the table tennis match in the following manner:

"I imagined the game, I imagine myself playing the opponent. [...] I'm trying different strategies and thinking of a way to end the game really quickly, as quickly as possible."

Petra [judo] also described how knowledge of an opponent plays a large part in strategically imagining a fight:

"On the day of the competition, you are told who you're fighting against. Then I tried to imagine a strategy, how I would proceed against that particular opponent. It is easier because I already knew many of them, so I would let the exact strategy of the fight run through my head."

Error correction. Sometimes, during the performance, athletes are correcting previously executed movements, or devising ways to correct strategies to react to their opponents' plays. Alana [badminton] described this as important:

"'I can't play to her low front corner or she's going to run me to the ground' so there's definitely times where you have to be ready to either try something new or change a part of your game."

On the other hand, it can be a negative experience to use corrections during a competition. Chris [golf] explained:

"... the more you can get away from overly analysing technical flaws, especially in competition, because they can become overwhelming psychologically, and can completely debilitate in terms of confidence."

Techniques. Imagery relating to technique and technical skill analysis was frequently mentioned. This type of imagery is often used for skill rehearsal. Sierra [discus] described using imagery the day before the competition while practicing in her mind:

"I think about little things that coaches tell you, keep the disc behind your butt, keep your arm behind you, keep left arm over left thigh."

Preparation. Concrete imagery can be useful when organising one's mind for a competition, or the logistics at a competition. Some athletes describe concretely imagining the surroundings and feel of a competition in practice, but also try to use imagery to prepare. Harry [jump] said:

"In practice, we try to get through the motions, try to do the same thing over and over again. It's all about improving without pressure. I try to imagine the audience and the coach and the line where you're supposed to jump off of."

Abstract imagery.

Desirability. Many athletes described mental representations of desirability that were general and seemed to be a main source of motivation, such as doing one's best, running faster, or having fun. Petra [judo] described that imagining winning against someone she has lost to before could be helpful:

"Particularly against tough opponents, I wanted to win against them. Especially when I'd lost in previous encounters. I would motivate myself by imagining that I would win against them."

Abby [cross-country] explained that using this type of imagery before her run motivated her:

"I try to be about positive motivation. I was thinking, ‘obviously you're at a championship you want to run your best’..."

Similarly, Chris [golf] added:

"You have to get back to the reality of why you're doing what you're doing. Is that's an event and you're doing it and want to because you have fun doing it, right?"

Symbolic representations. Some athletes described experiencing imagery that was symbolic, usually in terms of numerical abstractions like point systems or imaginary lines that an object they’re focussing on can follow. For example, Keith [table tennis] spoke of representing the score in his mind, and how this influences his performance:

"You can't ignore the umpire changing the points, a lot of the time. I can't do it. I try my best, but no matter how I do, the standing still affects me."

Chris [golf] described the symbolic line of the path a golf ball might take through the air; and, following it through into the distance,

"It's not imagining myself swinging or anything like that, or actually hitting the shot, it's just kind of imagining the line that it would take if I did that."

Psychological regulation: affect, arousal and mastery. Various affect types, arousal levels, and imagery of mastery can be present and accompany the performance of a sport. Affect is generally considered part of the functionality of imagery (Paivio, 1985), but often we also symbolically represent affect or arousal in our minds, for example, “I imagine what that would feel like”. Many athletes deferred to affect or arousal descriptions as their first answer when they recounted imagery. Harry [jump] described using arousal imagery in the moments before his jump:

"I think about how it would feel if I failed, if I didn't jump well. Some of my other jumps weren't good, so I think about past failures as well, I think about […] how mad I was after the meet […].”

Keith [table tennis] described how the emotional imagery of arousal has blocked concrete strategical imagery he needs to succeed:

“I feel like I have a lot of power and speed and everything? […] it also made me play so aggressively that I missed so many points. I wouldn't have, if I was thinking strategically. […] I think that adrenaline rush is sometimes, like in weight training, very good. But […] I completely lose my mental ability to play.”

During the interviews, it became clear that fear and anxiety consume much of mental imagery space, as Edward [track] described:

“I was really nervous and concerned with my "Oh, if I don't have a good race, it's the end of the world!"

Contrary to this, Amy [track] related that she preferred positive feelings:

“I guess, more focusing on, instead of a numbered goal, focusing on having a good race, or having a positive attitude, imagining how it feels getting through the start line.”

Verbal representations. Despite questions relating to their imagery, athletes often mentioned using internal verbalizations in and around competition. Previous literature suggests that verbalizations are distinct from imagery (Kosslyn, 2005; Paivio, 2009), though researchers are still divided as to the nature of imagery (Kosslyn, Thompson, & Ganis, 2006). In construal level theory, verbal representations are considered the most abstract form of mental representations, at one extreme of the continuum ranging from concrete pictorial to completely conceptual depiction (Amit, Algom, & Trope, 2009). For this reason, we decided to include a mention of verbal representations under the abstract imagery category.

Amy [track] described using self-talk to center herself during her running in competition,

"Sometimes I have a little mantra in my head, "Stay smooth", or "Stay calm" or just, something little to focus on?"

And finally, in order to prepare for the competition, Ron [table tennis] described using self-talk to regulate his emotions, even before arriving to the venue,

"I always prepare myself, especially mentally, before the tournament. So in the morning I would keep telling myself, "Be patient, no matter you're leading or you're losing the game." I tell myself to be patient and calm down, "Don't get mad because of one edge-ball or a lucky ball or something like that,", and "Don't look at the scoreboard." I want to try and play it one point by one point."

Analysis 2: Quantitative Results

Based on theoretical considerations, and exploratory hypotheses generated by analyzing our qualitative data thematically, we explored the relationships between our coded text units and sport type. Codes that we included were construal: *abstract* versus *concrete*, effectiveness: *helpful* versus *unhelpful*, and time point: *before competition* versus *before performance* versus *while performing*. Sport type: *static* versus *reactive* was a demographic factor. Our dependent variable was the frequency of our codes co-occurring, per participant. The frequency indicates, for example, in how many separate instances participants, on average, described use of *concrete* imagery *the day before* their competition (two codes), or how many times *concrete* imagery was *helpful* at the time *during* competitive performance (three codes co-occurring). Examples of coded text units for concrete and abstract imagery were previously provided in the qualitative analysis. We calculated means and standard deviations, and permutated blocked analyses of variance across all participants to test for significant differences.

We examined differences between sport types, and the general effectiveness of imagery. We did not find a significant difference between sport types for imagery effectiveness, $F(1, 10) = .61$, $p = .45$ ($p = .439$); athletes from both static and reactive sports in equal measures spoke of imagery being helpful or unhelpful. However, we did find a main effect for helpfulness of imagery, independent of sport type, $F(1, 10) = 27.38$, $p < .001$ ($p < .001$). Effective and helpful imagery was described by athletes more frequently than was unhelpful, ineffective imagery.

Secondly, we added imagery construal level to the analyses. We found no significant difference in either frequency of abstract and concrete imagery in general, *F*(1, 10) = .06, *p* = .80 (*p* = .820), nor for construal level use when we compared athletes from static and reactive sports, *F*(1, 10) = 4.79, *p* = .053 (*p* = .054). However, when we added the perceived effectiveness of abstract and concrete imagery by sport type to the analysis, we found significant differences, see *Figure 2*.

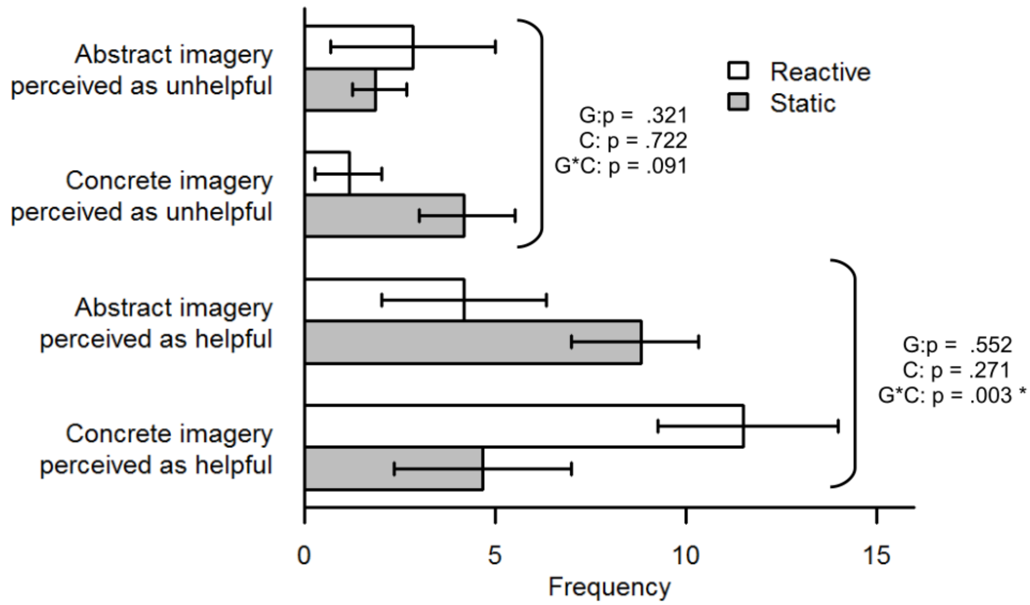

Figure 2 - Abstract and concrete imagery reported as helpful or unhelpful. Frequency is the number of coded text units on average per participant. Lighter bars denote athletes performing in reactive environments, darker bars athletes performing in static environments. Reported permutation p-values refer to main effects for G (Group, i.e. sport type), C (Code, i.e. construal-effectiveness co-occurrences) and the interaction of G*C. Error bars represent bootstrapped 95% confidence intervals.

We found that there was a significant interaction effect for helpfulness and imagery by sport, *F*(3, 30) = 10.03, *p* < .001 (*p* = .004). Abstract imagery was mentioned to be helpful more frequently by athletes from static sports (*M* = 8.83, *SD* = 2.85) than reactive sports (*M* = 4.16, *SD* = 4.4), while concrete imagery was considered effective more often by reactive sports athletes (*M* = 11.5, *SD* = 4.08) than those from static sports (*M* = 4.67, *SD* = 3.90). This interaction was found to be significant *F*(1, 10) = 18.35, *p* = .001 *(p* = .003). While there was no significant difference for unhelpful abstract imagery between the sport types, concrete imagery was considered more frequently unhelpful by athletes from static sports (*M* = 4.33, *SD* = 2.33) than reactive sports (*M* = 1.16, *SD* = 1.47). An interaction between groups and codes on unhelpful imagery was not significant, *F*(1, 10) = 4.11, *p* = .07 *(p* = .09).

Finally, we looked at the perception of imagery construal and effectiveness by time. Analyzing all our factors in combination allowed us to see which components and interactions were dominant in our data set. As in all previous analyses, simply belonging to the group of athletes from the static sports or reactive sports had no significance on the existing frequency of all codes, *F*(1, 10) = .06, *p* = 0.80 *(p* = .870). *Figure 3* illustrates the time points before competition and during performance.

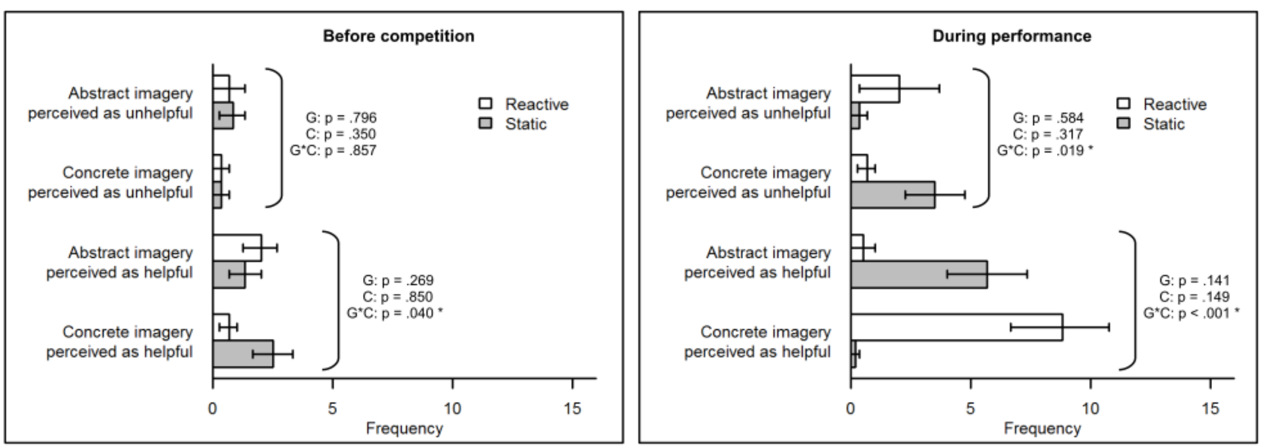

Figure 3 - Abstract and concrete imagery reported as helpful or unhelpful at a time the day/morning before competition (left graph), and during performance in competition (right graph). Frequency is the number of coded text units on average per participant. Lighter bars denote athletes performing in reactive environments, darker bars athletes performing in static environments. Reported permutation p-values refer to main effects for G (Group, i.e. sport type), C (Code, i.e. construal-effectiveness-time co-occurrences) and the interaction of G*C. Error bars represent bootstrapped 95% confidence intervals.

For the time span during performance, we found an interactive effect for our codes and the given sport type, $F(3, 30) = 27.73$, $p < .001$ ($p < .001$). In terms of helpful imagery, athletes from reactive tasks spoke more of concrete than abstract imagery while athletes from static tasks mentioned more frequently abstract imagery being effective than concrete imagery, $F(1, 10) = 56.93$, $p < .001$ ($p < .001$). The opposite pattern was observed for unhelpful imagery. Athletes from reactive sports more often perceived abstract imagery as unhelpful during their performance while athletes from static sports perceived the opposite (i.e., they indicated more frequently that concrete imagery tended to be unhelpful), $F(1, 10) = 6.45$, $p = 0.029$ ($p < .019$),

Interestingly, we found an unexpected inversion of these findings for the time before competition: while there was no difference for helpful abstract imagery use at the time before competition, we did see that athletes from static sports tended to judge their own use of concrete imagery more helpful in this moment ($M = 2.50$, $SD = 1.37$) than athletes from reactive sports ($M = .66$, $SD = .81$), who preferred abstract imagery ($M = 2.0$, $SD = 1.54$). This interaction was significant, $F(1, 10) = 5.82$, $p = .036$ ($p = .040$).

Analysis 3: Integration of Qualitative and Quantitative Data

Integration of qualitative and quantitative results has been argued to be the most integral part of use of mixed methodology, yielding results that are more than the sum of their individual parts (Fetters & Freshwater, 2015), and enhancing parallel or multiple methods research (Fetters, Curry, & Creswell, 2013; O'Cathain, Murphy, & Nicholl, 2007). We found two functions of integration in our study. Firstly, data from our statistical analysis demonstrate and validate exploratory hypotheses derived from first readings of our qualitative data. Athletes from static and reactive sports did, in instances, mention one type of imagery might be more effective or less effective than the other. For example, one athlete from a reactive sport reported that they would optimally generate even more concrete imagery ("*I think that it'd be helpful to use more imagery before I hit that shot*", Alanna, badminton), whereas abstract arousal imagery was perceived as destructive in comparison to static sports (*"I think [...] when you're in a game, for me, it's not good, because I completely lose my mental ability to play"*, Keith, table tennis). Concrete imagery was described as debilitating by some athletes performing in static environments, occasionally in a generalized way *("If you're still thinking about [strategy] when you're actually performing the shot, when you're hitting the shot, that interferes with your natural ability to play"*, Chris, golf). These and other quotes, joined with theoretical considerations from previous sports literature gave us a better idea what to look for when we started exploring the data with our statistical analyses. Generalizations across sports, based purely on text passages from the qualitative data, might not be considered reliable until they are supported with numerical results.

On the other hand, qualitative data can provide additional explanations for unexpected findings from statistical analyses, and therefore provide novel hypotheses that, in the future, can be tested with experimental research. In our data, the statistical analysis drew our attention to an interesting switch for the time before competition, when athletes' experience of effective imagery was reversed from in competition. Athletes from reactive sports more frequently reported abstract imagery being more helpful, whereas athletes from static sports found concrete imagery more frequently helpful. Going back to the qualitative text, coded units informed this finding with novel information: for many athletes that were going to compete in reactive environments, it seemed to make them feel better to focus on relaxing and distractions ("*The night before I can't do much, except try to relax a bit, try to drink a bit of water, so you need to get yourself settled in*", Bart, boxing), as they felt the strategy would be decided by the opponents they would be facing, so it is unpredictable and stressful ("*I'm very tense, because I don't know what to expect. I don't know who I'm playing, I don't know what division I'm going to be*", Bart, boxing). Some athletes competing in static environments preferred instead to imagine some technical details before the competition ("*The night before I can go through it in my mind, check the points in the forest that will be difficult or challenging, and use that to my advantage*", Amy, track), feeling that if they left it until the time of the competition, this might break up their performance, ("*I find if you come [to the competition] too bogged down, and think about what you have to do then, and say, "Oh, I've got to stick with this person," or "I want to get this place or this time", it'll throw you off"* Edward, track).

Discussion

The present research explored the implications of a mixed methods analysis of qualitative data in an investigation of athletes' use of different imagery construal levels in competition. We first conducted thematic analyses on interviews (Braun & Clarke, 2006; Patton, 2014) in order to understand the individual experiences of the athletes and their imagery use, and then progressed with a quantitative analysis of the qualitative codes, in order to extract patterns from the athletes' responses with regards to their use of imagery construal levels related to the dimension of time and their sport type.

While quantitative methodology has, in some previous mixed methods research, been applied to qualitative data, its empirical application is scarce, and when used, numerical counting is predominantly applied (Fakis et al., 2014). In our example, a mixed methods analysis generated a more comprehensive interpretation of our qualitative data and provided a clearer pattern of the use of different levels of construals amongst athletes. The implication of mixed methods analysis for mixed methods research is that combining both qualitative and quantitative analysis of a single data set can yield enhanced understanding of the source qualitative data. We showed that, by integrating the two, we achieved better validation for our findings by applying statistical methods to exploratory hypotheses pre-formed by qualitative analysis. We also generated some new hypotheses for further research by using qualitative data to explain statistical findings that would otherwise be left unexplained.

Transformation of data (here: qualitative to quantitative) can thus serve not just to facilitate merging of qualitative and quantitative data sets, but also to enhance understanding of a single type of data. Authors who have collected both qualitative and quantitative data, and use data transformation for merging, should consider two analyses: one, compare their interpretation of the qualitative data with its corresponding transformed quantitative data, and two, compare this quantitative, transformed data with their collected quantitative data to further validate their findings.

Construal Levels in Athletes' Spontaneous Imagery

Results from our methodologies suggest that a general framework of construal levels can be applied to athletes' spontaneous imagery, as all athletes described using concrete and abstract imagery in and around their competitions. Concrete imagery included representations of strategies and techniques, using imagery to perform mental error corrections, and to prepare for competition. Abstract imagery included a focus on desirability as a form of motivation, symbolic representations, regulation of affect, arousal and mastery, and verbal representations in one's mind. We found that imagery construals differed by experienced effectiveness between athletes when split by the factors of sport type and point in time, suggesting that whether an athlete imagines being the best or crossing the finish line first depends on what time they are imagining it, and what sport they perform. In particular, we found that during competitive performance, athletes performing in reactive environments more often reported concrete imagery to be helpful, while athletes performing in static environments reported more often abstract imagery being helpful.

With respect to the underlying processes responsible for these effects, previous studies of CLT can provide clues as to how construal level might affect performance. On one hand, abstract construals can inhibit speed of processing in situations where the task heavily draws on cognitive resources. It is hypothesized that active focus on implementation intentions impairs automatic action (Wieber et al., 2014). For athletes from static sports who rely more on execution of automatic behaviors, such as a putt in golf or a discus throw, using concrete imagery (which often has a focus on implementation details) would be more debilitative than abstract imagery which focuses on goal intentions, and increases motivation and self-control (Freitas, Gollwitzer, & Trope, 2004). For tasks in which predictions of future events are important, for example in reactive environments, concrete imagery might reduce prediction biases and increase attention to detail (Nussbaum et al., 2003; Wakslak, Trope, Liberman, & Alony, 2006).

Another significant finding from our data suggests that the above mentioned pattern could be reversed for the experience of imagery on the day or morning before the competition; in particular, athletes performing in static environments reported concrete imagery to be more helpful on the day or morning before the competition, while athletes performing in reactive environments seemed to prefer abstract imagery at this time. As mentioned, an integration of qualitative data here suggests this might be the case because reactive environments are unpredictable before a competition begins. A focus on implementation details could be considered a waste of resources which might be better spent on motivational or affective processes, such as controlling one's anxiety. On the other hand, performance in a static environment could benefit from strategizing or additional error correction imagery. This would be in line with above-mentioned mechanisms of construal level theory, as an increased attention to detail at this point would not interrupt automated processes for these athletes and could be used as additional preparation or practice without exerting too much energy.

Content and Functionality of Spontaneous Imagery

Paivio's (1985) imagery framework does not make a clear distinction between content (*what is being imagined?*) and functionality (*what is the purpose of it?*), possibly because in concrete imagery, one informs the other in such a way that they are difficult to separate. More recent frameworks (e.g., Bernier & Fournier, 2010; Fournier et al., 2008) report five functions of directed imagery: strategies/tactics, technical improvement, evaluation, psychological state management, and focus, which are presented on one dimension. While our investigation fits a two-dimensional construal level framework, we find intersections in terms of concrete imagery; athletes reported applying the first three of Bernier and Fournier's (2010) functions (termed strategies, technical details and error corrections in our framework). The lack of preparation imagery in Bernier and Fournier

(2010) might be due to it not being directly related to the performance aspect. In terms of abstract imagery, we find functionality to be more ambiguous: psychological regulation overlaps with psychological state management. Imagery that contains representations of desirability, verbal and symbolic representations cannot be clearly functionally categorized as any of their functions. This could be due to a lack of a motivational component in their framework. This can be more readily found in Paivio's (1985) framework, which mainly distinguishes between cognitive and motivational mental representations. Imagery reported as part of our desirability and verbal representation categories reflect well in Paivio's motivational function of imagery.

Finally, athletes in our study did not go into detail about the purpose of symbolic imagery, which was reported in a more content-focused manner. Symbolic representations have not, to our knowledge, been a topic in sport imagery research before. Future investigations will show whether they are incidental to spontaneous imagery, or whether athletes use them with a particular purpose in mind. They might yield some benefits, such as improve an athletes’ ability to switch attentional focus from near to far, a mechanism that has been studied in the construal level literature in instances when abstract imagery is induced (Liberman & Förster, 2009).

Limitations

Philosophical arguments have been made with regards to the quantitization of qualitative data, in particular with open-ended interviews where the number of responses and their direction is only minimally influenced. Instances might be missing from our data that might exist in experience and vice versa (Sandelowski et al., 2009). We attempted to validate our coding procedure by statistical analyses of all applied codes on our data, to show that our codes were well-balanced for our sample across all participants, i.e. box plot analyses showed no significant outliers in terms of codes applied per participant, or when split by sport type. There were also no significant differences in the frequency of concrete and abstract imagery experiences across all participants, only when split by sport type. This could be seen as first supportive information of this difference being a reflection of the athletes' experiences and not an artifact of quantization.

Secondly, our participant number is acceptable for qualitative interpretation, but low for statistical analyses. While for most of our data, parametric demands of normality and homogeneity of variance were met, we supplied results from permutation testing to solidify findings due to possible violations of other parametric assumptions, such as sphericity. While this solution increases the validity of our findings, it is not a perfect solution; it has been argued that permutations tests are not necessarily generalizable due to their lack of parametric assumptions about the general population from which the sample is drawn (Good, 2000). As we could not validate our coding by member checks, and as the sample size is low, findings from our analyses in general should be interpreted with care. They need to be replicated with bigger samples and experimental designs that might include interventions targeting the cognitions of athletes.

To add to the question of generalizability, our sample consisted of only elite level athletes. Skill level is a factor that needs to be further explored with regards to imagery construal level. Previous research suggests that experts in general benefit more from imagery than novices (Beilock & Gonso, 2008). Some studies have found that novices use less imagery, in particular imagery related to strategy and technique, but that its use can be increased and might be helpful to their performance (Arvinen-Barrow, Weigand, Hemmings, & Walley, 2007; Cumming & Ste-Marie, 2001). Since these aspects seem to be part of concrete imagery, manipulating spontaneous imagery to induce a concrete construal level in novices might be helpful to them in instances where imagery rehearsal is not applicable.

It is at the same time possible that our findings do not apply at all to novice athletes, as unlike many elite athletes, they might have no previous experience with imagery rehearsal. Elite athletes could be using previous knowledge about imagery without consciously considering it, while novice athletes might experience different types of spontaneous imagery than the ones described here.

Contributions and Further Research

To our knowledge, the manner in which we applied codings to the text and used co-occurring code frequencies to implement statistical analyses is novel and advances previously similar approaches of quantization. We present a practical way to apply permutation testing as proposed by Collingridge (2013) to facilitate statistical data analysis even with small sample sizes that violate parametric assumptions. Additionally, ours is one of the first papers in sport psychology to actively integrate qualitative and quantitative methodology instead of using them in a parallel or subsequent manner (Sparkes, 2015), an approach that is rare even in social science research in general (Fakis et al., 2014). Researchers are invited to apply this methodology on their data with the provided materials, in other to test the validity of the method.

Aside from the methodological advance, our findings also open some new avenues for sport imagery research. Spontaneous imagery in sport has not been extensively studied, nor manipulated with means of short-term interventions that change cognitive information processing. The application of construal level manipulations is frequently used in social psychological research in order to change cognitive processing of participants in a short-term manner (for a review, see Trope & Liberman, 2010), and should be considered as a possible way to direct the imagery of athletes in a beneficial way, for example by preventing debilitative imagery in sport on occasions such as penalty shootings or prior to the start of an important point in a tennis match, or to sustain beneficial imagery and prevent disadvantageous changes. The way construal levels are represented in imagery should also be further researched, with a focus on other times during the season outside of direct competitions, across athletes in various team sports, and in other athlete populations of different skill levels.

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MANUSCRIPT 2: Do construal levels affect athletes' imagery and performance outcomes? It depends on the task![2]

Many psychological interventions that are used to enhance sport performance, such as arousal regulation and mental imagery, require practice (Kendall, 1990; Weinberg, 2008). The application of mental imagery in sport generally focusses on rehearsed imagery, though some research indicates that one can enhance performance outcomes and improve coping strategies by targeting and directing spontaneous imagery (Cumming & Hall, 2002; Davis, 1990; Nordin & Cumming, 2005). Few investigations have examined effects of manipulating athletes' cognitive processing by on-the-spot interventions such as framing, where for example verbal cues are used to direct imagery. These approaches are of a similar nature to previously suggested use of verbal cues in motor skill learning (Landin, 1994), though in contrast, self-talk cues are instructional or feedback related. Previously, framing has been implemented by priming, where scrambled sentence priming alleviated skill failure in field-hockey players (Ashford & Jackson, 2010), and regulatory fit, where matching a person's motivational focus with a regulatory verbal frame improved penalty scores in soccer (Plessner, Unkelbach, Memmert, Baltes, & Kolb, 2009), and set points in table tennis (Kacperski & Kutzner, 2016).

In the present research, we investigated whether a novel, framing-based intervention based on construal level theory (CLT; for a review, see Trope & Liberman,

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2010) could be beneficial to athletes. Construal level theory is a psychological framework that proposes that individuals comprehend and interpret the world around them in a concrete or an abstract manner, and that this personal construal level is susceptible to manipulation due to characteristics of events or objects (Trope & Liberman, 2010). For example, a frame of temporal distance such as “this coming Friday” (compared to “sometime in August, next year”) induces a more concrete perspective (Liberman, Sagristano, & Trope, 2002, p. 255). Similarly, a spatially far instruction such as “3,000 miles away from here” compared to “3 miles away from here” induces an abstract perspective (Fujita, Henderson, Eng, Trope, & Liberman, 2006, p. 279). Abstract (high) and concrete (low) construal levels can also be applied to actions, which have been explained and manipulated in terms of feasibility (asking “how?”) and desirability (asking “why?”) (Liberman & Trope, 1998; Vallacher & Wegner, 1989). For example, in soccer, *making a goal* can be construed at a lower level as *kicking the ball into the net,* which focuses on the feasibility of the behavior, or it could be construed at a higher level as *winning the match,* focusing on the desirability of the behavior. Changing one's cognition from the how to the why and vice versa is also a form of manipulating one's construal level. Table 2 summarizes the concepts involved.

Table 2 - Concepts involved in high or low construal levels.

Rows indicate the two different levels of construals, columns detail abstraction inherent in, distance associated with and action focus of the construal levels, as well as question types that can be used for manipulation. The last column indicates our hypothesized fitting task environment.

Construal Type	**Abstraction Level**	**Action Focus**	**Associated Distance**	**Associated Features**	**Manipulation Question**	**Fitting task environment**
high construal	abstract	desirability	far	central, general	why?	static environment
low construal	concrete	feasibility	near	peripheral, detailed	how?	reactive environment

Previous work in cognitive psychology evidences a multitude of effects on a variety of tasks following the manipulation of individuals' construal levels. A change in CLT has been shown to induce changes in visual processing (Bar-Anan, Trope, Liberman, & Algom, 2007; Liberman & Förster, 2009), affect self-control and self-regulation (e.g., Fujita, Trope, Liberman, & Levin-Sagi, 2006; Schmeichel, Vohs, & Duke, 2011), confidence (e.g., Tsai & McGill, 2011), motivation (e.g., Davis, Kelley, Kim, Tang, & Hicks, 2015; Vasquez & Buehler, 2007; Wieber, Sezer, & Gollwitzer, 2014) and performance, for example in handgrip tasks, stop signal tasks, and go/no-go tasks (Schmeichel et al., 2011; Wieber et al., 2014). Many of these processes are relevant for sport performance. For example, perception processing affects attention and cue processing in team ball sports (Loffing & Hagemann, 2014; Memmert & Furley, 2007). Self-control is beneficial in all sports (for an overview, see Fullerton, 2016), though different task types, due to differing demands such as endurance versus inhibition control, can benefit from different types of self-control, which are enhanced through high or low levels of construal, as indicated by Schmeichel et al. (2011).

Individuals' general cognitive construals are usually the focus in CLT research, while mental imagery is considered a specific subclass of construals, in the sense of being a quasi-perceptual experience (Shaeffer, Libby, & Eibach, 2015). The differentiation between concrete and abstract imagery has only recently been applied to sport imagery (Kacperski, Ulloa, & Hall, 2016) and has never been tested in its application, despite being commonly accepted in the cognition literature and already known to impact, for example learning behavior (Rosenfeld & Kaniel, 2011). This might be due to the fact that abstraction levels of imagery cannot be directly measured. In cognitive psychology, there have been successful operationalization however, by measuring either the distance at which memories prompted by abstraction are perceived (Semin & Smith, 1999), or by studying the linguistic make-up of described imagery with the Linguistic Categorization Model (LCM; Fujita, Henderson, et al., 2006; Semin & Fiedler, 1989). To the best of our knowledge, how construal levels affect imagery and outcomes of sport tasks has never been explored. In the two studies presented here, we employed two framing interventions (distance framings and desirability/feasibility framings) to investigate this relationship, and we employed both methods described above (imagery recall and LCM) to examine levels of construal in mental imagery.

Construal Level in Reactive versus Static Environments

Athletes utilize different cognitive processes for tasks that are performed in static environments, which are relatively constant and where the activity is self-paced (e.g., golf, swimming) than for tasks that are performed in reactive environments, and which require reactions to opponents or balls (e.g., judo, tennis) (Mann, Williams, Ward, & Janelle, 2007; Ozel, Larue, & Molinaro, 2004). A recent mixed methods investigation of construal levels in elite athletes' imagery before and during competitive events explored how imagery abstraction and task demands interact, with results indicating that athletes from sports performed in static environments (e.g., running, golf) subjectively preferred abstract imagery in competition, while athletes from sports performed in reactive environment (e.g., table tennis, martial arts) subjectively reported preferring concrete imagery (Kacperski et al., 2016). While based on self-reports, results of this study suggest that a manipulation of construal levels that takes into consideration task requirements could be beneficial.

Previous research on static tasks (penalty kicks, golf putts) has found that peripheral stimulus-directed cognitive processes, such as an athlete's attention towards task-irrelevant stimuli like movement control, can be debilitative (Gucciardi & Dimmock, 2008; Nieuwenhuys & Oudejans, 2012; Wilson, Wood, & Vine, 2009). Changing a person’s processing towards high-level construals can increase self-control and motivation (Fujita et al., 2006; Wieber et al., 2014) and can move attention to big-picture perceptions of events, increasing the weight of central goal-directed processing relative to peripheral-feature processing (Liberman & Förster, 2009; Trope & Liberman, 2000), which we argue could improve performance outcomes for athletes.

Conversely, for reactive tasks (e.g., martial arts, racquet sports), for which cognitive processing of task-relevant stimuli is important (Abernethy, 1991; Mann et al., 2007; Ripoll, Kerlirzin, Stein, & Reine, 1995; Wang et al., 2013), we argue that changing athletes’ mental processing towards low-level construals could help, for one, by improving athletes’ attention to detail and prediction accuracy (Armor & Sackett, 2006; Wakslak, Trope, Liberman, & Alony, 2006), and secondly, by targeting those self-control mechanisms that have been shown to improve performance in tasks which require attention and responsiveness to the immediate environment (Schmeichel et al., 2011).

For the present research, we thus hypothesized that manipulating an athlete's on-the-spot imagery and construal levels by means of verbal construal level frames (such as distance frames and why/how frames) might impact the outcome of athletic tasks just as it has been found to affect a variety of other, purely cognitive tasks. In line with theoretical considerations from prior literature discussed above, we predicted an interaction effect, such that tasks in static environments would benefit in their outcomes from high level construals, while tasks in reactive environments would benefit in their outcomes from low level construals. The last column in Table 2 indicates this fit.

STUDY 1

In our first study, we investigated the link between construal levels and task outcomes, and looked at the relationship between CLT and athletes' self-reported imagery. We hypothesized that different construal levels (following verbal distance frames) would affect outcomes, with near distance frames improving reactive task outcomes and far distance frames improving static task outcomes.

Methods

Participants

Multiple varsity teams of an Ontario university were approached and informed about the possibility of participating in a study about verbal instructions. Aside from being highly skilled at their sport, no further inclusion/exclusion criteria were specified. After institutional ethics approval was granted, 16 players (7w) from the table tennis team and 14 athletes (8w) from the track and field team (8 throwers, 6 long jumpers) consented to participate, comprising our convenience sample. Mean age reported was 21.2 years (*SD* = 2.08), with an average of 8.1 years of experience *(SD* = 3.9). All players had previously participated in at least provincial competitions, with mean competitive level (range: 1 (regional), 2 (provincial), 3 (national) and 4 (international) based on a commonly used classification of competitions) of *M* = 2.86, *SD* = 0.99. The mean difference in the competitive level of the table tennis dyads on average was *M* = 0.83, *SD* = 0.40. Athletes' recorded competitive experience did not predict task outcome in a linear model, *B* = 0.24, *t* = 1.0, *p* = .30, which suggests that table tennis pairs were well-matched in terms of ability level.

Measures

Questionnaires. Before the performance trials, players reported age, sex, recent highest competitive level and years of experience. After every trial, athletes reported task outcome, and ratings on scales from 1 (not at all) to 7 (very much)**,** for three questions: "How satisfied are you with your performance?"; "How vivid was your imagery?"; and "How helpful was your imagery for your performance?"

Task outcomes. For table tennis, we coded win (as 1) and loss (as 0) for all trials. For throw and long jump, we coded each jump/throw as either a failure, called foul by judges (as 0), or as successfully executed (as 1). We also recorded distance for both jumpers and throwers, however, differences in distance measures across the two sports and high foul rates from all athletes made this measure unusable for further analysis due to a low sample size.

Player construal level. To assess initial preferred construal level of the athletes (termed chronic construal level), we used a shortened (8-item) Behavior Identification Form (BIF), a widely used instrument in CLT literature with validity α = .84 and re-test reliability r = .91 (Vallacher & Wegner, 1989). The form asks participants to circle one of two ways a particular behavior such as "joining the army" can be described, for example

(a) helping the nation's defense or (b) signing up. One of the behaviors identifies a low construal level "how" behavior (joining the army by signing up), and the other indicates a high construal level "why" behavior (helping the nation's defense by joining the army). The average score identifies an individual's preferred, general construal level on a continuous scale from 0 (low, concrete) to 1 (high, abstract construal level).

Experimental Conditions

Construal level was manipulated with verbal frames relating to spatial distance (successfully employed in prior research to induce construal levels, see Bar-Anan et al., 2007; Fujita, Henderson, et al., 2006), resulting in three experimental conditions. Baselines (two trials) were played after instructing the athletes to perform to the best of their ability. For the two low construal trials, we instructed, "*Right before you start, before the serve (the throw/ the run-up to your jump) please imagine performing at optimal level. Try to imagine it from a very near distance*." For the two high construal trials, we changed the last sentence to: "*Try to imagine it from a very far distance away*." The baseline condition was always first; the frame conditions were balanced for order across all participants. Neither order of play of participants, nor order of condition impacted outcome, or changed the results when we controlled for it, so they will not be discussed in the results.

Procedure

Table tennis. The main researcher as well as a research assistant met with the team during one of their practice sessions. The players warmed up, then were called together and informed about the general purpose of the study. The instructions were the same across all sessions of both studies: “Our research explores how verbal frames affect your performance in your sport task, so we would like you to execute your task multiple times after various instructions.” Participants filled in consent forms, demographics and the BIF while they were set up in pairs with the help of the coach on the basis of previous performance and USA Table Tennis ratings. Each pair of athletes approached the competition table (set up for this purpose), and was told that one player would start, receive instructions before their matches, and that the other player would participate afterwards. Each match started at 8:8, with the participant serving, and lasted until one player reached 11, or one player reached an advantage of two points thereafter.

Throwers. The main researcher met with the throwers during one of their practice sessions. The athletes were called together, briefed (as above), and completed the questionnaires while the coach helped set up a mock competition, with each of the 8 athletes performing the three experimental conditions (6 throws in total), with the frame conditions balanced for order. The coaching assistant was in charge of measuring distances and calling fouls.

Long jumpers. The main researcher met with the jumpers during one of their early season preparatory competitive events. The athletes were called together before their warm-up, briefed (as above), and completed the questionnaires. A judge was in charge of measuring distances and calling fouls for their six jumps, which as before, comprised the three experimental conditions.

All athletes recorded their results after each task: win/loss (and standing) in table tennis and success/foul (and distance, if applicable) in throwing and jumping. They also rated their perceived success and imagery experience. Afterwards, all athletes were debriefed with explanations about CLT, and thanked for their participation. No compensation was provided.

Data Analysis

After data input was completed, analyses were performed on our 2 (sport type) x 3 (CLT manipulation) mixed design, where the task type was between subjects and coded as static (1) and reactive (-1), and the manipulation (coded as high level (1), baseline (0) and low level (-1) was applied within subjects as a repeated measure. First, we tested whether the presence of the intervention by itself had an effect, and then added CLT and task type as factors to test for our main hypothesis. We tested how CLT affected perceived success and imagery experience. Finally, we tested for correlations between outcomes, perceived success, and imagery experience variables.

We chose to fit our model with modern mixed model approaches (Pinheiro & Bates, 2000) to improve statistical accuracy for our small sample size and the handling of non-normally distributed responses, lack of balance, and random factors. For our binary dependent variable (success), we estimated the generalized logistical mixed-effects model with the "glmer" function (binomial family, by maximum likelihood) from the lme4 package in R 2.3.3 (Bates, Mächler, Bolker, & Walker, 2015; R Development Core Team, 2008). For analysis of ordinal dependent variables (such as our imagery experience variables), we applied linear mixed-effects model with the "lmer" function with Kenward-Roger approximation (Bates et al., 2015; Halekoh & Højsgaard, 2014). In both, we added a random effect term for the grouping factor *participant* that was nested in the *dyads* (to control for pairs of matched opponents in table tennis). We report unstandardized *B* values to report slope direction, Wald z-value or t-value as main statistics, and p values for significance testing. We report the R^2 value of the correlation between the fitted and observed values as the effect size for significant models (Nakagawa & Schielzeth, 2013). Associations between imagery experience variables were tested using Pearson correlations.

Results

Main Hypothesis

Firstly, using a linear model, we regressed trials where an intervention was present (as compared to baseline) on outcomes. We found no significant difference, $B = 0.35$, $z = 1.01$, $p = 0.31$. When we entered construal level conditions and task types as factors and in interaction into the generalized logistical mixed model, predicting its effects on outcome, the interaction between construal level and task type significantly predicted outcomes, $B = 0.47$, $z = 2.27$, $p = .023$, with $R^2 = 0.326$. Figure 4 illustrates that throwers and long jump athletes benefitted more from a far distance frame compared to a near distance one, due to a higher success rate (i.e., less fouls), while table tennis players benefitted more from the near distance frame compared to the far distance, frame due to more won trials. In the baseline condition, table tennis players won their trial with a mean $M = 0.53$ ($SD = 0.5$) midway to the two intervention conditions, and jumpers and throwers succeeded with a mean of $M = 0.43$ ($SD = 0.5$), similar to their outcome in the low construal condition. We did not find a significant main effect of construal level, $B = -0.17$, $z = -0.82$, $p = .41$, nor of only task type, $B = -0.05$, $z = -0.22$, $p = .82$.

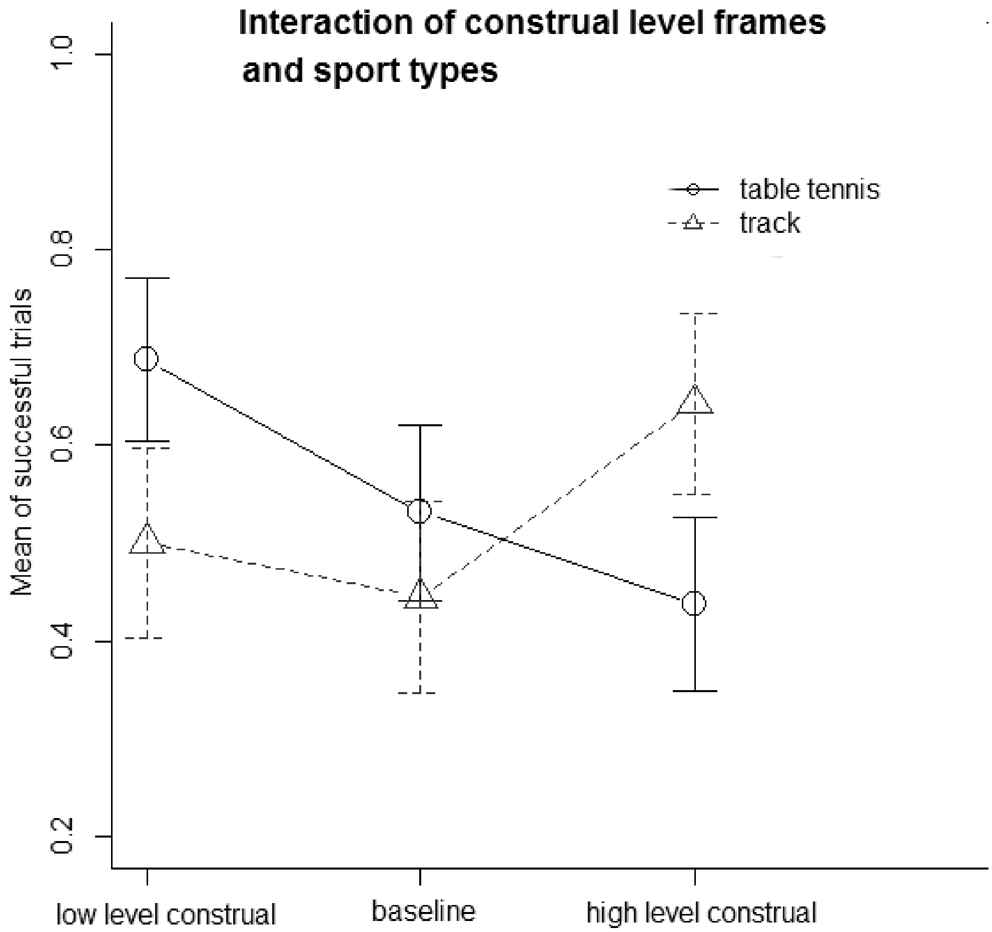

Figure 4 - Results of the interaction of construal level frame conditions and task types and their effect on successful trials. Y-axis indicates mean of successful trials on average per condition. Lines indicate players from table tennis (dot) or track athletes (triangle) across the three conditions distributed over the X-axis. Bars indicate standard errors.

Reported Perceived Success

We entered construal level conditions and task types as factors and in interaction into the linear mixed model, predicting their effects on outcome. With an effect size of R^2 = 0.11, there was no significant construal level and task type interaction on perceived success, B = 0.21, t = 1.25, p = .22, and no effect was found for construal level by itself, B = -0.1, t = -0.61, p = .54. There was a main effect, as task types differed in satisfaction, *B* = -0.6, *t* = -3.02, *p* = .008: table tennis players generally reported higher perceived success, *M* = 4.79, *SD* = 1.83, than throwers and jumpers, *M* = 3.59, *SD* = 1.8.

Self-Ratings of Imagery Experience

A linear mixed model showed a non-significant trend in line with predicted hypotheses, *B* = 0.29, *t* = 1.96, *p* = .066, R^2 = 0.11. No effect was found for construal level by itself, *B* = -0.07, *t* = -0.52, *p* = .61. Table tennis players reported they perceived their imagery to be more helpful than track athletes, B = -0.51, *t* = -2.24, *p* = .039.

In terms of imagery vividness, we found no significant main effects, neither for construal level, *B* = 0.13, *t* = 0.66, *p* = .51, nor for task type, *B* = -0.24, *t* = -1.3, *p* = .21. For the interaction term, a non-significant trend went in the predicted direction, *B* = 0.37, *t* = 1.84, *p* = .083, R^2 = 0.07.

Correlations

Perceived success after each trial correlated with the outcome across both task types, r(167) = .48, *p* < .001. Imagery helpfulness correlated with outcome, r(112) = .45, *p* < .001, and with perceived success, r(112) = .69, *p* < .001. Imagery vividness correlated with outcome, r(112) = .31, *p* < .001, and perceived success, r(112) = .54, *p* < .001.

Chronic construal level

Chronic construal level, as measured by the BIF, did not significantly correlate with task type, r(27) = -0.11, *p* = .55. It also did not significantly predict performance, neither by itself, *B* = -2.3, *z* = -0.96, *p* = .34, nor in interaction with task type, *B* = -3.27, *z* = -1.3, *p* = .19.

Discussion

In our first study, we found support for our hypothesis that near and far distance framings would impact task outcomes, such that a far distance frame, associated with a high level construal, increased the number of successful trials (i.e., decreased fouling) in jumps and throws, when compared to a near distance frame. Our near distance frame, associated with low level construal, improved the points won by table tennis players when compared to a far distance frame. We found no effect for the verbal intervention compared to baseline, which indicates that the interventions we used only had an effect when split by construal level content, and not merely through their presence.

Further analyses of self-reported imagery provided inconclusive results. Regarding athletes' subjective perceptions of their imagery, we found somewhat higher helpfulness and vividness ratings following a fit of task and construal level in the proposed direction. However, due to high correlations with actual outcome, no measures of content of this imagery, and non-significant trends, the relationship of construal level, imagery and task outcome needs to be investigated further.

Finally, individual chronic construal level, as measured before the study, was not associated with athletes' choice of sport, and we did not find that it affected task outcomes. This indicates that a chronic construal level is of less importance to performance outcomes, and is easily changeable by means of manipulations, just as has been evidenced by previous literature on CLT (Trope & Liberman, 2010).

Multiple limitations of our first study need to be improved upon. In particular, we perceived that various confounds might exist due to a mix of imagery and CLT intervention within one framing; for example, imagery ability and imagery perspective might both be influencing athletes' performance and thus the outcomes in each task. We also did not have a manipulation check to ascertain that the framing affected construal level - though based on consistent, strong effects from this type of framing found in previous literature (see Trope & Liberman, 2010), this can be assumed to have taken place. Finally, we did not include an imagery recall in order to analyze in detail how athletes' imagery was impacted by a manipulation of their construal levels, and how, in turn, this imagery might be affecting performance outcomes. Our second study was carried out in order to improve on weaknesses and provide more explanatory power for the findings of the first study.

STUDY 2

In this study, we again investigated effects of construal levels (as manipulated via verbal frame) and their interaction with task type on performance outcomes, with the same hypothesis as in the first study. In order to remove confounds mentioned above, we shifted from an imagery framing to a pure construal level frame based on feasibility/desirability frames similar to those reported in previous CLT literature (Fujita et al., 2006; Wieber et al., 2014). We also added a manipulation check after the frame, and an imagery recall task after each trial.

We hypothesized that athletes after verbal frames targeting desirability would describe their imagery in more distant, less detailed and in more abstract terms (i.e., more state verbs and adjectives as per LCM), while athletes after verbal frames targeting feasibility would report their imagery in less distant, more detailed, and in more concrete terms (i.e., more action verbs as per LCM). Furthermore, we hypothesized that this difference in imagery, in turn, would act as a mediator, and interact with task types to improve performance outcomes.

Methods

Participants

After institutional ethics approval was granted, 16 players from the women's varsity soccer team and 16 from the badminton team (10 women) at an Ontario university consented to participate. Athletes were aged at M = 19.2 years (SD = 0.9) and reported an average of 11.8 years of experience (SD = 4.25 years), practicing 8.5 hours on average per week (SD = 2.5). All athletes had previously competed in at least provincial competitions, most in national championships, with a mean player competitive level (range from 1 (regional) to 4 (international)) at M = 2.75 (SD = 0.86). For the dyads in badminton, the difference of competitive level on average was M = 0.75 (SD = 0.88). We did not find that athletes' competitive level impacted outcomes in badminton as predicted by a linear model, B = -0.005, t = -0.07, p = .94, suggesting that pairs were well-matched in terms of ability level.

Measures

Player construal level. The Behavior Identification Form (BIF; Vallacher & Wegener, 1989) was used to assess initial preferred (i.e., *chronic*) construal level of athletes as in Study 1.

Performance outcome. For badminton, we coded a win (as 1) and a loss (as 0) of each match across all participants. For penalty shots in soccer, we coded misses (as 0) and goals (as 1).

Manipulation/Audio-taped questions. Before athletes executed their tasks (either penalty kick or badminton trial), we asked them a question to manipulate their construal level, and audio recorded their answers as a manipulation check. We asked a *why* question to induce a high level construal through focus on desirability ("Please explain *why* you play soccer/badminton as the sport of your choice?"), and a *how* question to induce a low level construal through focus on feasibility ("Please explain *how* you prepare for a competitive event?"). Desirability and feasibility have proven closely associated with high and low construals (Liberman & Trope, 1998), and have been used to manipulate construal levels (Fujita et al., 2006; Wieber et al., 2014).

Post-task questionnaire. The post-task questionnaire was applied after each completed task (four times in total). The first question inquired about players' imagery: "Please describe in a few sentences or bullet points what thoughts or images were in your mind as you performed your penalty (badminton: your match)." We also asked athletes, “How successful was your rally/match regarding your technique?” on a scale from 1 (*very unsuccessful*) to 7 (*very successful*); “If you had any thoughts or images in your mind, how clear were they?” on a scale from 1 (*very unclear*) to 7 (*very clear*), and “How helpful were the thoughts that you described above in achieving your best shot/rally?” on a scale from 1 (*very unhelpful*) to 7 (*very helpful*).

Procedure

Soccer. The main researcher as well as two research assistants met with the soccer team on the pitch. Participants completed demographics (age, sex, competitive level, years of experience in their sport and hours of training per week) and the BIF before the task. They were randomly assigned to groups of four, and told that their score as a group would be evaluated against the other groups. This, as well as video-taping, was done to raise the experienced pressure on athletes and to induce a similar environment as in competition (Beilock & Carr, 2001). While the other twelve athletes ran drills, the experiment was performed with one group at a time. Each soccer player kicked four penalties in total, two penalties in the high level construal condition, and two penalties in the low level construal condition, balanced for order. After each penalty, participants completed the post-task questionnaire. After all participants had completed their four penalties, they were thanked, debriefed, and the entire team received snacks at the end of practice.

Badminton. The main researcher as well as two research assistants met with the badminton team in their practice gym. Participants completed questionnaires (as above), and were matched into pairs of equal skill (dyads), based on previous competitive results and the coach's assessment. Each badminton volunteer played four trials (games) successively, starting each at 20:20, until one player had a lead of two points. The opponent player in every case was not instructed. Each participant played out two trials in the high level construal condition, and two trials in the low level construal condition, balanced for order. Then their opponent became the participant, was instructed, and played the game situations (while the first player was the opponent). After each trial, participant completed the post-task questionnaire. After all participants had completed their four trials, they were thanked, debriefed and the entire team received snacks at the end of practice.

For both task types, neither order of play of participants, nor the order of condition impacted performance outcomes, so they are not further discussed.

Data Analysis

Data from audio-taped recordings was transcribed, and athletes' answers to *why* and *how* questions were rated by two raters (blind to condition) using an approach similar to directed content analysis (Hsieh, 2005). Raters were instructed on basic principles of construal level theory (for an overview of concepts, see Trope & Liberman, 2010), and they rated each response on distance (on a scale from 1 - very spatially/ temporally/ socially close, to 5 – very spatially/ temporally/ socially far) and detail (from 1 – few details, only general, central ideas to 5 – very detailed, many peripheral, non-central specifics) for a basic manipulation check of the intervention. For example, one soccer player described, “When we were little kids, I loved to kick balls all around the backyard. And I'm really bad with my hands, so I was limited” which was rated as a temporally distant (5) and medium detailed (2.5) statement. In another example, a badminton player described, “I just lay out everything, make sure that there's nothing that I have to worry about. I wake up and just have a small light breakfast, go do like half an hour warm up, get a good sweat going”, which was rated near on distance (2) and highly detailed (5).

Responses to the imagery recall question were also analyzed by two raters (blind to condition) on distance and detail (1 to 5 scale as above), and averaged, yielding one imagery distance score (we termed it the I-DIST score) and one imagery detail score (we termed it the I-DET score), for each of the four statements we received per athlete. A badminton player wrote, “picture the serve, feeling of contact with birdie, focus on getting an attacking shot, play defense” which was rated low distance and high detail by both raters, while a soccer player wrote, “not feeling very confident, the goalie is good at predicting my shot” which was rated high distance and low detail by both raters.

Two different raters coded all imagery recall responses based on the LCM (Semin & Fiedler, 1989), in which adjectives/adverbs are considered the most abstract form of linguistic category (coded as 4), followed by state verbs (3), while on the concrete side, there are interpretative action verbs (2) and most concrete, descriptive action verbs (1). Some example codes were: patient (4)/ confident (4), feel (3)/think (3)/predict (3), play (2)/mess up (2) and serve (1)/hit (1). Code values were summed and divided by the number of codes provided for each participant statement, and then averaged for the two raters, yielding a final abstraction score (termed I-LCM score).

After data input was completed, Spearman's rho was used (due to ordinal scales), to calculate interrater reliabilities for the two raters, with confidence intervals bootstrapped over 1000 iterations.

To test whether construal level frame (as a two-level factor, coded 1 for high level frame, and -1 for low level frame) impacted participants' responses in the manipulation check and athletes' imagery recall responses, we employed repeated measures ANOVAs (with an error term, blocking for participants). We also tested for associations with imagery experience (scales from 1 to 7) using Pearson correlations.

The rest of our analyses were performed using a 2 (task type) x 2 (CLT manipulation) mixed design, where the task type was between subjects and coded as static (1) and reactive (-1), and the manipulation (coded as high level (1) and low level (-

1)) was applied within subjects as a repeated measure. We decided not to include a baseline trial in this study to keep demands (both time and effort) on participants reasonable.

Due to the mixed-effect model required for analyses involving both within and between factors, we again employed modern mixed-effect models just as in Study 1, adding a random effect term for the grouping factor *participant* that was nested in *groups* (to control for pairs of matched opponents in badminton, and the competition groups of four in soccer). We report unstandardized *B* values (slope), Wald z-value or t-value as the main statistic, p values for significance testing, and the R^2 value of the correlation between fitted and observed values as the effect size for significant models.

Results

Interrater Reliability

For the manipulation check, the interrater reliability measure for response across distance and detail was $r = .85$, 95% *CI* (.769, .899), $p < .001$. For the imagery recall, the interrater reliability measure for imagery distance and detail was $r = .838$, 95% CI (.791, .879), $p < .001$. Interrater reliability applying the LCM on imagery recall was $r = .907$, 95% *CI* (.848, .946), $p < .001$.

Manipulation Check

We tested whether *how* versus *why* questions impacted the distance and detail of the audio-taped answers provided by the participants with a repeated measures ANOVA. We found a significant difference for distance, $F(1,31) = 152$, $p < .001$, $p\eta^2 = .91$, indicating that raters perceived that athletes' responses to the *why* question contained more distance (spatial, temporal, social) (*M* = 4.04, *SD* = 1.28) than to the *how* question (*M* = 1.36, *SD* = 0.51). Similarly, we found a significant difference for detail, $F(1,31) = 6.51$, $p = .016$, $p\eta^2 = .30$, indicating that raters perceived that athletes' responses to the *why* question contained less detail and more central features (*M* = 2.71, *SD* = 1.05) than to the *how* question, which were perceived as more detailed and containing more peripheral information (*M* = 3.39, *SD* = 1.17).

Main Hypothesis

To test our main hypothesis, we entered construal frame type and task type as factors and in interaction into the generalized logistical mixed model, predicting effects on task outcome. We did not find a significant main effect of verbal frame, $B = -0.04$, $z = -0.19$, $p = .85$. In terms of task type, penalty kickers were in general more successful in their task than badminton players, $B = 0.76$, $z = 3.55$, $p < .001$, which is to be expected (see Bar-Eli & Azar, 2009). Crucially, we found that the interaction between construal level and task type was significant, $B = 0.53$, $z = 2.3$, $p = .021$, $R^2 = 0.17$, such that penalty kickers benefitted more from a high level frame, *M* = 0.88, *SD* = 0.34, than a low level frame, *M* = 0.72, *SD* = 0.46, while badminton players benefitted more from a low level frame, *M* = 0.63, *SD* = 0.49, than the high level frame, *M* = 0.34, *SD* = 0.48.

Reported Perceived Success

Perceived success after each trial correlated moderately with outcome across both task types, $r(126) = .23$, $p = .008$. We entered construal level frames and task types and their interaction into the mixed-effect model, and did not find a significant effect of the interaction on perceived success, $B = 0.02$, $t = 0.19$, $p = .86$, nor for the main effect of construal level, $B = 0.02$, $t = 0.19$, $p = .86$. Soccer players generally reported higher subjective satisfaction with their performance than badminton players, $B = 0.48$, $t = 2.64$, $p = .028$.

Imagery as Mediator

Prior to running mediator analyses, we confirmed that performance success had not impacted the imagery recall reports of athletes. To test this, we regressed in three separate linear regressions performance outcome on I-DIST scores, I-DET scores and I-LCM scores, while controlling for task type, and for verbal framing conditions as a repeated measures factor; we found no evidence that performance outcome impacted any of the three variables, with all $p > .10$.

Construal level frame effects on imagery. We tested how construal level frames would impact I-DIST, I-DET and I-LCM scores. We entered the two frames as levels into a repeated-measure ANOVA and found the I-DIST scores were significantly affected, $F(1,30) = 8.23$, $p = .007$, $p\eta^2 = .354$, such that athletes' imagery in the high level condition had contained more distance (spatial, temporal, social), $M = 3.68$, $SD = 1.24$, than in the low level condition, $M = 3.00$, $SD = 1.52$. Similarly, we found a difference for the I-DET score, $F(1,30) = 5.20$, $p = .029$, $p\eta^2 = .257$, such that athletes' imagery in the high level condition had contained less detail and more central features, $M = 2.58$, $SD = 1.10$, than in the low level condition, $M = 2.99$, $SD = 1.25$. We also found a significant difference in LCM ratings, $F(1,30) = 12.61$, $p = .001$, $p\eta^2 = .457$; athletes' imagery in the high level condition contained more adjectives and state verbs, $M = 2.49$, $SD = 0.94$, and in the low level condition contained more interpretative and descriptive action verbs, $M = 2.04$, $SD = 0.89$.

Imagery effects on performance outcomes. In a second step, we tested whether imagery, as affected by verbal frame (in terms of the I-DIST, I-DET and I-LCM scores), had an effect on athletes' success, either as a main effect or in interaction with task type. To do this, we entered imagery scores, task type and their interaction into three separate linear mixed-effect models while controlling for the effect of construal level frames.

None of our models showed any significant effects, with all main effects and interactions $p > .23$, so we will only report interaction results. The interaction of I-DIST and task type was not found to be significant, $B = -0.01$, $z = -0.07$, $p = .94$; the interaction of I-DET and task type on performance was also not significant, $B = 0.15$, $z = 0.84$, $p = .40$; and the interaction of LCM scores with task type was not found to be significant, $B = 0.10$, $z = 0.48$, $p = .63$.

Self-Ratings of Imagery Experience

We investigated the relationship of construal level frames and athletes' ratings of their imagery in the post-task questionnaire with linear mixed model analyses, predicting imagery clarity and imagery helpfulness from construal level frames, task types and their interactions. We found no significant effects in any of our analyses, $p > .12$, and therefore do not report individual analyses.

Athletes' perceived imagery clarity correlated moderately with actual outcome, $r(126) = .23$, $p = .008$, and highly with subjectively perceived success, $r(126) = .58$, $p < .001$. We found no significant correlation for imagery helpfulness with outcome, $r(126) = .13$, $p = .12$. It was associated with perceived success, $r(126) = .76$, $p < .001$.

Chronic construal level

We did not find a significant correlation of chronic construal level, as measured by the BIF, and task type, $r(27) = -0.33$, $p = .08$, and chronic construal level, when input into a logistic linear regression, did not predict performance, $B = -0.17$, $t = -0.86$, $p = .39$.

Discussion

In our second study, construal level frames interacted with task type, such that soccer players improved their number of successful penalty kicks after a desirability frame, while badminton players improved their number of successful rallies after a feasibility frame. A manipulation check was performed which indicated that we induced high and low construal levels in athletes in line with the CLT literature (Liberman & Trope, 1998; Trope & Liberman, 2010).

Regarding the imagery reported by athletes in the imagery recall task after their performance, our first hypothesis – that construal frames impact imagery – was supported. In the high construal level condition, reported imagery was rated as more distant, less detailed and containing more abstract language; in the low construal level condition, reported imagery was rated as less distant, more detailed, and containing more concrete language. This is consistent with construal level literature findings that a strong connection exists between the abstraction/concreteness of thought, the desirability/feasibility of action, and the distance and detail of content (e.g., Fujita et al., 2006; Liberman & Trope, 1998; for a review, see Trope & Liberman, 2010).

Our second hypothesis regarding a mediation of imagery was not confirmed; we did not find any evidence that imagery following either frame, whether by itself or when matched with task type, impacted performance outcomes. Therefore, we did not perform subsequent steps of a mediation analysis to investigate the relationship further.

We again included self-report questions in order to clarify athletes' subjectively experienced imagery. As in Study 1, results based on these subjective self-report questions need to be evaluated critically, as the outcome of each task possibly influenced subsequent answers. Overall, we did not find that athletes experienced their imagery as clearer or as more helpful following construal level frames that matched their task type.

Finally, as in Study 1, individual chronic construal level, as measured before the study, was not associated with athletes' choice of sport, and we did not find that it affected outcomes.

Despite the fact that imagery was not found to be a mediator, the fact that construal levels can be used to impact imagery is an important finding, particularly as considerable imagery research has been focused on finding beneficial features of imagery (Budney, Murphy, & Woolfolk, 1994; Weinberg, 2008), and in light of prior attempts to merge imagery and self-talk, which have shown promising results (Cumming, Nordin, Horton, & Reynolds, 2006; Hall, Moore, Annett, & Rodgers, 1997; Saimpont et al., 2013). Construal level interventions can be used to investigate whether abstract and concrete imagery affect other important aspects of sport performance beyond the task outcomes investigated in this paper, such as self-efficacy, and affective or motivational aspects of behavior, for which construal level effects have been found in prior research (Davis et al., 2015; Tsai & McGill, 2011; Vasquez & Buehler, 2007; Wieber et al., 2014). Finally, research into the linguistic make-up of imagery as we investigated might give insights into the workings of imagery beyond more commonly investigated features of imagery such as valence or perspective (Cumming et al., 2006; Hanton, Mellalieu, & Hall, 2004).

General Discussion

Our research goal was to propose a new framing intervention based on construal level theory, and test verbal construal frames for their impact on sport performance outcomes. In particular, we investigated whether task type would interact with construal frames, since previous research has suggested that reactive tasks involve different cognitive processes than static tasks (Abernethy, 1991; Gucciardi & Dimmock, 2008; Wang et al., 2013; Wilson et al., 2009), and that different construal levels might support the differing cognitive processes demanded by these tasks (Armor & Sackett, 2006; Fujita, et al., 2006; Liberman & Förster, 2009; Wakslak et al., 2006). We found first evidence that athletes performing table tennis and badminton rallies benefitted from a low level construal approach for those particular rallies, while athletes performing throws, long jumps and soccer penalty kicks benefitted from a high level construal in terms of a higher rate of successful trials and penalty kicks. Since our dependent variable cannot be taken to be indicative of the entire performance of the sports we studied, our findings should await generalization until broader measures (such as a whole table tennis match) demonstrate similar results. Further research should also extend our findings to other task types beyond the five we studied.

An important characteristic of our study was that we elected to study effects of construal levels with elite level athletes who performed well-learned tasks. Future studies should consider whether automation of a task is an important factor underlying our findings; novice athletes might react to interventions using construal level frames in different ways than elite athletes. Due to a heightened information load and emotional arousal, attentional capacity can be decreased (Boutcher, 1992) and novices might have less accurate estimates of event probabilities (Abernethy, 1991). One possible extension would be to replicate our design and include participants of one task type additionally performing another task that is unfamiliar to them.

Our second goal was to investigate whether content of directed imagery would mediate effects of construal levels on performance outcomes, as recent research suggested that differences in abstract and concrete imagery might account for some performance outcomes (Kacperski et al., 2016). We found that construal level frames did impact imagery in the hypothesized way; but the way imagery differed for our participants in terms of distance, detail or linguistic make-up did not influence outcomes. Furthermore, in Study 1, we only found trends for self-reported vividness and helpfulness, and no relationship at all in Study 2.

Performance outcomes could have influenced subsequent reports in both studies, which might be one reason we failed to find a connection. We did find high correlations for imagery ratings, though we did not find any evidence that imagery as it was reported in recall was influenced by performance outcome. Another possible explanation is that processes responsible for the impact of construal level on performance are not consciously accessible to the athletes and might play out on a cognitive level that is not reflected in subjective self-reports; however, our data only allows for interpretations based on accounts of consciously accessible mental imagery (as reported by athletes).

Based on our research, we would like to propose an alternative line of study. Instead of imagery mediating between construal level and performance outcomes, construal level might be the mediating factor between certain imagery interventions and performance. A critical difference between our first and second studies was we manipulated imagery concurrently with construal levels in Study 1, while in our second study we attempted to improve on this by separating the two concepts. Thus, in Study 2 participants' imagery was only indirectly influenced by construal level frames and not directly manipulated in any way. Recently, Shaeffer et al. (2015) found evidence that changes in the visual perspective of action imagery impacted participants' levels of construal, which would support this alternative hypothesis for our findings. To study this possibility, an extension of our research would require testing various imagery frames against a baseline, under inclusion of imagery recall tasks, a dependent construal level variable, and performance outcomes.

Future studies should look to integrate our findings with imagery frameworks such as the revised applied model of deliberate imagery use (Cumming & Williams, 2013) and the PETTLEP model of imagery use (Holmes & Collins, 2001). This could be particularly useful when integrating construal level interventions within rehearsal interventions, which are more commonly applied in sport psychological training sessions. It could be useful to examine whether long-term practice effects develop after training how to consciously manage abstract and concrete mindsets.

Strengths and Limitations

In terms of ecological validity, with our investigation we managed to adequately simulate high stakes conditions by staging mock-competitions and raising pressure through application of a video presence. This also lowered demand characteristics as it provided participants with a distraction from the real purpose of our study. However, the researcher and research assistants who were present for the execution of the studies were not blind to hypotheses. This might have elicited demand responses from athletes and needs to be taken into account in future studies.

Due to the nature of imagery, in particular on-the-spot, non-rehearsed imagery (as it occurs immediately before, or simultaneous to performance), we measured imagery experience via subjective responses, and only after tasks had been completed. Thus, our results for these variables should be evaluated critically, in particular as we generally found correlations with outcomes, which suggests that the outcomes of each task sometimes influenced subsequent reports, especially self-ratings. Further, we did not use a validated measure of imagery ability and were not able to control for this possible confound. Future studies testing the relationship between construal levels and imagery should include this measure to ascertain whether imagery ability affects the results.

Finally, researchers should look to improve on our sample size and the diversity of the sample to allow for the generalization of results. We conducted our study on a convenience sample of fairly low size, so our findings should be evaluated critically with regards to explanative power and reliability. Despite this, consistent findings across our two studies suggest that we have provided a good basis for further investigations, and our chosen statistical analyses should counteract some of the difficulties generally encountered with small sample sizes and unbalanced designs.

Conclusion

With the present line of investigation, we are contributing novel ideas to two existing fields of research, construal level theory and mental imagery in sport. This opens opportunities for further research to extend our findings. With regards to construal level theory, the interaction of construal levels and task types can be explored beyond sport domains, for example with computerized tasks that simulate applied tasks that include both cognitive and motor demands, or provide a variety of environments. With regards to mental imagery in sport, researchers can consider how cognitive construals (both in terms of CLT and beyond) interact with and explain the effects of imagery. Further research should explore how directing spontaneous imagery and the differing abstraction levels of imagery can be applicable to sport performance.

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SUMMARY AND DISCUSSION

Summary and Future Directions

The main purpose of this dissertation was to investigate how the construal level theory framework (Liberman & Trope, 1998; Trope & Liberman, 2010) could be applied to sport imagery and whether construal levels affect imagery and sport performance outcomes. Multiple studies were conducted to achieve this purpose. A major contribution with regards to achievement of the described results was the application of a new methodology that allows the analysis of qualitative data in a quantitative manner.

Manuscript 1 consisted of two sections, pertaining to a study where semi-structured interviews were conducted with 12 elite athletes. Resulting data illustrated spontaneous sport imagery, where thematic categories were created based on the theoretical framework of construal level theory. The main focus of analysis was abstraction and concreteness of athletes' imagery. Athletes indeed differentiated between concrete and abstract imagery, and thematic categories coded for concrete imagery consisted of *strategy generation*, *error correction*, *technique*, and *preparation*. Thematic categories for abstract imagery consisted of *desirability*, *symbolic representations* and *verbal representations*, and *psychological regulation of affect*, *arousal and mastery*. Apart from this, results indicated other existing concepts such as the presence of a distance dimension and a differentiation of imagery valence.

We developed and applied a novel methodology for the analysis of the qualitative data. The main idea behind this methodology was to use a technique called co-occurring coding and then use quantization (i.e., extract frequencies of co-occurring codes), which yielded a quantitative data set that was analyzed with statistical means (i.e., analyses of variance and permutation tests). The methodology proved successful in extracting meaningful results and enhanced understanding of the data by allowing a more comprehensive interpretation of the qualitative text and by providing a different perspective and clearer patterns from which an integrated analysis was made possible.

The results of this mixed methods analysis (i.e., the integration of qualitative and quantitative data) indicated that experienced effectiveness of imagery differs between sports and between various competition times. We laid a particular emphasis on task types, differentiating between tasks performed in static versus reactive environments. Athletes from static sports reported subjectively experiencing abstract imagery as more helpful during competitive performance, while athletes from reactive sports reported subjectively experiencing concrete imagery as more effective during their performance. This perception of effectiveness of abstract and concrete imagery was seemingly reversed the day/morning before the competition.

This first study was conducted in an inductive-deductive manner, in the sense that the main purpose was the exploration of athletes' imagery with regards to levels of abstraction, but deductive due to our research driven hypothesis that there might be differences with regards to task types, reasoned from existing literature on imagery effectiveness. This hypothesis was supported by athlete's differing perceptions of their imagery effectiveness. However, one main concern about the first study was that it relied entirely on self-reported data and subjectively experienced effectiveness. Thus, following up on the results from this study, two further studies were performed testing these perceptions and whether they would recur under objective performance conditions. These results were reported in Manuscript 2.

The primary purpose of Manuscript 2 was to experimentally test whether construal levels would affect sport imagery and performance outcomes in the way that findings from Manuscript 1 indicated they might. It was hypothesized that, depending on task demand, abstract and concrete construal frames would change participant imagery and, through this process, performance outcomes.

Study 1 was conducted with 16 table tennis players to represent a reactive task demand, and 15 track athletes (throwers and long jumpers) to represent the static task demand. Athletes performed their task multiple times in succession, in baseline and framing intervention conditions, where framing differed on the basis of a distance intervention, which has been successfully applied before in construal level theory studies in cognitive settings (e.g., Fujita, Henderson, Eng, Trope, & Liberman, 2006). Study 2 was conducted with 32 athletes, 16 per sport, with badminton matches as the reactive task and soccer penalty kicks as the static task. This time, the construal level intervention consisted of feasibility and desirability frames given to athletes before task completion (e.g., Wieber et al., 2014). Aside from performance outcomes, imagery recall was documented as a second dependent variable. We found that in both studies, construal levels interacted with task type, such that table tennis and badminton players performed better in the low construal frame condition (near distance/feasibility condition) compared to the high level frame condition (far distance/desirability condition), while the track athletes and soccer players performed better after the high construal intervention compared to the low construal frame. However, while construal levels did impact self-reported imagery as measured by an imagery recall task, we found no significant effects of imagery on performance outcomes.

In summary, we found that the construal level framework can be integrated with athletes' imagery before and during competition and that, in line with athletes' perceived experiences, abstract and concrete construal level impacted sport performance outcomes in interaction with the demands of the sport. Thus, the here presented manuscripts provide a first contribution to how construal level theory can be applied to varying task demands in performance oriented tasks.

Conclusive results were not obtained with regards to imagery use by athletes, though recent literature on the connection between imagery and action identification suggests that they can indeed be integrated, just in a different manner than proposed (Libby & Eibach, 2011; Libby, Shaeffer, & Eibach, 2009; Mcisaac & Eich, 2002). In one of the presented studies, it was hypothesized that construal levels might impact imagery, however, a different interpretation can be that inducing imagery instead impacts construal levels. A recent study conducted by Shaeffer, Libby, and Eibach (2015) showed that, when the authors induced a change in visual perspective in participants' imagery, this resulted in concrete (for first-person perspective) versus abstract (for third-person perspective) construal of subsequent unrelated actions. This finding suggests that imagery is another type of intervention capable of inducing construal levels and not, as first assumed, an explanatory factor for the mechanisms behind construal level effects. Of course, the relation might not be as straightforward as proposed here, but certainly it cannot be discounted that the two are associated in some form. More research into construal levels should improve our understanding of the relationship between construal levels and imagery, especially the directionality of this relationship.

With regards to the functioning of construal level theory beyond the athletic domain, further studies can, for example, investigate the interaction of abstraction and concreteness with different task demands. As an extension of the present thesis, studies have been conducted by employing the use of computerized tasks that mimic reactive environments, investigating construal level framings similar to the ones employed in the present research but without the motor component required to execute sport performance (Kacperski & Ulloa, 2016). Further investigations of task demands that benefit from the application of construal levels will be necessary to ascertain the here tested relationship between task characteristics and construal level. Additionally, investigating characteristics beyond the static/reactive dichotomy could yield interesting results when combined with construal level theory.

Practical Implications

The wealth of research conducted on construal level theory in the past fifteen years speaks for CLT's applicability to human decision making and behavior. This thesis proposes a line of inquiry that makes CLT applicable in the sport domain as well. Though the present research is not yet sufficient on its own to recommend the use of construal level interventions to practitioners, a larger body of research in the future might help develop clearer ideas for standardized interventions based on CLT. In particular, it is imaginable that construal level interventions might in the future target athletes' cognitions in a short-term manner through verbal frames, matching athletes' individual cognitive styles and the specific task demands of each sport. The results obtained should generate more research on interventions like the ones proposed in this thesis (i.e., distance framings or feasibility/desirability framings), to further validate them and to examine what mechanisms play a role in their effects on athletes' performance.

A second implication can be derived from ideas regarding the trainability of construal levels. So far, much of the literature on construal levels has focused on individuals who have an innate capacity for switching between abstract and concrete construals easily. More research is needed and can make CLT more practically applicable when focused on individuals who show less skill in using one of the two construals. The idea that some individuals have a clear preference for one of the two construals has existed since the beginnings of action identification theory, which CLT is based on (Vallacher & Wegner, 1989). Findings in this area of research might turn out in line with previous literature discussing imagery ability in terms of vividness, and individual differences inherent therein (Gregg, Hall, & Nederhof, 2005). Following this line of inquiry, long-term engagement with construal levels (equivalent to sport psychological practices such as imagery rehearsal) might prove applicable in cases were individuals find it difficult to either think abstractly or concretely. One case where this might come in handy could be with children, who have been thought to lack the capacity for abstraction until they reach the formal operational stage (Piaget, 1972). While it is difficult to easily separate individuals' linguistic abilities from their capacity for various mental construals, some previous research, for example on construal levels and its effects on creativity, indicates that children can be successfully framed with for example spatial distance manipulations to induce a change in construal levels (Liberman, Polack, Hameiri, & Blumenfeld, 2012). If CLT turns out to be indeed a useful framework for improving sport performance in particular tasks, long-term engagement can prove both beneficial in terms of sportive success, and also give more insights into the mechanisms at play.

Finally, one main contribution from the present thesis is the development of a methodology that allows the quantitative analysis of qualitative data. In a time where computerized analysis of data is widely available, a tool that helps with the analysis of qualitative data has often been called for (Bazeley, 2010; Huber & Garcia, 1991; Kelle, 2004) but has not yet been presented and demonstrated as in the present thesis. In terms of practical application, mixed methods analysis can help increase validity of results by joining benefits from qualitative and quantitative methods and corroborating information across both results sets. Researchers of qualitative and quantitative methodologies are invited to make use of the provided materials and validate both the methodology as well as findings from their own studies by attempting mixed methods research through co-occurring coding and statistical analysis of overlapping codes in the future.

Conclusions

The research presented in this dissertation yields some initial insights into a novel intervention approach, based on the construal level theory framework. A major contribution is the development of a new mixed methods analysis tool to assist in the integration of qualitative and quantitative data.

By presenting an investigation into imagery abstraction and concreteness, this thesis offers a new direction for the research of imagery processes with elite athletes. It additionally advances sport imagery theory by focusing on spontaneous and directed imagery (as opposed to rehearsed imagery) and offers some ideas how to further investigate these processes.

The present results can also be a stepping stone for the development of future experimental designs in sport psychology for researchers that wish to use a more cognition focused approach. The application of behavioral change mechanisms to sport can be a fruitful avenue of future research, for example to examine how framing and nudging interventions direct sport cognitions, athletes' use of imagery, and sport performance.

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APPENDICES

Appendix A – Documents Supporting Manuscript 1 – Interview Guide

MANUSCRIPT 1 – Interview Guide

Section 1 - Introduction/Building Rapport: To begin, I would like to get some general information about you as an athlete

What kind of sport do you play; how long have you played, how many competitions/ at what level?

Section 2 – Inquiry about athlete's sport in practice and competition

1) How do you usually practice/ How do you prepare for competition?

2) Please describe what goals you set for yourself in respect for your sport, i.e. practice versus competitive goals (Probes: more detail: what is practice like; what is competition like)

3) How do you set them?

Section 3 – Inquire about imagery - time-dimensional imagery use in relation to the distance from their competition (i.e., the days and morning before the competition; at the competition right before the actual athletic performance; and at the competition while performing)

Some of the questions might be hard to answer on first thought as they are very general; I encourage you to think about any question for a moment before answering. Take all the time you need. There are no right or wrong answers, anything that comes to your mind will be very helpful, as this is explorative, and the more information and ideas are generated, the better!

1) I would like you to think back to a competition you remember very well. If you think back to a day before, or the morning before arriving at the competition, what happens then? Can you describe what goes through your head at this time, for example what kind of imagery (goal setting)? How helpful or effective do you think is this for your performance?

2) If you think back to the time during competition, the beginning of the competition for example, what happens then? Can you describe what goes through your head at this time, for example what kind of imagery (goal setting)? How helpful or effective do you think is this for your performance?

3) If you think back to the time during your performance, while you are running/in the match, what is happening? Can you describe what goes through your head at this time, for example what kind of imagery (goal setting)? How helpful or effective do you think is this for your performance?

Additional questions:

- Are you usually able to implement what you imagine? If yes, how? If not, why not?
- How do you imagine yourself in these situations? First person/third person? How vivid/fuzzy/detailed are you? Is your opponent, your environment?
- Finally, is there anything else that you would like to add?
- Are there any additional questions you think I should ask?

Appendix B – Documents Supporting Manuscript 1 – Parameter Tests

MANUSCRIPT 1 – Results from testing parameter requirements

Table 3 - Results of normality and homogeneity of variances tests.

Shapiro-Wilk normality tests and Bartlett's K^2 test for homogeneity of variances on residuals of all factor combinations reported in the manuscript, i.e. mixed design ANOVAs with coded text units as within factor and sport types as between factor.

Code combinations tested	**Shapiro-Wilk normality**	**Bartlett's K^2**
Time points of imagery use	W = .98, p = .56	K^2 = 5.07, df = 9, p = .83
Effectiveness of imagery	W = .98, p = .86	K^2 = 2.65, df = 3, p = .45
Construal level of imagery	W = .96, p = .44	K^2 = 1.26, df = 3, p = .74
Construal level and effectiveness of imagery	W = .97, p = .23	K^2 = 1.15, df = 7, p = .18
Construal level of unhelpful imagery	W = .98, p = .94	K^2 = .002, df = 3, p = 1
Construal level of helpful imagery	W = .96, p = .52	K^2 = 1.57, df = 3, p = .14
Construal level of imagery at all time points	W = .97, p = .28	K^2 = 2.57, df = 7, p = .92
Construal level and effective-ness of imagery, all time points	W = .95, p =.002	K^2 = 31.95, df = 15, p = .007
Construal level and effective-ness before competition	W = .98, p = .59	K^2 = 2.53, df = 7, p = .92
Construal level of helpful imagery before competition	W = .96, p = .55	K^2 = .056, df = 3, p = .99
Construal level of unhelpful imagery before competition	W = .97, p = .72	K^2 = .753, df = 3, p = .86
Construal level and effective-ness during performance	W = .97, p = .34	K^2 = 4.203, df = 7, p = .76
Construal level of helpful imagery during performance	W = .96, p = .54	K^2 = .643, df = 3, p = .88
Construal level of unhelpful imagery during performance	W = .96, p = .45	K^2 = .288, df = 3, p = .96

Appendix C – Documents Supporting Manuscript 1 – Figures A1 to A5

MANUSCRIPT 1 – Figures A1 to A5 (document figures 5 to 9)

Figure A1

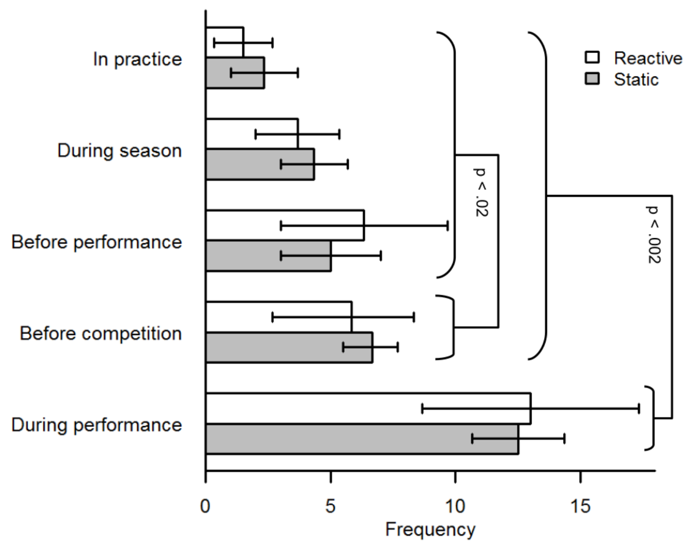

Figure 5. Reported imagery codes over 5 time distances in and around competition. Frequency is the number of coded text units on average per participant. No differences between sports (light and dark bars) were found. Reported permutation p-values refer to individual comparisons between each of the codes (combined for both sport types). Error bars represent bootstrapped 95% confidence intervals.

Figure A2

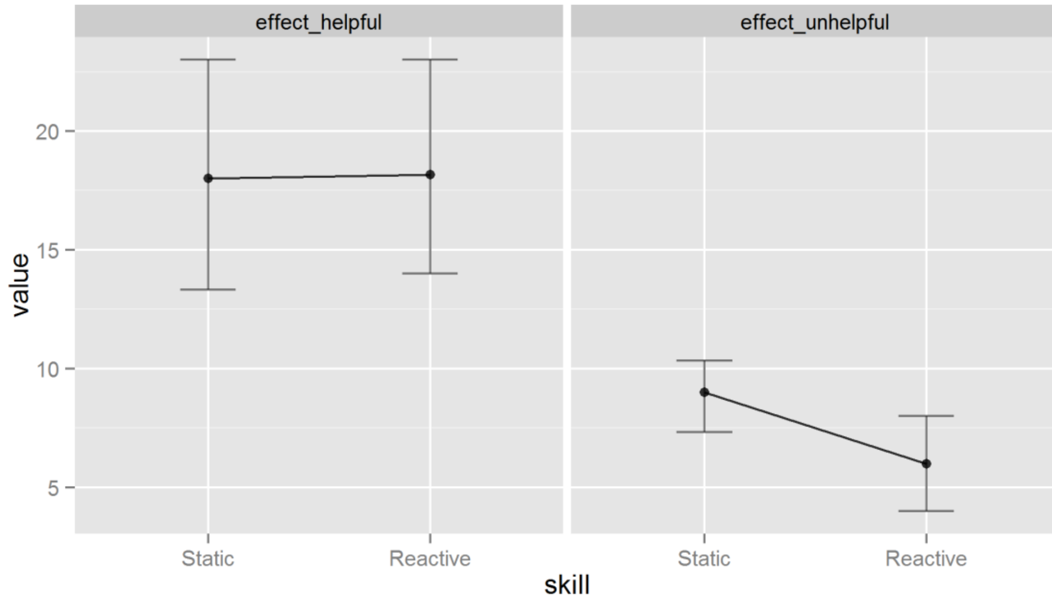

Figure 6. Interaction of effectiveness and sport type. Value refers to frequency of code per participant. Skill refers to sport type. Error bars are bootstrapped 95% confidence intervals.

Figure A3

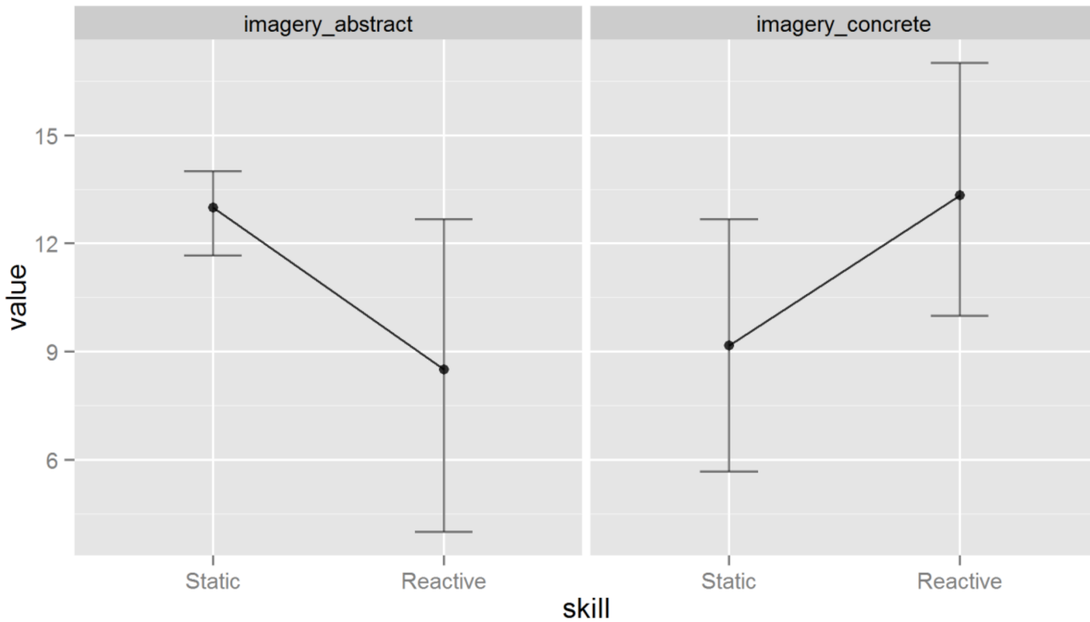

Figure 7. Interaction of imagery construal level and sport type. Value refers to frequency of code per participant. Skill refers to sport type. Error bars are bootstrapped 95% confidence intervals.

Figure A4

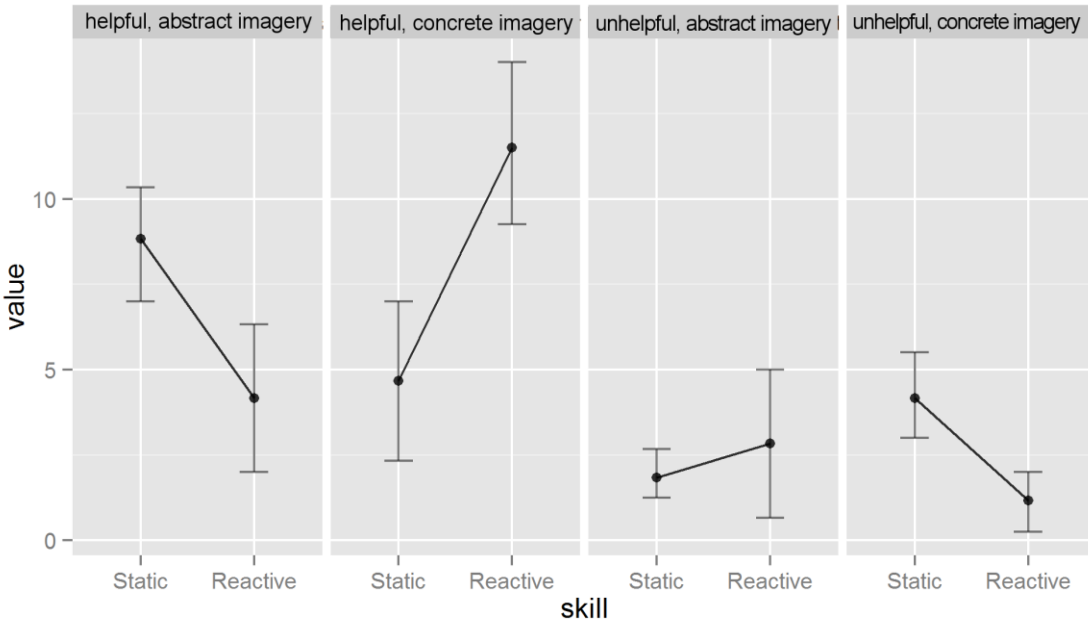

Figure 8. Interaction of imagery construal level, effectiveness and sport type. Value refers to frequency of code per participant. Skill refers to sport type. Error bars are bootstrapped 95% confidence intervals.

Figure A5

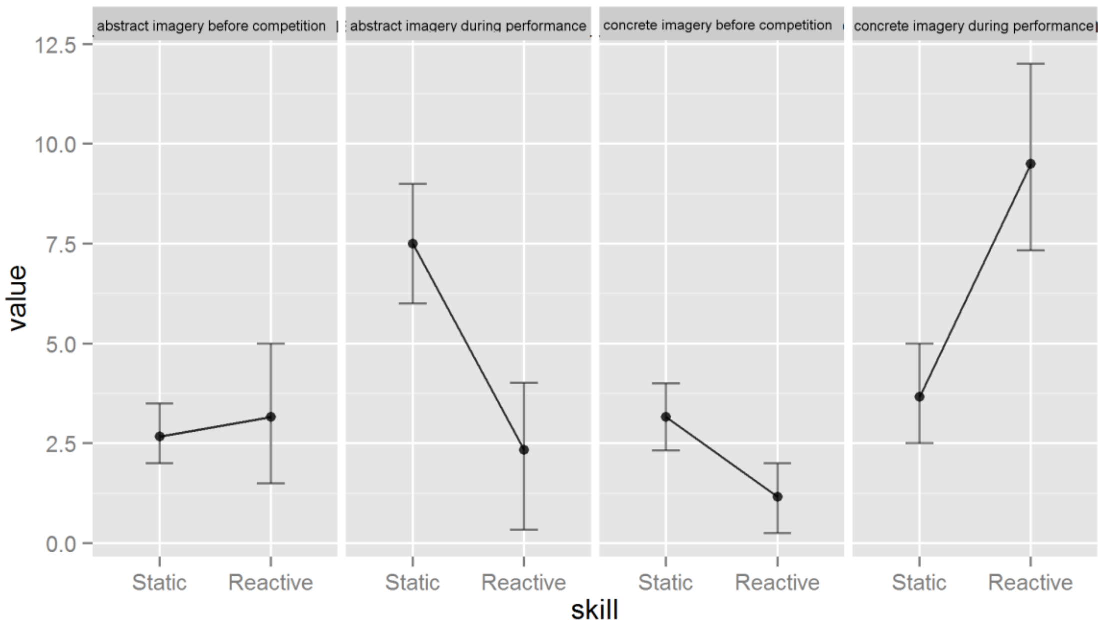

Figure 9. Interaction of time, imagery construal level and sport type. Value refers to frequency of code per participant. Skill refers to sport type. Error bars are bootstrapped 95% confidence intervals.

Appendix D – Documents Supporting Manuscript 2 Study 1

MANUSCRIPT 2 – Study 1

Demographic Questionnaire

Please fill in the blank or check the appropriate answer:

Age: __________

Gender: __________________

How many years have you played your sport? __________

Please select the highest level at which you have competed:

_____ Regional level

_____ Provincial level

_____ National level where: _______________________

_____ International level where: _______________________

How many days per week do you practice (i.e., outside of competitions/games)?

____

Have you had any contact with sport psychological interventions before?

□ if yes, please give more information: □ no

____

MANUSCRIPT 2 – STUDY 1 QUESTIONNAIRE Cont

BIF – Behavior Identification Form

Any behavior can be described in many ways. For example, one person might describe a behavior as "writing a paper," while another person might describe the same behavior as "pushing keys on the keyboard." Yet another person might describe it as "expressing thoughts." This form focuses on your personal preferences for how a number of different behaviors should be described. Below you will find several behaviors listed.

After each behavior will be two different ways in which the behavior might be identified. For example:

Attending class

a) sitting in a chair or b) looking at a teacher

Your task is to choose the identification, a) or b), that best describes the behavior for you. Simply circle the option you prefer. Be sure to respond to every item. Please mark only one alternative for each pair. Remember, mark the description that you personally believe is more appropriate for each pair.

Joining the Army
a) Helping the Nation's defense or b) Signing up

Washing clothes
a) Removing odors from clothes or b) Putting clothes into the machine

Picking an apple
a) Getting something to eat or b) Pulling an apple off a branch

Chopping down a tree
a) Wielding an axe or b) Getting firewood

Paying the rent
a) Maintaining a place to live or b) Writing a check

Voting
a) Influencing the election or b) Marking a ballot

Taking a test
a) Answering questions or b) Showing one's knowledge

Eating
a) Getting nutrition or b) Chewing and swallowing

MANUSCRIPT 2 – STUDY 1 QUESTIONNAIRE Cont.

After each performance, please respond to the following statements with the number corresponding on the following scale:

(1) (2) (3) (4) (5) (6) (7)

Not at all **Very much**

Nr 1	**Nr 2**	**Nr 3**
How satisfied are you with your performance? Number: _________	How satisfied are you with your performance? Number: _________	How satisfied are you with your performance? Number: _________
		How vivid was your imagery? Number: __________
		How helpful was your imagery for your performance? Number: _________
Result:	**Result:**	**Result**:

After each performance, please respond to the following statements with the number corresponding on the following scale:

(1) (2) (3) (4) (5) (6) (7)

Not at all **Very much**

Nr 4	**Nr 5**	**Nr 6**
How satisfied are you with your performance? Number: _________	How satisfied are you with your performance? Number: _________	How satisfied are you with your performance? Number: _________
How vivid was your imagery? Number: __________	How vivid was your imagery? Number: __________	How vivid was your imagery? Number: __________
How helpful was your imagery for your performance? Number: _________	How helpful was your imagery for your performance? Number: _________	How helpful was your imagery for your performance? Number: _________
Result:	**Result:**	**Result**:

Appendix E – Documents Supporting Manuscript 2 Study 2

MANUSCRIPT 2 – Study 2

BIF – Behavior Identification Form

Any behavior can be described in many ways. For example, one person might describe a behavior as "writing a paper," while another person might describe the same behavior as "pushing keys on the keyboard." Yet another person might describe it as "expressing thoughts." This form focuses on your personal preferences for how a number of different behaviors should be described. Below you will find several behaviors listed.

After each behavior will be two different ways in which the behavior might be identified. For example:

Attending class

a) sitting in a chair or b) looking at a teacher

Your task is to choose the identification, a) or b), that best describes the behavior for you. Simply circle the option you prefer. Be sure to respond to every item. Please mark only one alternative for each pair. Remember, mark the description that you personally believe is more appropriate for each pair.

Joining the Army
a) Helping the Nation's defense or b) Signing up

Washing clothes
a) Removing odors from clothes or b) Putting clothes into the machine

Picking an apple
a) Getting something to eat or b) Pulling an apple off a branch

Chopping down a tree
a) Wielding an axe or b) Getting firewood

Paying the rent
a) Maintaining a place to live or b) Writing a check

Voting
a) Influencing the election or b) Marking a ballot

Taking a test
a) Answering questions or b) Showing one's knowledge

Eating
a) Getting nutrition or b) Chewing and swallowing

Demographic Questionnaire

Please fill in the blank or check the appropriate answer:

Age: ___________

Gender: ____________________

How many years have you played your sport? ___________

Please select the highest level at which you have competed:

_____ Regional level

_____ Provincial level

_____ National level where: _________________________

_____ International level where: _________________________

How many days per week do you practice (i.e., outside of competitions/games)?

____

Have you had any contact with sport psychological interventions before?

□ if yes, please give more information: □ no

____

MANUSCRIPT 2 – STUDY 2 QUESTIONNAIRE Cont.

Please use the space below to describe what thoughts or images were in your mind before or during your match point, in a few sentences or bullet points:

How successful was your rally/match regarding your technique?

(1) (2) (3) (4) (5) (6) (7)

Very unsuccessful **Very successful**

If you had any thoughts or images in your mind in this round, how clear were they?

(1) (2) (3) (4) (5) (6) (7)

Very unclear **Very clear**

How helpful were the thoughts that you described above in achieving your best shot?

(1) (2) (3) (4) (5) (6) (7)

Very unhelpful **Very helpful**

Appendix F – Ethics Approval Documents

MANUSCRIPT 1 – Ethics Approval

Western Research

Research Ethics

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Craig Hall
File Number:103322
Review Level: Full Board
Approved Local Adult Participants: 24
Approved Local Minor Participants: 0
Protocol Title: A qualitative analysis of goal construal level in sport
Department & Institution: Health Sciences\Kinesiology,Western University
Sponsor:
Ethics Approval Date: January 31, 2013 **Expiry Date:** December 31, 2013

Documents Reviewed & Approved & Documents Received for Information:

Document Name	Comments	Version Date
Other	Interview Guide	2012/12/11
Western University Protocol		2012/12/11
Letter of Information & Consent	Revision of LoI and Consent Form	2013/01/27
Letter of Information & Consent	Revision of Letter of Information and Consent Form	2013/01/27

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above named research study on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussions related to, nor vote on, such studies when they are presented to the NMREB.

The Chair of the NMREB is Dr. Riley Hinson. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Ethics Officer to Contact for Further Information

✓ Grace Kelly (grace.kelly@uwo.ca)	Janice Sutherland (jsutherl@uwo.ca)

This is an official document. Please retain the original in your files.

Western University, Research, Support Services Bldg., Rm. 5150
London, ON, Canada N6A 3K7 t. 519.661.3036 f. 519.850.2466 www.uwo.ca/research/services/ethics

MANUSCRIPT 2 – Ethics Approvals

Western Research

Research Ethics

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Craig Hall
File Number: 103321
Review Level: Full Board
Approved Local Adult Participants: 40
Approved Local Minor Participants: 0
Protocol Title: Effects of goal construal level on athletic performance in a dynamic or stable task context
Department & Institution: Health Sciences\Kinesiology,Western University
Sponsor:
Ethics Approval Date: January 31, 2013 **Expiry Date:** January 31, 2014

Documents Reviewed & Approved & Documents Received for Information:

Document Name	Comments	Version Date
Other	Email Text	2012/12/08
Western University Protocol		2012/12/11
Letter of Information & Consent	Revised LoI and Consent Track-and-Field	2013/01/28
Letter of Information & Consent	Revised LoI and Consent TT	2013/01/28
Other	Revised Questionnaires and Demographics	2013/01/27

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above named research study on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussions related to, nor vote on, such studies when they are presented to the NMREB.

The Chair of the NMREB is Dr. Riley Hinson. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Ethics Officer to Contact for Further Information

✓ Grace Kelly grace.kelly@uwo.ca	___ Janice Sutherland jsutherl@uwo.ca

This is an official document. Please retain the original in your files.

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STUDY 2 ETHICS APPROVALS Cont.

Western Research

Research Ethics

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. Craig Hall
File Number:103321
Review Level: Delegated
Protocol Title: Effects of goal construal level on athletic performance in a dynamic or stable task context
Department & Institution: Health Sciences\Kinesiology,Western University
Sponsor:
Ethics Approval Date: December 09, 2013 **Expiry Date:** January 31, 2014

Documents Reviewed & Approved & Documents Received for Information:

Document Name	Comments	Version Date
Instruments	Manipulation Check questionnaire	
Revised Letter of Information & Consent		
Revised Western University Protocol	Adding golf participants, a written frame and a questionnaire at the end of the task performance.	

This is to notify you that The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the applicable laws and regulations of Ontario has granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above.

This approval shall remain valid until the expiry date noted above assuming timely and acceptable responses to the NMREB's periodic requests for surveillance and monitoring information.

Members of the NMREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussions related to, nor vote on, such studies when they are presented to the NMREB.

The Chair of the NMREB is Dr. Riley Hinson. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Ethics Officer to Contact for Further Information

Grace Kelly [illegible]	Vikki Tran [illegible]	Mina Mekhail [illegible]	Erika Basile [illegible]

This is an official document. Please retain the original in your files.

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STUDY 2 ETHICS APPROVALS Cont.

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Amendment Approval Notice

Principal Investigator: Dr. Craig Hall
Department & Institution: Health Sciences\Kinesiology,Western University

NMREB File Number: 103321
Study Title: Effects of goal construal level on athletic performance in a dynamic or stable task context
Sponsor:

NMREB Revision Approval Date: November 10, 2014
NMREB Expiry Date: May 31, 2015

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Revised Western University Protocol	Badminton and Soccer	2014/10/02

The Western University Non-Medical Science Research Ethics Board (NMREB) has reviewed and approved the amendment to the above named study, as of the NMREB Amendment Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

EB Chair

Ethics Officer to Contact for Further Information

Erika Basile ebasile@uwo.ca	Grace Kelly grace.kelly@uwo.ca	Mina Mekhail mmekhail@uwo.ca	Vikki Tran vikki.tran@uwo.ca

This is an official document. Please retain the original in your files.

Western University, Research, Support Services Bldg., Rm. 5150
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CURRICULUM VITAE

Name:	Celina Sylwia Kacperski
Post-secondary Education and Degrees:	University of Heidelberg Heidelberg, Germany 2006 – 2011 Diplom (joint B.Sc./M.Sc.) - Psychology
	University of Western Ontario London, Ontario, Canada 2012 – 2016 Doctor of Philosophy - Sport Psychology
	University of Mannheim/University of Heidelberg Heidelberg, Germany 2016 – 2019 Postdoctoral Researcher - Environmental Psychology
Notable Honours and Awards:	Mitacs Globalink Research Award 2015 Value: $5, 000
	Vanier Canada Graduate Scholarship (SSHRC) 2013-2016 Value: $150, 000
	Research Western Financial Grant 2013-2016 Value: $10, 000
	Western Graduate Research Scholarship (WGRS) 2012-2016 Value: Tuition + $12,000 per year
	Franz-Weinert Prize Awarded for best M.Sc. thesis of graduation class 2011 2011

Publications:

Journal Articles

Kacperski, C., Ulloa, R., & Hall, C.R. (accepted). Do athletes imagine being the best, or crossing the finish line first? A mixed methods analysis of construal levels in elite athletes' spontaneous imagery. *Journal of Mixed Methods Research*.

Kacperski, C., & Hall, C. (2016). Do construal levels affect athletes' imagery and performance outcomes? It depends on the task! *Journal of Applied Sport Psychology*, 1–16. doi:10.1080/10413200.2016.1220992

Kacperski, C., & Kutzner, F. L. (2016). Adherence to tactical choices mediates regulatory fit effects in table tennis. International Journal of Sport and Exercise Psychology, 1–9. doi:10.1080/1612197X.2016.1199581

Ulloa, R., **Kacperski**, C., & Sancho, F. (2016). Institutions and cultural diversity: Effects of democratic and propaganda processes on local convergence and global diversity. PLOS ONE, 11(4), 1–26. doi:10.1371/journal.pone.0153334

Publications in Preparation

Kacperski, C., Tobin, D., Hall, C.R., & Law, B. (2016) How to succeed in PE class: The when, what and why of children's use of imagery.

Kacperski, C. & Ulloa, R. (2016). Effects of a desirability and feasibility frame on performance in a computerized shooting task.

Kutzner, F., **Kacperski**, C., Read, D., & Chater, N. (2016). Unlikely Events in Contingency Judgments: Evidence for Caution.

Book Publications

Kohn, R., Reich, P., **Kacperski**, C. (2011). Looking After Sexual Health: Dokumentation und Evaluation. Ein Projekt für die sexuelle Gesundheit schwuler Jugendlicher und junger Erwachsener. Ludwigshafen: BB Druck & Service. (A project for the sexual health of gay youth and young adults).

Related Work Experience

Teaching

Teaching instructor for selected lectures, Western University
Psychological Interventions in Sport, Exercise and Injury
2015
Introduction to Exercise Psychology
2014

Teaching assistant, Western University
Psychology of Sport
2012

Teaching instructor & course coordinator, Mannheim University
Specific problems of consumer psychology
2011

Independent Study Supervisor
Body language and power posing in soccer
Construal level effects on imagery use in soccer
Construal level effects on imagery use in hockey

Reviewer
Journal of Applied Sport Psychology
Journal of Imagery Research in Sport and Physical Activity
In-Mind Magazine