Conceptual Metaphor and Spatial Representations of Time: The Role of Affect

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Statement of Authentication

This thesis is submitted in partial fulfilment of the requirements for the Doctorate of Philosophy degree. To the best of my knowledge, this is my own work except where otherwise specified. I hereby declare that I have not presented this material, either in whole or in part, for a degree at another institution.

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LIST OF ABBREVIATIONS

AQ	(approach question)
CMT	(conceptual metaphor theory)
EA	(ego-agency)
EI	(emotion induction)
EIP	(emotion induction procedure)
ME	(moving-ego perspective)
MT	(moving-time perspective)
NA	(negative affect)
PA	(positive affect)
TA	(time-agency)
TAQ	(temporally ambiguous question)

ABSTRACT

Conceptual metaphor involves understanding abstract concepts (e.g., time) in terms of more concrete bodily experiences (e.g., spatial location and movement). Research has identified two different spatio-temporal metaphorical perspectives on time, as reflected in the contrast between "Christmas is coming" and "We are approaching Christmas". It has been found that which perspective is chosen can depend on the perceiver's situation and experience. Four recent studies (Hauser, Carter, & Meier, 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond, Clare Wilson, & Zinken, 2012) examined the role of emotion on choice of temporal perspective. The current project sought to address the anomalous results and several key issues arising from those studies. First, a series of critical questions were developed and discussed from interrogating the wider research literature on the two spatio-temporal metaphors and from conducting a research synthesis that examined methodological and statistical issues in that wider literature. This was followed by two experiments. The first experiment tested which of two emotion-induction methods, text or film, would be more effective. The second experiment examined the effect of induced emotion (via text) and event valence on choice of spatio-temporal metaphor. Participants ($n = 504$) were randomly assigned to one of nine experimental conditions, each participant having either a positive, negative, or neutral emotion induced and responding about an event that was either positive, negative or neutral. Additional measures were taken of trait test anxiety, social anxiety, and more general negative emotional states. Emotion induction was effective and there was a significant difference in some responses for traits and for more general negative emotional states. No other significant differences were found. The combined results of the literature interrogation, research synthesis, and experiments are discussed in light of the changing climate in psychology favouring a broader approach to science that includes conceptual analysis, null results, and replications. It is argued that the project has highlighted a previously unacknowledged relationship between emotion, event valence, and temporal perspective, and has revealed a general misunderstanding regarding the interpretation of responses on the standard measures used. This suggests redirection along more fruitful lines of future research into the effect of emotion on choice of spatio-temporal metaphor.

CHAPTER 1

Introduction: A Broader Scientific Approach Combining Conceptual Analysis and Empirical Investigation

In a recent paper encouraging psychology to adopt a richer view of the scientific method Machado and Silva (2007) point out that this enrichment could be achieved by bringing back the focus on conceptual (or logical) analysis. According to Machado and Silva, there are three recognizable activity-clusters that comprise the scientific method: experimentation, mathematization, and conceptual analysis. However, psychology has devalued and neglected the last of these in favour of the “two major novelties” of the scientific revolution: “experimentation and quantification” (2007, p. 679). This has left psychology with an impoverished view of scientific method and has thus compromised its commitment to scientific investigation.

Science is the study of the natural world, and so, by logical implication, whatever exists in the natural world (e.g., entities, meanings, relations, psychological phenomena) is open to scientific investigation. At the core of science is a conception of *critical inquiry* that was introduced in the Western tradition by the ancient Greeks. Critical inquiry is premised on the recognition of human cognitive fallibility, such that scientific investigation is a process of employing our best available error-detection mechanisms and strategies. In that respect, scientific method is “simply the pursuit of truth as determined by *logical* [emphasis added] considerations” (Cohen & Nagel, 1934/2002, p. 192). As part of scientific method, conceptual analysis encompasses the actions researchers engage in when they seek to understand and evaluate their field of study. Examples of such actions include assessing concepts for clarity and coherence, scrutinising scientific hypotheses for precision and for logical derivation from theory, evaluating arguments for coherence and for any unstated but important assumptions, and assessing conclusions arising from empirical data for clarity and for consistency with stated hypotheses and theories. Taken together, these activities reveal that scientific research encompasses both theoretical/conceptual research and empirical research, and that logic is necessary at all stages of evaluating and conducting psychological research (see Michell, 2010; Petocz & Newbery, 2010). In sum, conceptual analysis can help to clarify theoretical concepts, to inform empirical research, and to position empirical findings within coherent theoretical frameworks.

A recent example of the return of conceptual analysis has been the steadily increasing groundswell of critical scrutiny of experimental research programs in psychology including questioning the appropriateness of the statistical analyses employed and the accuracy of the values reported (e.g., Bakker & Wicherts, 2011, 2014; Nuijten, Hartgerink, van Assen, Epskamp, & Wicherts, 2015; Wicherts, Bakker, & Molenaar, 2011).

The present thesis is located within this recent critical groundswell and adopts the recommendation of Machado and Silva (2007) to include conceptual analysis within a broader conception of scientific method. The focus of the thesis is a particular area of cognitive science, that of conceptual metaphor, and a particular area of conceptual metaphor, perceptions of (abstract) time and temporal events in terms of (concrete) space and physical movement, and how such perceptions might be influenced by emotion.

Over the last three decades, the conception of cognition has gradually expanded from the computer model of "first-generation" cognitive science to the idea of cognition as being embodied and intimately connected to bodily and emotional experiences. Embodied cognition connects body, brain, and environment and recognises that each interacts with the other (Clark, 1997, 2011; Gallagher, 2005, 2008; Kövecses, 2005; Wheeler, 2005). This has been called "embodied-embedded cognitive science" (Wheeler, 2005, p., 11) and "second-generation" cognitive science (Kövecses, 2005, p. 169; Lakoff & Johnson, 1999, p. 75). Supporters of this shift argue that in first-generation cognitive science the computer model represents a disembodied mind, sitting apart from the body in a Cartesian fashion, operating via abstract mental processes. In contrast, second-generation cognitive science encompasses an embodied mind, a mind that interacts with both its body's structure and its body's sensorimotor experiences in the environment (Gallagher, 2005; Kövecses, 2005; Lakoff & Johnson, 1999). Part of this expanded field of cognitive science is occupied by the notion of conceptual metaphor.

Conceptual metaphor involves our tendency to think of abstract concepts (such as the mind) in terms of more concrete or bodily experiences (such as a container). According to proponents of Conceptual Metaphor Theory (CMT), such metaphors are not merely linguistic devices but are part of how we think and act (Gibbs, 1994, 2006; Johnson, 1987; Lakoff, 1987, 1993, 2003; Lakoff & Johnson, 1980, 1999; Turner, 1996).

One conceptual metaphor that has been the subject of recent empirical research is that of spatio-temporal conceptual metaphor – that is, our perception of time and temporal events in terms of space and movement. Empirical evidence supports not only a relation between space and perception of time but also a relation between movement (something that can be experienced) and the perception of an event's movement through time (an abstract concept) (e.g., Boroditsky, 2000; Boroditsky & Ramscar, 2002; Duffy, Feist, & McCarthy, 2014; Sullivan & Barth, 2012).

Conceptual analysis suggests a further link, that between motion and emotion, and thus a possible link between the emotional state of a perceiver and how that perceiver thinks of an event's movement through time. Empirical investigation of this link between spatio-temporal conceptual metaphor and emotion is relatively new, and, as such, is understandably restricted to a mere handful of studies. Yet even at this early stage it has – intriguingly - produced mixed results (see Hauser, Carter, & Meier, 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond, Clare Wilson, & Zinken, 2012). For these reasons, and particularly in view of the emerging *zeitgeist* of increased research accountability, it is worth devoting extra attention to the conceptual and methodological issues of the emerging research program. Such attention may help this new field to develop in directions that are theoretically sound and empirically fruitful. The aim of the present thesis is to contribute to that venture.

Therefore, in adopting the broader conception of scientific method the thesis includes a comprehensive research synthesis and meta-analysis that involves scrutiny of both conceptual and empirical issues. As such, it includes conceptual analysis of theoretical issues that have not yet received close enough attention. Specifically, this involves addressing questions concerning: the nature and location of affect; the relation between affect and motion (in terms of approach and avoidance); the metaphorical time-perspectives that have been identified in existing research; and the assumptions underlying the standard approach to assessing these perspectives. The conceptual analysis is then extended to methodological issues in the empirical research that pertain to questions of control conditions, statistical analysis and reporting. Finally, what emerges from the conceptual analysis via the research synthesis is used to inform two new experimental investigations. In these, a more complex approach is adopted than that which has so far appeared in the literature. The first empirical investigation compares two emotion induction procedures using the same dependent measure, allowing selection of the better procedure for the subsequent main study. This is an aspect of the research area that has remained relatively underexplored to date (Martin, 1990). The second experimental investigation attempts to separate out the role of emotion in how individuals perceive an event's movement through time. This involves the same dependent variables as have been used in previous research, but the analysis and interpretation of these variables takes on added complexity to reflect previously unacknowledged relationships between emotion, event valence, and spatio-temporal perception and to highlight a current misunderstanding regarding the dependent variables themselves. It is argued that, by adopting this broader scientific approach, an enriched understanding has been provided of the relation between spatio-temporal conceptual metaphor and emotion, and that this enriched understanding can be fruitfully applied to future research in the field.

The thesis is developed across seven chapters. Chapter 2 examines the theoretical foundations for conceptual metaphor theory, considering where a theory of embodied cognition is situated within the discipline of cognitive science, what conceptual problems have been inherited in the shift from first-generation to second-generation cognitive science, and where that leaves Conceptual Metaphor Theory (CMT). Chapter 3 addresses spatio-temporal conceptual metaphor, focusing on how our experience of space and movement informs our perception of an event's movement through time, and presenting empirical evidence for that relationship. Chapter 4 discusses how emotion and event valence are linked to motion via approach and avoidance motivations and explores how such a link would facilitate a relationship between these affective phenomena and spatio-temporal understanding. Chapter 5 presents an analysis of methodological and statistical issues relating to the research program of spatio-temporal conceptual metaphor. Chapter 6 reports a preliminary experimental investigation comparing film and text as effective emotion-induction procedures. Chapter 7 presents the main study, an experimental investigation of the influence of affect on spatio-temporal metaphor preference. Finally, Chapter 8 presents a general discussion of the results in the light of earlier conclusions from the conceptual and methodological analysis, and offers suggestions for the way ahead.

CHAPTER 2

Embodied Cognition and Conceptual Metaphor

Cognitive science, a multidisciplinary field studying how humans think, encompasses disciplines from within and outside of psychology including anthropology (e.g., Csordas, 1994, 1999a, 1999b; Kimmel, 2008; Lock, 1993), computer science (e.g., Brooks, 1991a, 1991b; Husbands, Harvey, & Cliff, 1995), developmental psychology (Thelen, 2000; Thelen, Schöner, Scheier, & Smith, 2001), psycholinguistics (e.g., Casasanto, 2011; Lakoff & Johnson, 1980, 1999), and neuroscience (e.g., Panksepp, 1998). This chapter sets the scene for the investigation by providing the background and context. It describes the evolution of cognitive science from a disembodied to an embodied perspective, and examines a number of issues with each perspective via a review of some of the theoretical and empirical literature. It then locates the emergence of Conceptual Metaphor Theory (CMT) and addresses its theoretical background, the empirical evidence, and some of the more prominent criticisms that have been levelled against it. It concludes with the claim that CMT can survive these criticisms and that empirical research in conceptual metaphor can be fruitfully pursued from within a coherent realist theoretical framework.

First-Generation Cognitive Science: A Disembodied Perspective

The cognitive revolution of the 1950s that ultimately gave rise to cognitive science occurred as a reaction against behaviourism[1] and its focus on psychology as a science of overt behaviour. In a critique of B. F. Skinner's *Verbal Behaviour* (1957), a behavioural treatment of language and communication, Chomsky (1959) demonstrated, via conceptual analysis, the necessity of cognition as mediating between stimulus and response. For example, in response to a painting hanging on a wall (stimulus), one person might say "Beautiful", while another might

[1] For the first half of the twentieth century behaviourism was the dominant paradigm in the British and American traditions, what I shall call mainstream psychology, but behaviourism was not dominant in other countries (e.g., in parts of Continental Europe and some of the developing countries).

say “Clashes with the wallpaper”. What the person is thinking when looking at the painting determines his or her response, and so we cannot predict a person’s response solely on the basis of knowing the external stimulus. By omitting cognition from scientific study, Skinner, and behaviourists in general, had been “play-acting at science” (Chomsky, 1959, p. 39). The return of cognition as an area of study coincided with developments in areas such as neuroscience, artificial intelligence, and information processing (Gardner, 1987). It was believed that by understanding how electronic computers process information we can understand how humans *think* (Newell & Simon, 1961, 1972). As a result, within this first-generation cognitive science, the computer analogy that psychology adopted involved both a symbol processing approach to cognition and a disembodied view of cognition.

With respect to the first of these, the computer analogy for understanding human cognition was claimed by Fodor to be “the *only* respect in which contemporary Cognitive Science” (1985, p. 93) had advanced over the preceding two hundred years. In this model, cognition is comprehended as analogous to the computer’s software and the brain is analogous to its hardware. Specifically, information input from sensory and motor systems is transformed (i.e., transduced) and stored as abstract mental symbols (Fodor, 1975; Pylyshyn, 1984) with cognitive processes understood as “formal operations carried out on [these abstract mental] symbol structures” (Pylyshyn, 1980, p. 111). These abstract mental symbols are amodal, that is, they are independent of the sensory and motor systems for perception and action. Moreover, the symbols stand as internal representations of external features of the world. Thus, perception is not direct. Representationism is a central tenet of cognitive science (see Billman, 1998, p. 658; Gardner, 1987, p. 38; Ramsey, 2007, p. xi). Representationist theories of cognition claim that our knowledge of the environment is indirect, that is, our knowledge is mediated by cognitive representations where "[these] representations *refer* to or are *about* the facts or situations known" (Michell, 1988, p. 228). On this view, we do not know the fact or situation *directly*; rather, what we know directly is a cognitive representation via amodal symbols of that fact or situation.

The second main feature of first-generation cognitive science in addition to its representationist approach is what has been identified by critics as neglect of the body. This neglect is unsurprising given that what counts for cognitive processing are the amodal symbols and not the information input from sensory and motor systems which is transduced into the symbols. However, these two characteristics of first-generation cognitive science also comprise its two major problems.

Problem 1: Representationism

The first major problem involves the complex and interrelated set of logical flaws associated with representationism. All of these problems have been presented and discussed in the literature (see Anderson, 1927/1962; Maze, 1983, 1991; McMullen, 2011). However, for the present discussion, the three main problems are the homunculus problem, an inability to accommodate error, and the so-called "semantic problem". Each of these will now be considered in turn.

It is important to understand that any representation requires perceiving the representation and the represented, and seeing that the former refers to the latter. On this understanding, if humans cognise via internal mental representations then one must ask who or what perceives the internal mental representation? This requires an internal perceiver, an homunculus, who is able to perceive the cognitive representation and to link it to its referent in the world. An homunculus is problematic for two reasons. First, how does an homunculus perceive an internal representation? According to the theory, perception must be indirect, so it must be via another internal representation. If so, then to perceive an internal representation an homunculus would need its own homunculus which in turn would need its own homunculus and so on ad infinitum. Moreover, because at each step perception is assumed, rather than explained, the problem of perception is thus endlessly deferred, and so the infinite regress becomes a vicious regress—a question-begging pseudo-explanation. Second, how does this internal perceiver, who has no direct access to the world, match an internal cognitive representation against its referent in the world? Such matching assumes direct perception, but direct perception is denied by representationist theories of cognition. Hence, the theory is self-contradictory and renders pointless the initial postulation of the need for representations. No one is denying that cognition must be neurally instantiated. However, such neural firings are the "*means by which* things are known, and not the things known" (McMullen, 2011, p. 332).

The second problem is that of an inability to accommodate error. If an internal cognitive representation cannot be compared against its referent in the world how would we ever know whether the internal representation and its external referent match or mismatch? Indeed, how could we have ever conceived of the notion of error? This is not without irony considering that representationist theories were developed to account for errors in perception by separating experience (i.e., knowing a cognitive representation) from the truth or falsity of that experience in reality (i.e., the relation of the cognitive representation to reality).

The third problem is widely referred to as the "semantic problem for mental representations"; that is, how do the internal representations acquire their meaning? There are two possibilities, namely, that the meaning of a cognitive representation is understood as being either extrinsic to it or intrinsic to it. Neither of these possibilities is logically sound.

The first possibility is that cognitive representations get their meaning in the same way as do internal computer symbols, that is, the meaning of a representation is extrinsic to it. On this view, the relation between a representation and a fact or situation may be understood in the same way as a relation between conventional symbols and the entities they signify. For a computer, what a symbol signifies is determined by the meaning given to that symbol by an external cogniser (i.e., a programmer). Without a programmer assigning meaning the computer program is merely syntax and “syntax alone is not sufficient for semantics” (Searle, 1984, p. 34). However, unlike a computer, a human does not have an external assigner of meanings, so how can cognitive representations acquire meaning? Let us consider that for an English speaker to know the meaning of the conventional symbol “sun” he or she must also know what this symbol signifies (in this case, the star around which the earth orbits) and that this symbol is used to signify that particular thing. Extending this to cognitive representations then an individual would have to know a fact or situation before knowing what a cognitive representation means. In this case, explaining meaning as extrinsic to a cognitive representation is logically circular; it begs the question by assuming the knowledge it attempts to explain. Thus, at the same time, it undermines the original claim that cognition requires representations.

The second possibility is that the meaning of a cognitive representation may be understood as being intrinsic to it. That is, a cognitive symbol has “one content and no other” (Pylyshyn, 1984, p. 40). However, if this is the case, then, the computer analogy is inapt, because in a computer representation meaning is extrinsic and assigned, and computers may interpret the same symbols in different ways (e.g., as words, numbers, images, etc.). The idea that meaning is intrinsic to a representation is logically flawed as nothing can have intrinsic meaning. That is, meaning involving the three-term symbol-symbolised-cogniser (as discussed above in the “sun” example) is relational and relations are external to the things related (for a review, see Michell, 1988). Therefore, in believing that humans think in the same manner as computers represent, cognitive psychology rests on a mistake (Heil, 1981). Michell provides a summary of the flawed basis of a computer analogy concerning human thinking when he states:

> …the meaning of computer representations is extrinsic but cognitive representations require intrinsic reference….the concept of intrinsic reference is logically incoherent. So, far from being an existence proof of cognitive representations, computers confirm the fact that representation or reference is an external relation. In taking the computer as a model for their theories, representationalists have ignored this fundamental disparity. (1988, p. 231)

If the symbol-processing computer analogy for cognition fails, can any other model be used? The 1980s saw the *classical* view of cognition as being sequential symbol processing replaced with the *connectionist* view of distributed processing of parallel network connections (e.g., Bechtel & Abrahamsen, 1991; Rogers & McClelland, 2004, 2008; Rumelhart, McClelland, & the PDP Research Group, 1986). These two views may differ regarding processing but, despite appearances, each view is representationalist (Bickhard, 1996), hence, susceptible to the same logical flaws discussed earlier. A critical examination of the assumption that mental representation operates similarly to computer representation reveals that such an assumption is flawed. Humans do not think in the same manner as computers represent information whether that information is conceived along classical symbolic lines or along connectionist lines. So when Shapiro asked recently “might the computer metaphor still be of service?” (2007, p. 345), the answer, as demonstrated above, is no (see also, Heil, 1981; McMullen, 2011).[2]

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[2] The answer no refers to the use of the computer analogy to understand how humans are held to possess and use internal mental representations. However, Michell (1988) argues that the computer analogy may be helpful to understand the neural processes underlying cognition but only insofar as the computer is conceived of as a

If the relation between a cognitive representation and a fact or situation cannot be extrinsic or intrinsic then logically a cognitive representation cannot *refer to* a fact or situation (Michell, 1988). Therefore, representationist theories are logically incoherent. The logical incoherence of representationist theories is not acknowledged by Fodor, because he states that "[O]f the semanticity of mental representations we have, as things now stand, no adequate account" (1985, p. 99). This implies that he thinks it is just a matter of time before the adequate account is provided. In turn, it is a mistake to believe that any representationist theory can have empirical support, for a logically incoherent theory cannot be empirically tested (Petocz & Newbery, 2010). Or, to put it another way, any empirical support claimed for such theories is "irrelevant" (Michell, 1988, p. 230). By the same token, the flaws of representationism cannot be avoided via any kind of empirical manoeuvre.

To summarise, by assuming that perception must be indirect and creating the problem of an homunculus, by an inability to accommodate the notion of error, and by the problem of how to account for the semanticity of cognitive representations, representationist theories are shown to be logically incoherent. As a logically flawed theory, representationism cannot provide a coherent basis for research. Thus, the epistemological approach that is representationism must be rejected. Reject representationism and these problems disappear; these problems are "dissolved conceptually" (Machado & Silva, 2007, p. 675). Having rejected mental representationism in any form, what is left is a realisation that the only viable alternative is a non-cognitively-mediated account of cognition, namely, direct realism.

"deterministic system in which outputs are partially caused by the structure of the internal states" (p. 231), but that is not what the representationist wants to use it for.

Solution to Problem 1: A Realist Perspective

Direct realism is the view that cognition is a direct relation between an organism (the knower) and an objective situation (the known) (Anderson, 1927/1962; Maze, 1983; Michell, 1988); that is, cognition is not mediated by internal mental representations. Thus, direct realism avoids the problems associated with representationism that were discussed above. To elaborate, cognition as a direct relation between an organism and an objective situation allows for the checking and matching involved in recognising error, removes any need to postulate an homunculus, and avoids the problems of determining how such internal representations acquire their meaning.

The majority of mainstream psychologists would consider themselves realist; they believe there is “an objective world that includes human minds and behaviour, and these can be investigated scientifically” (Petocz & Mackay, 2013, p. 216). However, there are many types of realism (cf. Archer, Bhaskar, Collier, Lawson, & Norrie, 2013; Harré, 1986, 2012; Petocz & Mackay, 2011; Varela & Harré, 1996). Also, many theorists who *claim* to be realist nevertheless do fall into various forms of anti-realist pronouncements and theorising. Direct realism has often been dismissed and the grounds offered for dismissal reveal that it has been misunderstood. There are three specific misconceptions, namely, that direct realism rejects any kind of mediation, that it guarantees accurate perception, and that it does not accommodate different perspectives of the world. First, direct realism’s rejection of epistemological mediation in no way implies rejection of neurophysiological mediation; all kinds of neural processes, including patterns of neural activation, are acknowledged by realism to be involved during cognition. However, to say that perception or cognition is “direct” is to say that such neural processes are not themselves perceived or cognised; they are the neural means by which perceiving is enabled.

Second, a direct (i.e., epistemologically unmediated) relation does not entail accuracy. To illustrate, on seeing a green fruit in a bowl we may believe we have seen an apple, when the fruit is in fact a pear. However, we can look at the fruit again to check whether or not our belief regarding our perception was correct. That is, we are able to apprehend match and mismatch, we are able to understand the concept of error. Third, direct realism allows for different perspectives of the world. Realism recognises that concepts vary over time and across cultures. In other words, having different views of the world does not necessitate relativism, namely, the notion that truth is subjective. Realism does not claim that everyone must have the same understanding. Individuals with different views of the world are accommodated within a realist view of an objective world composed of objective states of affairs.

Problem 2: Neglect of the Body

The second major problem for first-generation cognitive science is its neglect of the body. Such neglect is seen with sensorimotor processes being viewed as merely peripheral input and output devices (Block, 1995; Fodor, 1975; Pylyshyn, 1984; Wilson, 2002). That is, what counts for cognitive processing are the amodal symbols and not the information input from sensory and motor systems which is transduced into the symbols. A representationist theory of cognition places cognition solely in an organism's brain. From such a theoretical position two implications arise. First, in privileging the brain over the rest of the body it is but a small leap to then separate one from the other, hence, ignoring that "[m]y thinking is first and last and always for the sake of my doing" (James, 1890, p. 333). Second, placing cognition solely in an organism's brain is to commit the mereological fallacy, that is, to confuse the part with the whole. As an illustration, lungs do not breathe. Breathing is embodied, it is something that a person does. Lungs play a role in the breathing process. Indeed, without lungs a person would be unable to breathe. However, to believe that lungs breathe or that brains think is to confuse what can only be ascribed to the whole as being ascribed to a part of that whole. As Clark notes, John's brain does "not have John's thoughts. John has John's thoughts" (1997, p. 224).

Solution to Problem 2: An Embodied Perspective

Including the body in cognition is consistent with a realist approach. As discussed earlier a fundamental tenet of realism is that cognition is a direct relation between an organism and an objective situation. On this view, to understand human cognition, we must understand the person as a physical organism including their motivation and emotional states, and as located within their social environment.

Second-generation cognitive science sought to redress the neglect of the body in first-generation cognitive science. With this move, it is worth considering whether it has overcome the two problems of first-generation cognitive science. Has second-generation cognitive science successfully brought the body back into cognition? Has second-generation cognitive science rid itself of representationism? As will be seen, the answer to the first question is a clear yes, whereas the answer to the second question depends on which version of embodied cognition is offered.

Second-Generation Cognitive Science: An Embodied Perspective

Second-generation cognitive science reflects a change in perspective from a narrow brain/mind focus of cognition to a broader focus where cognition can arise from the body, that is, from the body's structure and its sensorimotor experiences in the environment. It is important to note that all cognitive scientists agree that the "body is needed if we are to think" (Lakoff & Johnson, 1999, p. 37) because all processes must be neurally instantiated. However, within second-generative cognitive science the term *embodied* is much broader as it recognises the importance of context: we think the way we do because of our bodily structure (including brain structure) and because of the biopsychosocial environments we inhabit (Anderson, 2003; Chemero, 2009, 2013; Clark, 1998; Glenberg, Witt, & Metcalfe, 2013; Lakoff & Johnson, 1999; Merleau-Ponty, 1945/2012; Spivey, 2007; Varela, Thompson, & Rosch, 1991). Thus, second generation cognitive science puts "cognition back in the brain, the brain back in the body, and the body back in the world" (Wheeler, 2005, p. 11).

This approach is also known as embodied cognition (EC). Within EC differing emphases on the role of the body in cognition give rise to a diversity of claims (Menary, 2010; Spackman & Yanchar, 2014; Wilson, 2002). Such differences have prompted Shapiro to label embodied cognition a "*research program*" (2011, p. 2) rather than a theory. Labels aside, such a holistic approach means that the mind is no longer to be understood solely as what the brain does (as in first generation cognitive science) or what the body does (as in behaviourism). Prima facie it would appear that second-generation cognitive science has, from its theoretical perspective, successfully brought the body back into cognition.

Has Second-Generation Cognitive Science Solved the Problem of Representationism? It depends

With respect to the question whether second-generation cognitive science has rid itself of representationism, the answer is that it depends. An emphasis on the roles of the body and the environment in cognitive functioning does not necessarily entail a rejection of mental representations. Some embodied cognition researchers whose position is referred to as weak-EC accept representationism. This is clearly evident in the work of various embodied cognition researchers who claim that internal mental symbols are distributed across the different sensory systems and with no transduction required (e.g., Barsalou, 1999, 2008, 2009, 2010; Clark, 1997, 2011; Glenberg, 1997, 1999; Keijzer, 2002; Markman & Dietrich, 2000a, 2000b; Pecher, Zeelenberg, & Barsalou, 2004; Sutton, Harris, Keil, & Barnier, 2010; Wilson, 2002). Clark argues that incorporating the body and the environment into our understanding of cognition "can be seen as complementary to the search for computational and representational understandings" (1997, p. 149) and Wilson, reviewing embodied cognition research in general, claims that "we can and do build up robust detailed representations with repeated exposure" (p. 632). Such weak-EC faces conceptual difficulties despite its commendable move to embodiment (i.e., from amodal to modal symbols).

Expanding cognition from a focus on isolated cortical areas to now including the body and the environment is a positive step. However, this step does not translate into a real form of scientific progress if this wider realm of cognition is representationist in nature because such a view of embodied cognitive science inherits the problems associated with any representationist theory (i.e., logically incoherent, as discussed earlier). *Given* the problems of representationism, any approach to EC that *retains* representationism will be as hampered as was first-generation cognitive science, and will remain fundamentally flawed.

However, embodiment does not *require* representationism. In fact, there are several existing versions of EC that explicitly reject representationism, and these are labelled strong-EC approaches. It is worth noting that such rejection tends to be articulated as "*need* [emphasis added] not form representations" (Chemero, 2013, p. 148) and "does not *assume* [emphasis added] the existence of…mental representations" (Hutto, 2013, p. 176) suggesting that this group, similar to the group that retain representationism, also fails to appreciate the logical flaws of representationism, which would lead to the conclusion that we cannot *possibly* have representations. Nevertheless, the versions of EC that explicitly reject representations are the most promising in the field by virtue of offering a coherent (i.e., direct realist) theoretical framework.

This coherent theoretical framework of EC involves rejecting computationalism and rejecting representationism (see Beer, 1995, 2014; Chemero, 2009, 2013; Gallagher, 2005, 2008; Hutto & Myin, 2013, 2014; Gibson, 1966, 1979; Thelen & Smith, 1994; van Gelder, 1995, 1998). This strong-EC approach has been labelled *radical* embodied cognitive science (RECS; Chemero, 2009). The term *radical* refers to the rejection of representationism, perhaps spelled out most clearly by Gibson who stated that perception of the environment is direct, that is, "not mediated by *retinal*…*neural*…or *mental* pictures" (1979, p. 147). On the one hand, the term *radical* seems appropriate because such a position is a seen as being a marked departure from the representationist understanding of embodied cognitive science within mainstream psychology. On the other hand, for those areas of psychology that developed outside of the representational shadow cast by Descartes there is nothing radical about RECS. Indeed, for Chemero (2009, 2013), who notes that RECS has its historical roots in American naturalism (i.e., James, Dewey) and Gibsonian ecological psychology, it is not that RECS is radical, but, rather, that mainstream embodied cognitive science is itself a "watering down of radical embodied cognitive science" (p. 30, 2009). Such adulteration occurs because of mainstream psychology's attempt to combine Jamesian psychology with computationalism (Chemero, 2009, 2013). For RECS-based researchers (e.g., Chemero, 2009, 2013; Hutto & Myin, 2013, 2014), organism-environment relations exist in historically- and contextually-embedded complex spatio-temporal situations where relations are external to the things related and not found in the things themselves. As there are only complex spatio-temporal situations it follows that there is no requirement for cognitive enrichment via internal representations.

A common objection to radical (i.e., antirepresentationist) embodiment is summed up by it being a "less attractive" option that "seems to narrow the range of phenomena that can be addressed and explained" (Sebanz & Knoblich, 2009, p.1232). However, this is a weak objection because no matter how broad the range of phenomena, they are only *apparently* explained within representationist approaches; if such approaches are incoherent, then any "explanation" is illusory. Explaining phenomena may appear "a lot harder" when one cannot appeal to internal mental representations (Schubert & Semin, 2009, p. 1137), but employing conceptual analysis leads to a rejection of representation in the first place, so the answers will be known to necessarily thereby be realist answers. In summary, while representationism must be abandoned because of its logical flaws, that does *not* entail abandoning the embodied perspective. Explicitly accepting EC within a realist framework involves adopting a coherent foundation for theory and research in the area. Having established the required theoretical framework, we can now turn to review the empirical research.

Empirical Evidence Supporting an Embodiment Perspective

There are numerous empirical studies providing evidence that thinking cannot be separated from the body, that our bodies and the way they are situated in the environment influence how we think. Areas of investigation include, but are not limited to, the relation between evaluation and physical state (or physical activity), muscle activation and reported emotion, and neuronal activation correspondences with perception.

Regarding evaluation and physical state (or physical activity), research has shown that the same geographical slant (e.g., a hill) appears steeper when the perceiver is tired (Proffitt, Bhalla, Gossweiler, & Midgett, 1995), wearing a heavy backpack, of low physical fitness, or elderly (Bhalla & Proffitt, 1999). Also, the distance to a target looks longer when you are wearing a heavy backpack (Proffitt, Stefanucci, Banton, & Epstein, 2003). Thus, visual perception is affected by an individual's physiological state (Proffitt, 2006). In addition, evidence demonstrates that people prefer objects that are easy to interact with (Beilock & Holt, 2007; Elder & Krishna, 2012; Jasmin & Casasanto, 2012; Ping, Dhillon, & Beilock, 2009; Shen & Sengupta, 2012). For instance, an object's handle orientation influences evaluation of that object with easy-to-grasp oriented objects being rated more positively than hard-to-grasp oriented objects irrespective of whether participants engage in grasping objects (Ping et al., 2009) or are shown pictures of objects (Elder & Krishna, 2012). Investigating the link between judgements of value and spatial location as determined by handedness provides further evidence for an embodied perspective concerning evaluation and physical state. For example, individuals tend to associate a "good" object with their dominant side, regardless of whether the object placement involves the use of their hands (i.e., written response) or not (i.e., oral response) (Casasanto, 2009). Additionally, children as young as five years old evaluate animals shown on their dominant hand side as being smarter and nicer than animals shown on their non-dominant hand side (Casasanto & Henetz, 2012). This evidence demonstrates that an individual's physiological state influences his or her evaluations and judgements.

Evidence of embodiment effects regarding muscle activation and reported emotion is provided when considering the facial muscles used in expressing negative emotion. On the one hand, paralysis of these facial muscles via an injection of Botox has been found to reduce the symptoms of major depression when compared with a placebo condition (Finzi & Rosenthal, 2014; Wollmer et al., 2012) and to selectively slow the reading times for sentences describing angry or sad events but not happy events (Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2010). Such findings suggest that movement of those muscles contributes to the symptoms of major depression and to better reading efficiency when reading about angry or sad events. On the other hand, involuntary frowning, a process which activates the same pattern of facial muscles as in the expression of anger, has been found to increase self-reported levels of aggressiveness. People who were walking when facing the sun and thus experiencing involuntary frowning had increased self-reported levels of aggressiveness compared with those who walked with the sun behind them or who wore sunglasses when facing the sun while walking (Marzoli, Custodero, Pagliara, & Tommasi, 2013). Taken together, this evidence supports muscle activation as influencing reported emotion.

Offering neurological support for embodiment effects are the findings via event-related fMRI of common neural substrates for perceiving objects and for conceptualising those objects. For instance, viewing verbs (i.e., action words) such as “lick,” “pick,” and “kick” in isolation or listening to sentences containing such action words activates areas of the motor and premotor cortex associated with the face, hands, and legs, respectively (Hauk, Johnsrude, & Pulvermüller, 2004; Tettamanti et al., 2005). Furthermore, the context for action words appears to moderate activation of cortical areas associated with motor responses with words presented in isolation or within literal sentences (e.g., The fruit cake was the last one so Claire *grabbed* it) having higher activation than words presented in idiomatic contexts (e.g., The job offer was a great chance so Claire *grabbed* it) (Raposo, Moss, Stamatakis, & Tyler, 2009). In another example, perceiving colour and processing colour words (e.g., “green,” “yellow”) was found to activate the same cortical region (the left fusiform gyrus) (Simmons et al., 2007). Thus, thinking about objects involves the same cortical regions as when acting or perceiving, suggesting that cognition has its foundation in bodily structures and functioning.

These examples of empirical research are sufficient to demonstrate how our bodies and the way they are situated in the environment influence how we think. Thus, for the earlier question, has second-generation cognitive science successfully brought the body back into cognition, the answer is yes from both a theoretical and empirical perspective.

Overall, EC researchers agree on embodiment but, as discussed earlier, disagree regarding representationism. However, as has been argued, embodied cognition requires *both* embodiment and a direct realist rejection of representationism (i.e., strong-EC). Only that way can it avoid both major problems of first-generation cognitive science.

Criticisms of Embodied Cognition

Despite the empirical evidence there have been three major criticisms of EC. Firstly, it has been argued that the empirical evidence can be explained by a non-embodied approach. The second criticism is that if EC is true then motor impairment should impair cognition, but motor impairment does not impair cognition. Finally, it has been argued that the claims for EC are both too vague and not needed to explain the key findings of cognitive science. As will become clear, adherence to representationism in some versions of EC infiltrates the field of challenges and replies; in contrast, the criticisms do not apply to or undermine the direct realist EC position.

The first criticism of EC is that much of the empirical evidence is open to interpretation as supporting a non-embodied approach (e.g., Adams, 2010; Laakso, 2011; Mahon & Caramazza, 2008). This claim is made by embodied cognition researchers wishing to retain representationism, that is, weak-EC researchers. To give one example, when considering the finding by Hauk et al. (2004) that areas of the motor and premotor cortex associated with the legs are activated when participants view the word “kick”, Mahon and Caramazza state that whether the “activation of the motor system was not mediated by the retrieval of ‘abstract’ conceptual content….is precisely the ‘unknown’ that is at issue” (2008, p. 61). However, as discussed earlier, such an issue is irrelevant because representationist theories are logically flawed (see Anderson, 1927/1962; Maze, 1983; Michell, 1988; Petocz & Newbery, 2010) and a logically flawed theory cannot explain empirical findings. Thus, to put forward a representationist theory as providing an explanation of any fact is to ignore those aspects that undermine the theory.

The second criticism of EC is that motor impairment provides evidence against the view that sensorimotor processes are constitutive of cognitive processes. For example, Mahon and Caramazza (2008) claim that strong-EC may be rejected on the basis that patients with apraxia,[3] although unable to use particular objects, are able to name those objects and to recognise pantomimes of actions for those objects. In other words, the motor processes involved in using an object are not necessary for cognitive processes such as naming or recognising pantomimes of actions for that object. However, accepting that assumption does not entail that sensorimotor processes are not involved in some way when patients with apraxia name or recognise pantomimes of actions for objects. Like healthy individuals, an individual with apraxia: (a) possesses the bodily structures (e.g., limbs, joints, muscles, neurons) needed to engage in motor actions;[4] (b) possesses mirror neurons or, more accurately, a mirror neuron system (Buccino et al., 2001, 2005) which is activated when an individual performs or observes an action (Gallese,

[3] Apraxia is an impairment for using objects that occurs in the absence of paralysis or loss of sensory function.
[4] Even if a person did *not* possess the limbs (e.g., amputees, thalidomide victims), the person would still be able to understand and name motor actions they cannot perform, and their cognition would be no less “embodied” than anyone else’s.

2000; Murata et al., 1997; Rizzolatti & Craighero, 2004; Rizzolatti, Fogassi, & Gallese, 2000; Strafella & Paus, 2000); and (c) lives in an environment where there are objects and where action(s) with such objects have been witnessed/or described (otherwise irrespective of apraxia an individual would fail to name an object and identify the actions associated with that object). These considerations demonstrate that being unable to use particular objects does not equate with having no sensorimotor processing concerning those objects. Thus, the existence of individuals with apraxia is not sufficient evidence to reject embodied cognition. Moreover, the coherent version of EC does not claim that motor impairment must impair cognition. Therefore, to claim that it must do so, as Mahon and Caramazza have done, is a case of the logical fallacy of *ignoratio elenchi*, according to which the critic is mistakenly attributing to the theorist a view that is not actually held.

The third criticism of EC arises from a recent article by Goldinger, Papesh, Barnhart, Hansen, and Hout (2016) arguing that claims made for embodied cognition are unacceptably vague, trivial, and irrelevant to key findings. Specifically, the researchers' critique involves three main points: "…[(i)] that the basic principles from embodiment theory are either unacceptably vague…[(ii)] or [that] they offer nothing new….[and (iii)] for the vast majority of classic findings in cognitive science, embodied cognition offers no scientifically valuable insight" (p. 1). As will be seen, a consideration of these three points reveals that Goldinger and colleagues have no substantial case.

In criticising EC as being "unacceptably vague" Goldinger et al. (2016) appear to be making two claims. On the one hand, vagueness refers to the diversity of claims regarding EC among EC theorists. On the other hand, vagueness refers to definitions being unclear across publications. Both criticisms are accurate, but they are hardly unique to EC and are not fatal for the theory. In their critique Goldinger et al. are treating EC as one homogenous theory which, as discussed earlier, it is not. In addition, within psychology unclear definitions are not confined to EC. For example, what is meant by "self" is not made clear in those definitions from social psychology that deal with what is self-control, that is, self-control is "the ability of the self to exert control over the self" (Hagger, Wood, Stiff, & Chatzisarantis, 2010, p. 496) or self-control is "the self exert[ing] control over itself and over the external world" (Baumeister, Bratslavsky, Muraven, & Tice, 1998, p. 1252). Unclear definitions are troublesome, but, in and of themselves, they are not sufficient grounds on which to dismiss a whole theory; instead, they are grounds for closer attention, clarification, and theory refinement.

On their second point, Goldinger et al. (2016) are correct to a point when they claim that EC offers nothing new in so far as "[e]veryone knows that mind and body are deeply connected" (p. 2). However, by privileging mind over body first-generation cognitive science did come to neglect the mind and body connection. Indeed, it was this neglect of the body that was the main motivator of second-generation cognition science, as discussed earlier. So while it is true that EC is not new in its highlighting the connection between mind and body, it is important to recognise that EC reflects a change in perspective from the first-generation cognitive science brain/mind focus of cognition to a broader focus where cognition can arise from the body, that is, from the body's structure and its sensorimotor experiences in the environment. As Goldinger and colleagues are representationist theorists who echo Descartes' seventeenth century view that cognition is "only from the brain" (Descartes, 1641, p. 164, Med. 6) it becomes clear then why the view of cognition as "[t]he mind is embodied…not just embrained" (Damasio, 1994, p. 118) may appear as too sweeping.[5]

On the third point by Goldinger et al. (2016) that "embodied cognition offers no scientifically valuable insight" (p. 1) for many of the findings in cognitive science, the reply is twofold. In the first place, EC theorists are not claiming that EC explains all, or even most, findings in psychology. The underlying claim of EC is that we think the way we do because of our bodily structure (including brain structure) and of the biopsychosocial environments we inhabit. By repeatedly making claims such as "mind and body are deeply connected" (p. 2), "[e]veryone surely agrees that cognition cannot occur without a living body" (p. 5), and "[c]learly, people have profound connections of body and mind" (p. 15), Goldinger et al. appear reasonably comfortable with some role for the body within cognition. In the second place, the essential question posed by Goldinger et al. (2016) as the basis for their article is fundamentally flawed. That "essential question is…are there classic findings that are better explained from the EC perspective, relative to standard cognitive theories" (p. 6). Representationism is a central tenet of cognitive science (see Billman, 1998, p. 658; Gardner, 1987, p. 38; Ramsey, 2007, p. xi) and, as demonstrated earlier, representationism is fatally logically flawed. So, findings "explained" by standard cognitive theories, theories that are fatally logically flawed, are not thus explained. Hence, there is little to be gained scientifically from comparing EC to such theories. It is clear that Goldinger and colleagues are aware that the explanations provided by standard cognitive theories for the "classic findings" (e.g., face perception, sentence processing, serial recall) involve representationism because the researchers repeatedly ask how EC could explain such findings when EC posits "a mind devoid of…representations" (p. 8) and "a mind without

[5] If the mental is a relation between an organism and an object external to the body/brain of that organism then, strictly speaking, cognition would be *partly* embodied/embrained.

representations" (p. 9, p. 10, p. 12). In these cases it seems that the version of EC that they are objecting to is a radical embodied version (e.g., Chemero, 2009, 2013; Hutto & Myin, 2013, 2014), the only version that, as has been argued here, is conceptually coherent. Hence, there is irony as Goldinger et al. claim that EC "falls woefully short – on simple, logical grounds – of addressing any aspect of cognitive life" (p. 15) seemingly without any awareness that it is the very representationist theories that they promote that fall short on simple, logical grounds. The irony continues when Goldinger et al. (2016) warn that "once ideas take[s] root, they can become profoundly difficult to dislodge" (p. 16). This warning is aimed at EC but in uncritically accepting representationist theories Goldinger et al. unwittingly help demonstrate that no idea is more profoundly rooted and difficult to dislodge than the idea that psychology needs representations.

Overall, Goldinger and colleagues' (2016) critique of EC is confused because the researchers treat EC as one homogeneous theory. That is, the representationist-based and the nonrepresentationist theories of EC are unjustifiably lumped together. In addition, the scientific value of an anti-representationist version of EC is ignored because Goldinger et al. accept uncritically representationist theories and mistakenly claim that the empirical evidence supports such theories. That is not to say that the Goldinger et al. critique of EC is without merit. Like any theory, EC would benefit from clearer definitions and from greater scrutiny of its own core tenets thus leading to rejection of those versions of EC that are representationist theories.

A direct realist EC position is not undermined by any of the three major criticisms discussed here (i.e., that the empirical evidence can be explained by a non-embodied approach; that motor impairment does not impair cognition; and that claims for EC are both too vague and not needed to explain the key findings of cognitive science). Indeed, it is only within such a coherent (realist) perspective that the various positive contributions of EC can be fruitfully located. Conceptual Metaphor Theory is one such fruitful area of EC.

Conceptual Metaphor Theory (CMT)

Metaphor, as a figure of speech, is defined as transferring attributes of one object to a different but “analogous” object (OED: Simpson & Weiner, 2009). Metaphor plays a role in the creative arts, such as, literature, poetry, and song writing. For example:

> And so, from hour to hour, we ripe and ripe,
> And then, from hour to hour, we rot and rot;
> (Shakespeare, *As You Like It*, Act II, Scene VII)
>
> To sleep? Perchance to dream! Ay, there’s the rub;
> For in that sleep of death what dreams may come?
> (Shakespeare, *Hamlet*, Act III, Scene I)

In the first example our life cycle of maturation and degeneration is analogous to the temporal sequence of ripening and decaying for fruit, whereas in the second example sleep is analogous to death. As these examples demonstrate metaphor as a linguistic device is a long recognised and noncontroversial proposition. A more recent and a more radical claim made regarding metaphor is that metaphor is not merely a linguistic tool as traditionally believed (e.g., Grice, 1975; Searle, 1993; Pinker, 2007) but also part of how we think and act (Gibbs, 1994, 2006; Johnson, 1987; Lakoff, 1987, 1993, 2003; Lakoff & Johnson, 1980, 1999; Turner, 1996). According to Conceptual Metaphor Theory (CMT), conceptual metaphors are “metaphors of thought” (Gibbs, 2011a, p. 530); they are fundamentally cognitive, and not merely linguistic, systems. Conceptual metaphors involve our tendency to apprehend abstract concepts in terms of more concrete or bodily experiences. A conceptual metaphor maps elements from concrete bodily-grounded experiences (the source domain) onto elements of a more abstract nature (the target domain); hence, metaphors are embodied (Gibbs, Lima, & Francozo, 2004; Lakoff & Johnson, 1980, 1999; Núñez, 1999). The source domain contains elements that arise from "natural kinds of experience" (Lakoff & Johnson, 1980, p. 117). These kinds of experience are *natural* because they derive from our bodies (e.g., motor apparatus, perceptual apparatus) and from our interactions with our physical environment and with other people. In other words, we think and act the way we do because of the bodies that we have and the world in which we live. To illustrate, the conceptual metaphor MIND IS A CONTAINER[6] encompasses such notions as holding certain articles (e.g., thoughts, beliefs, values) in our minds, filling our minds with ideas, emptying them of distractions, looking into them, and so on. The activities of *holding*, *filling*, *emptying*, and *looking into* are elements of our concrete experiences with containers and we use these elements to understand and think about the mind.

Another conceptual metaphor, HAPPY IS UP, helps with understanding the importance of body and environment. In a thought experiment Lakoff and Johnson (1980) invite us to "[i]magine a spherical being living outside any gravitational field, with no knowledge or imagination of any other kind of experience. What could UP possibly mean to such a being?" (p. 57). Or to put it more specifically, would such a being have the same concept of HAPPY IS UP that humans have? The answer is no. With no concept of up, such beings would be unlikely to think of and describe happiness in terms of feeling *up*, feeling *uplifted*, *boosted* spirits, or *high* spirits. If such beings did conceive of happiness it would be different to a human being's concept of happiness, this difference having its basis in the different bodies and environments of each organism.

[6] As per convention, conceptual metaphors are expressed in smaller font uppercase characters as TARGET-DOMAIN IS SOURCE-DOMAIN.

Proponents of CMT do not claim that all elements from a source domain are mapped onto a target domain (Grady, 1997b; Lakoff, 2008; Lakoff & Johnson, 1980, 1999; Gibbs, 2011b; Kövecses, 2010a). Indeed, if this were true that would be fatal for CMT because "one concept would actually *be* the other, not merely be understood in terms of it" (Lakoff & Johnson, 1980, p. 13). The point of CMT is that mappings *are* only partial; and the important and interesting task is to identify the relevant similarities in any particular case.

Conceptual metaphors that are directly grounded in our sensorimotor experiences are called *primary metaphors* (Grady, 1997a, 2005) and are explained in terms of early experiences. For example, AFFECTION IS WARMTH is argued to be a primary metaphor because it is held to arise from our experiences as infants of being held close to another person who cares for us. That is, the correlation between being physically warm (source domain) and feeling positively emotionally connected with another person (target domain) is one of our earliest experiences and tends to be consistent across cultures. This explanation is supported by neuronal coactivation theory (Narayanan, 1997). Within this theory metaphors are physical mappings via neural circuitry. These mappings occur based on a neuroscience maxim derived from Hebb's cell-assembly theory: *Neurons that fire together wire together* (Hebb, 1949). When we are held by a caregiver, who helps us meet our needs, neurons related to warmth (sensorimotor system) and neurons related to affection (higher cortical regions) are being fired together. This neuronal coactivation forms the basis of the conceptual metaphor AFFECTION IS WARMTH allowing elements of the source domain (warmth) to be mapped conceptually to elements of the target domain (affection). Hence, conceptual metaphors are embodied in two ways: Our body's sensorimotor system gives rise to metaphor's source domain and neural coactivation establishes the connection between source domain and target domain (Grady, 1997a, 2005; Lakoff, 2008;

Lakoff & Johnson, 1999; Narayanan, 1997). Furthermore, as discussed earlier in the context of embodied cognition generally, mirror neurons fire when we observe an action (e.g., Aihara, Yamamoto, Mori, Kushiro, & Uehara, 2015; Enticott, Kennedy, Bradshaw, Rinehart, & Fitzgerald, 2010; Gangitano, Mottaghy, & Pascual-Leone, 2004; Newman-Norlund, van Schie, van Zuijlen, & Bekkering, 2007). Thus, first-person experience relates to other-person actions. Another side of the experiential link between temperature and feeling is seen in the conceptual metaphor EMOTIONALLY UNRESPONSIVE IS COLD. Indeed, Grady (2005) noted that many cultures use the same word to denote being physically cold and being unfeeling (e.g., *frigus* in Latin, *buruuda* in Arabic, *dingin* in Indonesian, *leng* in Chinese, *úar* in Old Irish). The point here is that for primary metaphors the link between source domain and target domain is experiential (Grady, 2005; Lakoff & Johnson, 1980, 1999).

Not all conceptual metaphors are primary metaphors. Other conceptual metaphors may emerge from a combination of primary metaphors, what Grady (1997b) calls *complex* conceptual metaphors. In turn, integrations of conceptual metaphors (i.e., primary and complex or complex and complex) give rise to other conceptual metaphors in a process known as *blending* (Fauconnier & Turner, 1998, 2002, 2008). Thus, emergent conceptual metaphors (i.e., complex, blended) are grounded ultimately in sensorimotor experiences. Consider the conceptual metaphor LOVE IS A JOURNEY where the abstract concept of love is understood via the more concrete concept of journey: we're *at a crossroads*; I don't think this relationship is *going anywhere;* we can't *turn back* now; and our marriage is *on the rocks*. This complex metaphor includes further mapping of the source domain element *vehicle* to the target domain element *the love relationship itself* (see Table 1 for more source domain to target domain mappings for LOVE IS A JOURNEY). This mapping combines two primary metaphors, A RELATIONSHIP IS AN ENCLOSURE (early experiences of living in the same enclosed physical space with other people) and INTIMACY IS CLOSENESS (early experiences of being physically close to people we cared for and who cared for us), into the complex metaphor AN INTIMATE RELATIONSHIP IS A CLOSE ENCLOSURE, and a typical enclosure for travellers (the lovers are travellers) is a vehicle (Lakoff & Johnson, 1999; see also Lakoff, 2008). So we can see how our understanding of a love relationship being a vehicle arises from multiple metaphors. Moreover, these metaphors combine with other metaphors to produce the complex metaphor LOVE IS A JOURNEY. This complex metaphor is also classified as conventional, that is, it is well-established and generally escapes notice as being a metaphor at all (Kövecses, 2010a).

Table 1

The Systematic Set of Mappings that Characterise the Conceptual Metaphor LOVE IS A JOURNEY

Source: JOURNEY		*Target: LOVE*
the travellers	→	the lovers
the vehicle	→	the love relationship itself
the journey	→	events in the relationship
the distance covered	→	the progress made
the obstacles encountered	→	the difficulties experienced
decisions about which way to go	→	choices about what to do
the destination of the journey	→	the goal(s) of the relationship

Note. Adapted from "Metaphor: A Practical Introduction" by Z. Kövecses, 2010a, p. 9.

Another important feature of conceptual metaphor is that the mapping is unidirectional, from the concrete to the abstract (Lakoff & Johnson, 1980, 1999; Kövecses, 2010a). For the conceptual metaphor LOVE IS A JOURNEY it is elements from the domain of journey structuring how we understand the concept of love, but the reverse does not occur; we do not think or talk of a journey using elements of love. Of course, the concept of love may be understood in ways other than in terms of a journey. These include LOVE IS A NATURAL FORCE (e.g., She *swept* me off my feet; We were *engulfed* by love), LOVE IS WAR (e.g., He *fled from* her *advances*; He *won* her hand in marriage), LOVE IS MADNESS (e.g., I'm *crazy* about him; I'm just *wild* about Harry) and LOVE IS A PATIENT (e.g., We're getting back *on our feet*; They have a *strong, healthy* marriage) (Gibbs, 2011a; Lakoff & Johnson, 1980). These examples demonstrate how each conceptual metaphor highlights particular aspects of the abstract concept of love while simultaneously hiding other aspects. For instance, LOVE IS A PATIENT focuses our attention onto love as something involving care and nurturing whereas LOVE IS WAR focuses our attention onto love as something involving conflict and manipulations. Each conceptual metaphor draws upon different characteristics of the concept of love; our understanding of love is multidimensional. Thus, while [many] abstract concepts will ultimately be derived from concrete experiences,[7] understanding any one abstract concept may involve multiple conceptual metaphors (Grady, 1997b; Lakoff & Johnson, 1980, 1999; Kövecses, 2010a).

When considering that multiple conceptual metaphors may be utilised and that individuals come from different cultures it seems reasonable to ask: Are there novel metaphors? The two earlier examples from Shakespeare involve trying to create original linguistic metaphorical expressions. But do these, or indeed any, linguistic metaphors truly describe previously "unapprehended relations of things" (Shelley, 1891, p. 4)? After all, if metaphors were truly original then how would we understand what the writer intended? Proponents of conceptual metaphor claim that linguistic metaphors are created from conventional conceptual metaphors by processes such as extending, elaboration, questioning, and combining (Kövecses,

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[7] The many LOVE IS A… conceptual metaphor examples above illustrate the fact that individuals have a tendency to use conceptual metaphor. But, of course, that does not mean that we cannot understand more abstract concepts without using conceptual metaphor; we can, but we tend to prefer not to.

2010a). These processes can be seen in the two earlier examples from Shakespeare: the first example elaborates on the conventional metaphor PEOPLE ARE PLANTS by linking our life cycle of maturation and degeneration with the temporal sequence of ripening and decaying for fruit plants, whereas the second example questioned the appropriateness of the common metaphor DEATH IS SLEEP by incorporating dreaming, dreaming being commonly associated with sleep but not with death. These examples show how metaphor "both motivates and constrains the way we think creatively" (Gibbs, 1994, p. 7). It seems likely that currently there are no truly novel conceptual metaphors. However, this can change when our experiences within our world change dramatically.

One such dramatic societal change was the Industrial Revolution that occurred within Western culture in the eighteenth and nineteenth centuries. During this time manufacturing shifted from home-based, basic tools, small scale production to factory-based, specialised machinery, mass production. And with the new industrial (and urban) focus came a new way of understanding time, namely TIME IS A RESOURCE and its subcategory TIME IS MONEY. Today, linguistic reflections of such conceptual metaphors include: There's plenty of time *left* to finish this thesis, that job *took* all day, he's *wasted* an hour of my time, we *need* more time, this smart app will *save* you time, I've *spent* too much time on that, and I've *invested* a lot of time on this thesis. Thus, we conceive of time as something that is a limited resource and can be spent and saved. However, unlike money, time cannot be returned; once we have used, spent, or wasted our time we cannot get that time back. Not all cultures conceptualise time as a resource or as money, but such changes in thinking about time may be seen today in emerging economies. So, with dramatic changes come new experiences that can be applied to existing abstract concepts, hence producing novel conceptual metaphors.

Having provided a theoretical account of CMT, that is, metaphor as being conceptual rather than merely a linguistic tool, examining source-to-target mappings, metaphor complexity (i.e., primary, complex, blending), directionality, and novelty, we can now turn to review the empirical research.

Empirical evidence supporting CMT. There is an extensive body of research into conceptual metaphor across multiple conceptual domains. Examples include education (Alger, 2007; Brookes & Etkina, 2007; Danesi, 2007), emotions (Gevaert, 2005; Kövecses, 2000, 2010b), illness (Gibbs & Franks, 2002; Scherer, Scherer, & Fagerlin, 2015), mathematics (Lakoff & Núñez, 2000; Núñez & Lakoff, 2005), morality (Johnson, 1993; Lee & Schwarz, 2011), politics (Bougher, 2012; Lakoff, 2002; Musolff, 2004, 2010), power (Giessner & Schubert, 2007; Schubert, 2005; Zanolie et al., 2012), time (Boroditsky, 2000; Casasanto & Boroditsky, 2008), and valenced concepts (Casasanto & Dijkstra, 2010; Meier & Robinson, 2004).

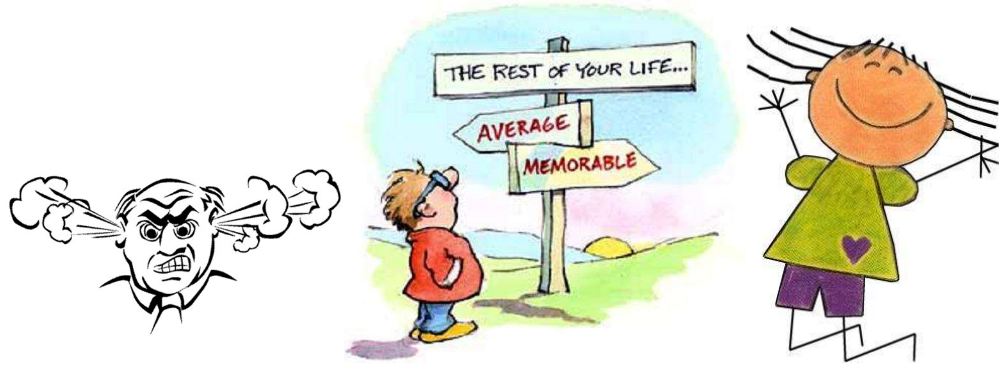
One of the early criticisms of CMT was that it deals with merely linguistic material (McGlone, 2007, 2011; Murphy, 1996). This is perhaps unsurprising given that linguistic expressions were used as supporting evidence for CMT particularly in the earlier stages of the theory's development (e.g., Johnson, 1987; Lakoff, 1987, 1993; Lakoff & Johnson, 1980). Indeed, linguistic expressions have been used as support for CMT earlier in this thesis (e.g., I'm feeling *up*, we're *at a crossroads*; *filling* her mind with ideas). This early focus on linguistic expressions may account for some researchers' scepticism concerning the claim that metaphor is a cognitive (as opposed to a merely linguistic) phenomenon (e.g., Glucksberg, 2001; Murphy, 1996, 1997; Steen, 2011). Nevertheless, there is now ample nonlinguistic empirical evidence supporting CMT, and this body of evidence is growing rapidly, so to criticise CMT on the grounds of a lack of such evidence is no longer warranted. For example, nonlinguistic evidence for CMT has been demonstrated via speed of evaluating or locating targets, ratings of perceived interpersonal closeness, understanding of images, and gestures.

Empirical research has shown that we are faster at evaluating or locating targets when what we are asked about is congruent with our typical metaphorical understanding of that concept even though the congruence/incongruence is irrelevant to the task. An example of faster evaluation regarding values and colour is the finding that people categorise words as positive or negative faster and with greater accuracy when positive words are presented in white font and negative words are presented in black font rather than when positive words are presented in black font and negative words are presented in white font (Meier, Fetterman, & Robinson, 2015; Meier, Robinson, & Clore, 2004). This finding is congruent with the conceptual metaphors GOOD IS WHITE and BAD IS BLACK. Faster evaluation regarding emotion and location is shown in faster responses for recognising facial images displaying mild emotions of happiness and of sadness when those images are presented on a screen congruent with the HAPPINESS IS UP and SADNESS IS DOWN metaphors, although only for females (Mahieu, Corneille, & Yzerbyt, 2014). Faster evaluation regarding values and location is demonstrated in the finding that a target is located faster when its position on a screen, top or bottom, is congruent with a word associated with perceived social power (e.g., king or servant) presented prior to the target presentation (Zanolie et al., 2012). That is, targets displayed in the top portion of the screen are located faster than targets in the bottom portion of the screen when the preceding word has a POWER IS UP association rather than a POWERLESS IS DOWN association and targets displayed in the bottom portion of the screen are located faster than targets in the top portion of the screen when the preceding word had a POWERLESS IS DOWN association rather than an POWER IS UP association.

Furthermore, the same metaphor congruency effect is found using words associated with Chinese honorifics, elevating or denigrating, rather than words associated with perceived social power (Lu, Zhang, He, Zheng, & Hodges, 2014).

In examining a link between emotion and temperature, empirical evidence exists for understandings of interpersonal relationships via conceptual metaphor. To illustrate, the metaphor AFFECTION IS WARMTH explains why, having briefly held a hot cup of coffee, individuals rated a fictitious person's interpersonal traits as being warmer than did those who had briefly held a cup of iced coffee (Williams & Bargh, 2008a). In another study, participants who held a warm beverage produced higher ratings of perceived closeness with another person who was known to them compared with ratings from participants who held a cold beverage (Ijzerman & Semin, 2009). The metaphor INTIMACY IS CLOSENESS accounts for individuals reporting stronger bonds with their family and their hometown after engagement in a closer-distance task (i.e., positioning two dots close together on a Cartesian plane) when compared with individuals who had positioned the two dots far apart on a Cartesian plane (i.e., a further-distance task) (Williams & Bargh, 2008b). In each example, our experiences in the world (i.e., warmth, closeness) influence our perception of the way we think about abstract emotional concepts (i.e., affection, intimacy).

Cartoons provide further nonlinguistic evidence for conceptual metaphor. The "literal" meaning intended in cartoons often relies on conceptual metaphors (Kövecses, 2010a). Figure 1 presents three examples of conceptual metaphors being used within cartoons. There is no text in two of the three cartoons, yet each cartoon image is easily understood, demonstrating how ubiquitous conceptual metaphor is in our lives. Other visual domains that employ conceptual metaphors include comics and films (Forceville, 2002, 2005, 2008; Ortiz, 2011).



ANGER IS A HOT FLUID IN A CONTAINER | LIFE IS A JOURNEY | HAPPINESS IS UP

Figure 1. Cartoon images depicting conceptual metaphors in a literal way.

Evidence of metaphorical thought manifesting through gestures further supports metaphor as being a part of how we think and act rather than merely linguistic. There are some gestures that have become cultural norms or "emblems" (Efron, 1941; Ekman & Friesen, 1969), infused with specific meaning. Such "emblems" in Western Society include crossing one's fingers (middle finger over index finger) when wishing someone good luck and the "thumbs up" gesture (thumb vertically upright and fingers folded) to indicate positivity. Conversely, there are gestures that occur spontaneously during speech, providing another window onto how individuals think metaphorically (Calbris, 1990; Chui, 2011). Many studies investigating metaphorical gestures have focussed on hand and arm gestures (e.g., Alibali & Nathan, 2012; Chui, 2011; Cienki, 1998, 2008; Cienki & Müller, 2008; Gibbs, 2008; McNeill, 1992, 2005). For example, a hand chopping movement in the vertical plane has been observed when individuals discuss the topic of honesty (Cienki, 1998, 2008). This gesture was interpreted as a bodily manifestation of the conceptual metaphor HONESTY IS STRAIGHT whose linguistic expression is found in examples like "tell it to me *straight*". In one study, the chopping movement occurred without any accompanying linguistic metaphorical expressions regarding chopping or straight (Cienki, 1998). In another study, an individual made the chopping movement at the same time as using the linguistic metaphorical expression "black, white" to denote wrong and right moral categories of honesty, respectively (Cienki, 2008). Taken together, these studies suggest that metaphorical gestural expressions reflect thought rather than merely reflecting language. The existence of such considerable nonlinguistic evidence supporting CMT clearly demonstrates that a criticism of CMT as merely dealing with linguistic material is now unwarranted.

Criticisms of CMT. Four other main criticisms of CMT deserve attention. Firstly, it has been argued that CMT resorts to circularity. The second criticism is that CMT cannot explain why only some elements are mapped from source to target. The third criticism is that CMT cannot explain scientific technical jargon. Finally, it has been argued that CMT suffers from the homunculus problem. As will become clear, some criticisms arise from misunderstanding CMT or are legitimately applicable only to a representationist view of CMT, but most importantly, none are fatal for a coherent realist version of the theory.

CMT resorts to circularity. One criticism of CMT is that it suffers from circularity (e.g., Kertész & Rákosi, 2009; McGlone, 2007, 2011; Murphy, 1996). If this criticism were true it would be a fatal logical flaw for the theory. To address this criticism two instances from McGlone published six years apart concerning the conceptual metaphor exemplar THEORIES ARE BUILDINGS are examined.

> How do we know that people think of theories in terms of buildings? Because people often talk about theories using building-related expressions. Why do people often talk about theories using building-related expressions? Because people think about theories in

> terms of buildings. Clearly, the conceptual metaphor view must go beyond *circular reasoning* [emphasis added] of this sort and seek evidence that is independent of the linguistic evidence. (2001, p. 95)

> How do we know that people think of theories in terms of buildings? Because they use building-oriented terminology to talk about theories. Why do people think about theories in terms of buildings? Because they use building-oriented terminology to talk about theories. CM theorists clearly must abandon *circular reasoning* [emphasis added] of this sort and seek substantiation of their claims that is independent from the linguistic evidence. (2007, p. 115)

The opening two sentences of each example suggest that McGlone is saying the same thing in both cases, namely, that conceptual metaphor theorists claim that the only evidence we have for people thinking in a certain way is that people talk in that way. However, the two examples differ somewhat in their third and fourth sentences. The first example, that is, "Why do people talk about….Because people think about…" (McGlone, 2001, p. 95), concerns the hypothesised causal connection between thinking and talking claiming that language is used as evidence that thinking causes the language use. The essence of the argument from the first quote is shown in Figure 2. So is that a convincing argument for circularity in conceptual metaphor? The answer is no. There is nothing circular about claiming that language (i.e., talking) is evidence for the existence of thinking and also for a causal role of thinking in producing language. To use another example, a human footprint in the sand is evidence that a person has walked there, and also evidence for the causal hypothesis that the footprint was caused by a person walking there.

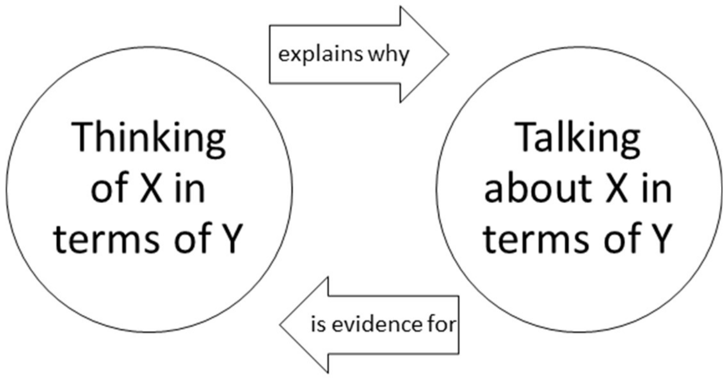


Figure 2. Schematic of the criticism of "circularity" levelled against conceptual metaphor theory by McGlone (2001).

The third and fourth sentences in the second example, that is, "Why do people think about….Because they use…to talk about…" (McGlone, 2007, p. 115), differ from the first example, but the form and expression of the entire second example parallels the first example so closely that it seems reasonable to think that McGlone is intending to say the same thing in both cases. If this is the case, then this second example does not demonstrate circularity in conceptual metaphor for the reason given earlier for the first example. If this is not the case, then the claim being made in this second example is that conceptual metaphor theorists hold that people think about abstract concepts (i.e., theories) in metaphorical terms because they use metaphorical language. Here, the reply is twofold. In the first place, if McGlone (2007) is claiming that the origin of metaphorical thinking is linguistic metaphor, then this is another case of the logical fallacy of *ignoratio elenchi* because McGlone is mistakenly attributing to the conceptual metaphor theorists a view that is not actually held. Indeed, the conceptual metaphor theorist George Lakoff claimed language to be "secondary" to "thought and reason" (1993, p. 208) and later that "metaphor does not reside in words but in ideas" (2008, p. 35). In the second place, if

McGlone is claiming that once language has been acquired, then metaphorical thinking can produce metaphorical linguistic utterances *and* linguistic metaphorical expressions can influence us to think metaphorically, then that is acceptable. It is acceptable because thinking and language do influence each other in this mutual and reciprocal way. But, either way, this does not involve circularity. If conceptual metaphor theorists were guilty of circular reasoning, they would be claiming that our only evidence for metaphorical thinking is language, and our only evidence for language is metaphorical thinking, and, further, that people actually think metaphorically only because they speak metaphorically. But none of these is claimed by conceptual metaphor theorists.

An important point is that, from a direct realist perspective, a conceptual metaphor must precede a metaphorical linguistic expression of that metaphorical concept. The relationship between language and thought is that, because language must refer to something else, that something else must exist prior to its being referred to; hence, when what is expressed in language is thinking (i.e., metaphorical thinking), then, again, thought must precede language as otherwise there is nothing for the language to refer to. On that understanding, when considering McGlone’s (2007) criticism of conceptual metaphor regarding circularity Kertész and Rákosi note that “the two chains of inferences leading in opposite directions constitute two different perspectives rather than turn the argumentation into a full circle” (2009, p. 709). Overall, the criticism of circularity against conceptual metaphor theory, as examined via the two core instances from McGlone (2001, 2007), does not hold up under scrutiny.

The final sentence from each example is a call for evidence regarding conceptual metaphor “that is independent of [from] the linguistic evidence” (McGlone, 2001, p. 95, 2007, p. 115). However, such a call may no longer be considered to be a legitimate criticism of CMT because, as demonstrated earlier, there is ample nonlinguistic empirical evidence supporting CMT (e.g., Cienki, 1998, 2008; Meier et al., 2015; Williams & Bargh, 2008a).

CMT cannot explain why only some elements are mapped from source to target. As noted earlier, a source domain provides elements that structure our understanding of a target domain. These source-to-target mappings are partial with source elements being used to highlight one or more aspects of a target domain and, in the case of complex or blended metaphors, with elements from any number of source domains being used. Such partial mappings have led researchers (e.g., Clausner & Croft, 1997; McGlone, 2001, 2007; Murphy, 1996) to ask: Why *one particular subset* of elements is mapped and not a different subset? For instance, if it is the case that the conceptual metaphor THEORIES ARE BUILDINGS informs our understanding, why then do we apprehend theories in terms of some elements of a building (e.g., foundation, framework) but not in terms other elements of a building (e.g., hallway, staircase, sprinkler system, attic, basement) (Clausner & Croft, 1997; McGlone, 2007, 2011)?

This is a legitimate question and one that is somewhat encouraged via the use of metaphor nomenclature that is not fine-grained enough (Clausner & Croft, 1997; Grady, 1997b). To elaborate, in *THEORIES ARE BUILDINGS Revisited* (1997b) Grady built on his work concerning primary metaphors and argued that THEORIES ARE BUILDINGS is a complex metaphor arising from two primary metaphors: ORGANIZATION IS PHYSICAL STRUCTURE and PERSISTING IS REMAINING ERECT, whereby we understand abstract principles based on our experiences with making, breaking, and rearranging physical structures and our experiences with objects that remain upright or erect when viable and with objects that fall down when not viable, respectively. So, we can understand theories as being *solid*, *well put together*, and able to *stand up*, or as being *flimsy*, and *shaky*. On these experiential bases an erect physical structure does entail a foundation and a framework, or rather does entail a relation between a foundation and a framework (Grady, 1997b, p. 227), but such a structure does not entail walls, windows, hallways, staircases, sprinkler systems, attics, etc., nor does it entail a relation between such elements. Therefore, it would be better, regarding clarity and coherence, to discern the complex metaphor as THEORIES ARE ERECT PHYSICAL STRUCTURES rather than THEORIES ARE BUILDINGS.[8] The latter phrasing persists over the former because we latch onto similarities and not differences and in Western culture a prototypical erect physical structure is "likely to be a building, rather than, say a telephone pole, or an electric tower" (Grady, p. 279).

CMT cannot explain scientific technical jargon. In 2012, Meteyard, Rodríguez Cuadrado, Bahrami, and Vigliocco asked "how much of the technical abstract jargon of our scientific knowledge could be characterized in this manner [i.e., via CMT]?" (p. 800). The question is asked in the context of inquiring as to the explanatory scope of CMT in accounting for all abstract domains of knowledge. However, CMT does not claim that *all* abstract concepts arise from concrete experiences. The researchers do not provide any examples of what is meant by "technical abstract jargon", but it appears that Meteyard and colleagues are conflating technical abstract jargon with abstract concepts: jargon is comprised of words and phrases learned from teachers and books, what Gibson (1979) called "a different kind of knowledge" (p. 253), whereas knowledge of the latter does not "*come from* anywhere; it is got by looking, along with listening, feeling, smelling, and tasting" (p. 253). CMT need not account for the former. Of course, that is not to say that the person who initially coined the technical jargon did not have some reason (i.e., got from listening, feeling, etc.) for selecting that particular terminology.

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[8] Similar to Grady (1997b), Clausner and Croft (1997) claim that some metaphors "are formulated too generally" (p. 259) and that the metaphor THEORIES ARE BUILDINGS is better understood as THE CONVINCINGNESS OF THEORIES/ARGUMENTS IS THE STRUCTURAL INTEGRITY OF A BUILDING.

CMT suffers from the homunculus problem. Another criticism is the claim by McGlone (2011) that conceptual metaphor theory has an "untenable theoretical position", one "akin to positing 'handler homunculi'" (p. 567) because "CMT explains the problem of metaphor comprehension by positing metaphors in our minds that tell us how to interpret metaphors we encounter in discourse, and also how to use them appropriately ourselves" (p. 566). This criticism is justified only in the case where proponents of CMT either claim that conceptual metaphor "allows us to understand" abstract concepts (e.g., Lakoff & Johnson, 1999, p. 82; Núñez, 1999, p. 45; Sullivan, 2013, p. 1) or support a representationist epistemology. In these cases, the expression suggests that conceptual metaphor is a piece of knowledge or a tool that we can *employ* to help us understand a linguistic metaphorical expression. However, by being clear that conceptual metaphors involve our tendency to, rather than allow us to, apprehend abstract concepts in terms of more concrete or bodily experiences it may be seen that the theory does not claim that a conceptual metaphor *tells* us anything. So the homunculus criticism is unwarranted. Rather, what is claimed is that our experiences in the world inform our understanding of the world, a part of which is understanding what is being said or written by other people. After all, what else do people communicate about if not experiences? If your friend says "I'm feeling down" you would understand that your friend is sad or in a low mood. While it is true that part of your understanding is based on the grammatical rules of the sentence "I'm feeling down", this is not sufficient for understanding. For the most part, your understanding of the concept being expressed is based on your sensorimotor experiences of, for example, bending head downwards, slouching shoulders, and downturned mouth when experiencing sadness yourself or perceiving sadness in others. These experiences shape the conceptual metaphor SADNESS IS DOWN, of which, "I'm feeling down" is a linguistic expression. Thus, metaphor is embodied. Within a direct realist theoretical framework there is no disembodied “little man” telling an individual how to interpret or use metaphors in discourse. Or as Gibbs has argued in defence of his dynamical perspective of CMT, no “little man” is required to create understanding for an individual because “[m]eaningful metaphoric interpretations are emergent products of an entire self-organizing system as it adaptively engages the world” (2011a, p. 577). Of course, as argued earlier, any CMT supporters who retain a representationist epistemology are open to being criticised for being caught in the homunculus problem and the fatal logical flaws associated with representationism. But, as also argued earlier, CMT is more coherently accommodated within a direct realist framework.

Conclusion

Criticisms of CMT tend to either rest on a misunderstanding of conceptual metaphor or be legitimately applicable only to a representationist view of CMT. If presented in realist terms embodied cognition and conceptual metaphor survive critical scrutiny both of the theory and of the empirical support. Conceptual metaphor is a theoretically and empirically fruitful way to proceed with research on embodiment. One particular focus of attention in recent research has been conceptual metaphor and perceptions of time. This will be the subject of the next chapter.

CHAPTER 3

Spatio-Temporal Conceptual Metaphor: Understanding Time in Terms of Space and Motion

According to Gibson "[t]here is no such thing as the perception of time, but only the perception of events and locomotions" (1975, p. 295). The famous English cook Delia Smith (2009) claims that it takes seven minutes in simmering water for an egg to become hard-boiled. How do we know that seven minutes have passed? One way is to set an egg-timer, that is, twist our plastic egg-shaped timer to the number seven on the dial or invert our hourglass shaped timer. In both cases (dial or hourglass) the amount of time passing is being determined by a "successive iteration of physical events" (Lakoff & Johnson, 1999, p 138), and that is what we perceive, we perceive either the motion of wheels driven by the release of springs or the flow of sand through a narrow middle neck, respectively.

Perceiving time in terms of events and locomotions appears to be a universal phenomenon, although other sensory systems seem less involved; unlike the relationship between valence and colour (see Meier et al., 2004), "the future can't taste purple" (Núñez, 1999, p. 52). At its most basic level elements from our experiences of space are mapped onto our understanding of the abstract temporal domain in what has been labelled the TIME ORIENTATION metaphor (Lakoff & Johnson, 1999). Typically, the location of the observer corresponds to the present, the space in front of the observer corresponds to the future, and the space behind the observer corresponds to the past.

A Conceptual Understanding of Future, Past, and Present

The spatial concepts of FUTURE IS IN FRONT OF EGO and PAST IS BEHIND EGO appear to be common across most cultures. For example, findings in a study assessing spontaneous fluctuations in the magnitude and direction of postural sway while participants recalled or imagined events in a typical day four years in the past or in the future, respectively, suggest a correlation between thinking about time and bodily postural movements (Miles, Nind, & Macrae, 2010). Specifically, individuals engaged in retrospective thinking tend to lean backward while individuals engaged in prospective thinking tend to lean forward. There are a few cited exceptions to this way of thinking. For instance, hand movements by Aymara speakers[9] away from and toward the body when talking about the past and the future, respectively, demonstrate those speakers' metaphorical understanding of the past as being in front of an individual and the future being behind an individual (Núñez & Sweetser, 2006). In another study, when presented with a figure between two boxes, where the figure's facial features (eyes, nose) allowed interpretation of which box was in front of and which box was behind the figure, speakers of Darija,[10] were more likely to indicate future events in the box behind the figure and to indicate past events in the box in front of the figure than vice versa (de la Fuente, Santiago, Román, Dumitrache, & Casasanto, 2014). Similar claims of PAST IS IN FRONT OF EGO and FUTURE IS BEHIND EGO have been made concerning the Ancient Greeks (Allan, 1995; Dee, 2010, September 3), and speakers of Malagasy[11] (e.g., Dahl, 1995), Mandarin Chinese (Alverson, 1994), Māori[12] (Thornton, 1987), and Toba[13] (Klein, 1987). In cases where the empirical evidence for a claim of a *future-behind, past-front* view of time is linguistic in nature some researchers argue that the claim is based on faulty extrapolations from linguistic data (e.g., Núñez & Sweetser [2006] for Malagasy, Māori, and Ancient Greeks; Yu [1998, 2012] for Mandarin Chinese). This theme will be pursued later when considering the importance of reference point and referent in conceptualising time.

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[9] Aymara is an Amerindian language spoken in the Andean highlands of western Bolivia, south-eastern Peru, and northern Chile.
[10] Darija is a Moroccan dialect of modern Arabic.
[11] Malagasy is the Austonesian language of Madagascar.
[12] Māori is a language of New Zealand.
[13] Toba is an Amerindian language spoken in the Gran Chaco region of Argentina, Bolivia, and Paraguay.

Another possibility, one not considered in the literature, for why people appear to think differently about future and past is that they are using different criteria for determining what is *front*. To elaborate, the "front" of an object is usually the end containing the perceptual apparatus (e.g., as for birds and cats) or the preceding end when the object is in typical motion (e.g., the front of a car being driven on a road) (Clark, 1973; Fillmore, 1971). While the perceptual apparatus and typical direction of motion of humans have the same *front*,[14] it may be that how we discern future and past depends to some extent on which ego-centric criterion for determining *what is front* is favoured. On the one hand, a *future-front, past-behind* view of time favours a criterion dependent on motion. That is, this view is grounded by our experiences with space and motion. Our typical motion is forward which means that when we pass by an object, that object is now behind us and an object that is in front of us is one that we are yet to pass by. So, anything that has been experienced can be understood as being behind us whereas anything yet to be experienced can be understood as being ahead of us; the past is behind us and the future is in front of us. On the other hand, a *future-behind, past-front* view of time favours a criterion dependent on perceptual apparatus. That is, this view is grounded by the experience of being able to easily perceive what you have just done in front of you but it is not that easy to perceive anything behind you; hence the past is in front and the future, being as yet unseen, is behind. Importantly, our understanding of future and past is embodied irrespective of which criterion may be privileged.

[14] Not all organisms' perceptual apparatus and typical motion have the same *front*. For example, a crab's perceptual apparatus is forward-facing but its typical motion is sideways.

Spatio-Temporal Conceptual Metaphors

It is clear from the preceding material that mappings from our experiences with space alone are not sufficient to conceptualise time as most people understand it (i.e., future-front, past-behind); we also need mappings from our experiences with motion. Spatio-temporal conceptual metaphor involves apprehending abstract time and temporal events in terms of concrete space and movement (Boroditsky, 2000; Clark, 1973; Lakoff & Johnson, 1980, 1999).

Two Temporal Perspectives: MOVING TIME (MT) and MOVING EGO (ME)

Combining elements from the source domain of motion with the spatial elements already mapped in the TIME ORIENTATION metaphor gives rise to two complex metaphors: MOVING TIME (MT) metaphor and MOVING EGO (ME) metaphor (Lakoff & Johnson, 1980, 1999). Both these metaphors involve two entities, an observer (i.e., an ego) and a temporal event, where one entity is deemed to be moving along a path (i.e., a timeline) relative to the other entity being stationary. Front and back orientations are assigned to the moving entity (i.e., ego or temporal event) based on its *typical* direction of motion (Boroditsky, 2000; Clark, 1973; Fillmore, 1971; Lakoff & Johnson, 1999). An ego's typical direction of motion is futureward because the space in front of the observer corresponds to the future and people typically move in a forward direction. A temporal event's typical direction of motion is pastward because once encountered that event moves behind the observer who is facing the future while being located in the present. So, we recognise time as being unidirectional; we encounter an event once only. Table 2 presents the mappings for each metaphor.

Table 2

The Systematic Set of Mappings that Characterise the Conceptual Metaphors MOVING TIME *and* MOVING EGO

Source: SPACE, MOTION		*Target: TIME*
	MOVING TIME	
location of the ego[a]	→	the present
space in front of the ego[a]	→	the future
space behind the ego[a]	→	the past
objects[b]	→	times
the motion of the objects past the observer[b]	→	the ‘passage’ of time
	MOVING EGO	
location of the ego[a]	→	the present
space in front of the ego[a]	→	the future
space behind the ego[a]	→	the past
locations on ego’s path of motion[b]	→	times
the motion of the ego[b]	→	the ‘passage’ of time
distance moved by the ego[b]	→	the amount of time ‘passed’

Note. Adapted from “Philosophy in the Flesh” by G. Lakoff and M. Johnson, 1999, pp. 140-147.
[a] SPACE. [b] MOTION.

The statements *Christmas is coming* and *Christmas has arrived* are linguistic expressions of the MT metaphor where a temporal event (i.e., Christmas) is considered as moving pastward (an event’s typical direction of motion) relative to a stationary observer. The statements *we are coming up on Christmas* and *we have reached Christmas* are linguistic expressions of the ME metaphor where an observer is considered as moving futureward (a person’s typical direction of motion) relative to stationary temporal events. MT and ME perspectives have been identified cross-linguistically, for example, in English (Clark, 1973; Lakoff, 1993; Lakoff & Johnson, 1980), Chinese (Yu, 1998, 2012), and Hungarian (Kövecses, 2005). See Figure 3 for a graphical representation of these two spatio-temporal metaphorical perspectives.

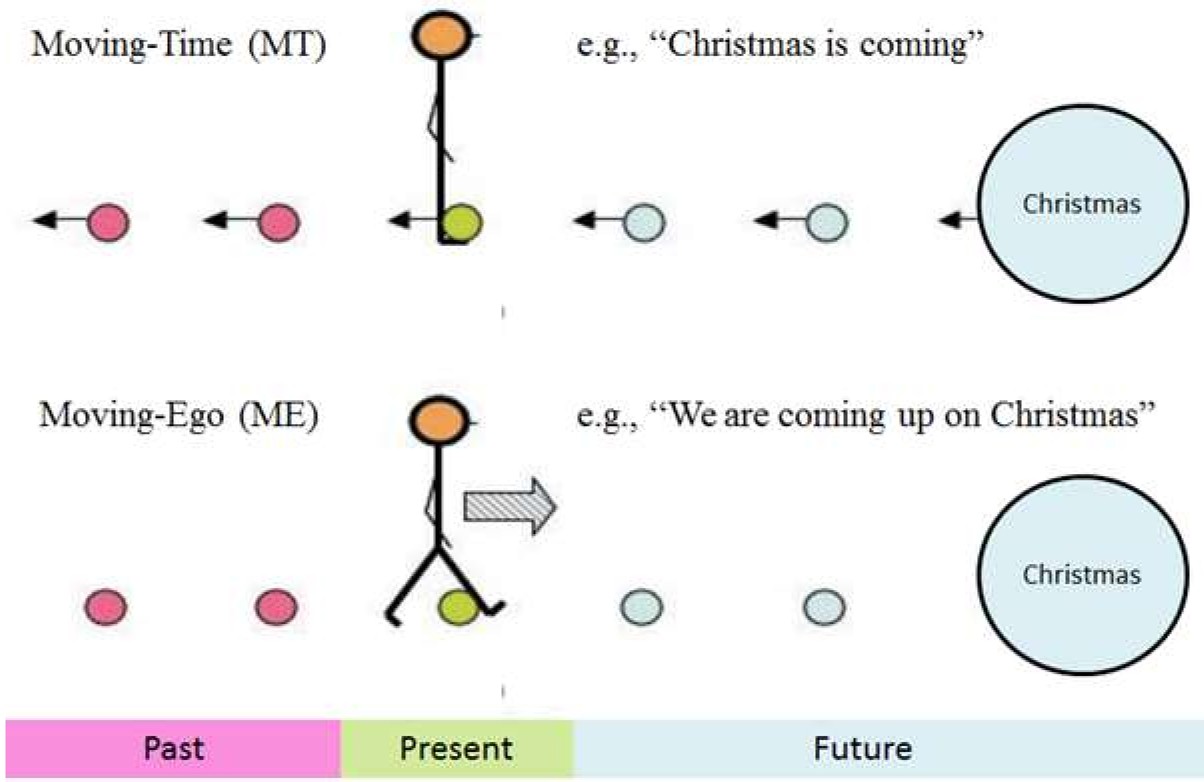

Figure 3. MOVING TIME and MOVING EGO spatio-temporal metaphors.
Circles represent temporal events. Arrows represent the moving agent's direction of motion. Adapted from "With the Future Behind Them: Convergent Evidence from Aymara Language and Gesture in the Crosslinguistic Comparison of Spatial Construals of Time," by R. E. Núñez, and E. Sweetser, 2006, *Cognitive Science: A Multidisciplinary Journal*, *30*, p. 406.

Reference Points

It has been argued that spatio-temporal conceptual metaphors can also vary depending on different reference points. The MOVING TIME and MOVING EGO metaphors are ego-reference point (Ego-RP) metaphors. That is, future and past are understood in relation to the present (i.e., now) with an observer co-located with the present. However, temporal understanding also occurs without reference to an ego as when we think about earlier temporal events in relation to later temporal events or vice versa; this is a time-reference point (Time-RP) understanding. For example, *the deadline is after Christmas* or *the deadline is before the holidays*. A Time-RP is concerned with *earlier than* and *later than* relationships not with future-now-past relationships. Evidence for this distinction between reference points was provided in a study by Núñez, Motz, and Teuscher (2006). In that study, participants viewed a row of five differently coloured boxes (two of which contained a ball) sliding across a screen in either a rightward or leftward direction before answering questions about which coloured box was "in front" of another coloured box or whether the ball moved forward or backward when moving to an adjacent box. Viewing the boxes sliding across the screen and answering the subsequent questions is considered an ego-free prime because neither activity involves an object moving relative to an observer. Indeed, what this prime is asking participants to consider is objects moving relative to one another, that is, ascribing anteriority and posteriority to the movements. After such priming, participants answered a question concerning a "Next Wednesday" event being *moved forward* two days, with the question being *On what day will the [event that has been moved forward] now take place?* The wording of the question is ambiguous as to the direction of the event's movement (the section below discusses in more detail this temporally ambiguous question – TAQ). Participants were found to be more likely to move the event "forward" two days to Monday rather than to Friday which given the ego-free prime suggests that participants were more likely to interpret "moving forward" as "moving earlier", in this way demonstrating that temporal understanding does not necessarily involve reference to an ego.

Therefore, to understand how individuals perceive time it is important to identify which reference point (i.e., Ego, Time) is involved. In addition, to avoid misunderstandings one must also consider the combination of reference point and referent. Typically, the referent is a temporal event with the reference point and referent combination concerning how an observer (an ego) is perceived relative to an event (e.g., *we're coming up on Christmas*) or how one event is perceived relative to another event (e.g., *the holidays are in the week following the deadline*). Recently, Yu (2012) has argued that some studies suggesting that speakers of Mandarin Chinese understand time as *future-behind, past-front* (e.g., Ahrens & Huang, 2002; Alverson, 1994) were flawed because researchers mistakenly assumed an Ego-RP and temporal event referent combination when analysing their linguistic data. In these cases, Yu introduces an extra complexity into spatio-temporal metaphor by claiming that the more appropriate combination is an Ego-RP and human-sequence referent combination. In a human-sequence of time humans (i.e., older age humans or earlier generations preceding younger age humans or later generations) can be located along the metaphoric path we conceptualise to understand time. In this case, humans are similar to temporal events, with earlier human generations being in front of later human generations, and if there is an Ego-RP, the ego is facing toward the earlier generations. Yu argues that Ahrens and Huang (2002), in failing to consider a human sequence view of time, mistakenly claim that sentences like the one given below support a conclusion that "what is in front of the speaker is in the past, while what is in back of the speaker is in the future" (p. 500).

qian	*bu*	*jian*	*gu*	*ren,*	*hou*	*bu*	*jian*	*lai*	*zhe.*
front	not	see	ancient	people	back	not	see	come	those

'Before me, I can't see any predecessors; behind me I can't see any followers.'[15]

That is, it is a mistake to believe that this *earlier/later* understanding involving human objects maps onto *past-front/future-behind* understanding involving event objects. Employing a queue analogy helps to explain how the human sequence view works in tandem with other ways of understanding time. People in a queue have the earlier comers (or "predecessors") ahead of them, the later comers (or "followers") behind them. However, for everyone in the queue, in

[15] For temporal understanding the importance of this sentence is the implication drawn from the "Before me…predecessors; behind me…followers" portion. The "I can't see any" segment is not relevant.

working their way to the front of the queue they are moving forward (i.e., futureward). This queue analogy demonstrates that considering your predecessors (i.e., those who arrived before you) as being *in front* of you does not entail that you also consider the past as being *in front* of you. Hence, Ahrens and Huang (2002) were incorrect to assume such an entailment when they claimed that “what is in front of the speaker is in the past” based solely on their linguistic data (Yu, 2012). The important point is that linguistic data can be misleading if it is considered in isolation from extra information about the reference point (i.e., Ego or Time) and what is the referent (i.e., temporal events, humans). Indeed, Núñez and Sweetser (2006) claim that misunderstanding the reference point and referent combination has led to a mistaken view of a *future-behind, past-front* perspective of time for Māori speakers and the Ancient Greeks (Thornton, 1987) and for Malagasy speakers (Dahl, 1995).

While it is acknowledged that there are several different temporal reference classifications (i.e., Time-RP, Ego-RP and human-sequence referent combination) the focus of the present thesis is the Ego-RP and event referent understanding of time. MT and ME conceptual metaphors have an Ego-RP with the ego (i.e., observer) co-located with the present (as shown earlier in Figure 3). Numerous studies have investigated MT and ME perspectives of time and we now turn to review this empirical research.

Empirical Research Supporting Ego-Reference Point Perspectives of Time via the Temporally Ambiguous Question (TAQ)

A widely used measure of whether an individual adopts an MT or ME metaphor when thinking about time is their chosen answer to a *temporally ambiguous question* (TAQ). In a TAQ, people are presented with a statement similar to: “The meeting originally scheduled for next Wednesday has been moved forward two days”, and then asked ‘What day is the meeting now that it has been moved?” The statement is temporally ambiguous because nothing indicates the event’s (i.e., the meeting’s) direction of motion. Therefore, *moving forward* may be understood in two ways depending on the conceptual metaphor involved: an MT metaphor perspective interprets the event as *moving forward* toward the observer in time’s typical direction of motion (i.e., pastward) to Monday, whereas an ME metaphor perspective projects the observer’s typical direction of motion onto the event, thus interpreting the event as *moving forward* (i.e., futureward) to Friday (Boroditsky, 2000; Boroditsky & Ramscar, 2002; McGlone & Harding, 1998; Núñez et al., 2006). For a graphical representation of how the TAQ is interpreted based on MT and ME metaphors, see Figure 4.

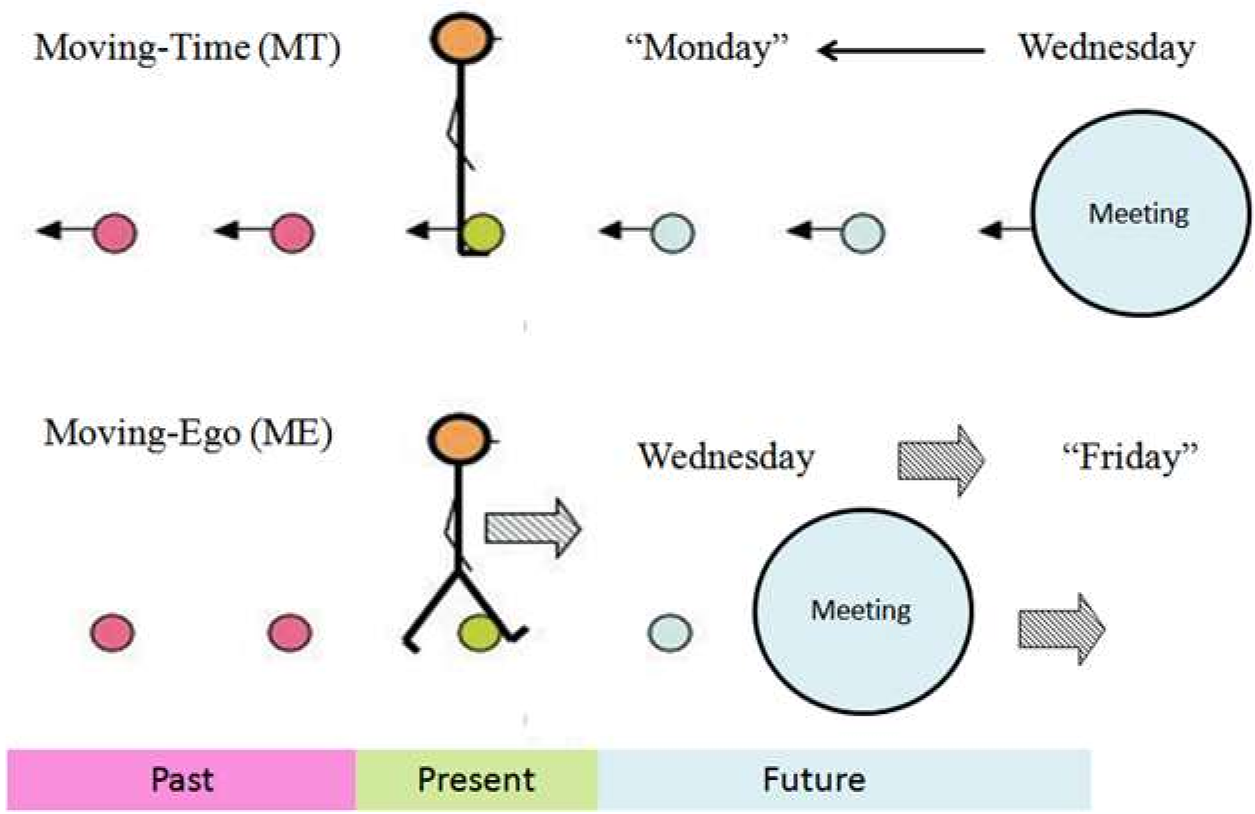

Figure 4. Interpretation of TAQ responses based on whether MOVING TIME or MOVING EGO metaphors are adopted.
The temporally ambiguous question to be interpreted in this instance is: *The meeting originally scheduled for next Wednesday has been moved forward two days. What day is the meeting now that it has been moved?* Adapted from "With the Future Behind Them: Convergent Evidence from Aymara Language and Gesture in the Crosslinguistic Comparison of Spatial Construals of Time," by R. E. Núñez, and E. Sweetser, 2006, *Cognitive Science: A Multidisciplinary Journal*, *30*, p. 406.

McGlone and Harding (1998) were the first to use a TAQ and found that participants primed with MT metaphor statements (e.g., "The wedding is coming up in two days") were more likely to answer Monday while participants primed with ME metaphor statements (e.g., "We are coming up on the wedding in two days") were more likely to answer Friday. These findings demonstrate that an individual's understanding of time can be manipulated. However, it could be argued, as indeed it was by McGlone and Harding, that the factors involved were linguistic conventions rather than spatio-temporal metaphors, and that participants were merely responding in a way that was consistent with the linguistic primes.

Motion and perceptions of time. The spatial element of motion corresponds to elements of how individuals understand time (Boroditsky, 2000; Clark, 1973; Kövecses, 2010a; Lakoff & Johnson, 1980, 1999). This was demonstrated in the Núñez et al. (2006) Time-RP study reviewed earlier. Therefore, motion should influence temporal understanding (Time-RP or Ego-RP). There is a relatively small body of empirical research that has supported the distinction between MT and ME perceptions of time as influenced by motion. In one study using nonlinguistic spatial primes Boroditsky (2000) found that a majority of participants answered a TAQ in a prime-consistent manner. That is, among participants in an ME scenario (e.g., having viewed images of a human-like figure moving on a path toward stationary objects) there were more Friday responses, whereas among participants in an MT scenario (e.g., having viewed images of objects moving on a conveyor belt toward a stationary human-like figure) there were more Monday responses. A similar breakdown in TAQ responses was observed in later studies where participants viewed an image and imagined themselves as the portrayed human-like figure either moving toward an object (i.e., ME scenario) or pulling an object toward itself (i.e., MT scenario) (Boroditsky & Ramscar, 2002; Sullivan & Barth, 2012). Since the primes here were spatial and pictorial, these studies provide support for a *conceptual*, as opposed to merely *linguistic*, interpretation of the metaphorical responses.

Extending on laboratory scenarios, Boroditsky and Ramscar (2002) reported a series of studies that used real-life motion experiences to investigate the influence of motion on temporal understanding. One experiment found a greater ME bias as individuals progressed along a lunch queue; that is, individuals physically moving forward in a queue were more likely to act as if they were projecting their forward movement onto their understanding of time and thus answer Friday rather than Monday to a TAQ. Another experiment found that people travelling on a train were more likely to have an ME perspective of time close to the beginning or the end of their journey, whereas mid-journey either spatio-temporal perspective (i.e., MT or ME) was equally likely. Thus, while everyone experienced similar motion as the train moved toward its destination, there were more Friday than Monday TAQ answers at those points (i.e., beginning, end) when people are usually actively engaged in thinking about their journey. These findings were supported by Duffy et al. (2014), in a study that found that people at a bus station en route to work were more likely to have an ME perspective of time when running late for work, whereas individuals running on schedule or running early for work were more likely to have an MT perspective of time. Again, everyone was in a similar situation (i.e., at the bus station on the way to work), but there were more Friday than Monday TAQ answers at the point (i.e., running late) when people are usually actively engaged in thinking about their journey to work. Such findings show that *simply thinking* about motion, and not necessarily the experience of motion itself, influences temporal understanding; although conceptual metaphors are embodied, they can also be separate from the actual experiential factors that ground their structural framework.

Ramscar, Matlock, and Dye (2010) investigated whether the motion and time relationship extends to the more abstract fictive motion, that is, idiomatic expressions that attribute motion to objects incapable of movement. These researchers found that participants who read an MT perspective fictive motion sentence (e.g., “The road comes all the way from New York”) were more likely to answer Monday while participants who read an ME perspective fictive motion sentence (e.g., “The road goes all the way to New York”) were more likely to answer Friday.

These findings demonstrate that a person does not need to imagine or actually experience physical motion for motion to influence time perception.

Further separating actual physical motion from thoughts regarding motion, Matlock, Holmes, Srinivasan, and Ramscar (2011) found that filling in the blanks in a sequence (i.e., numbers or alphabet) either forward (i.e., 5 to 17 or G to P) or backward (i.e., 17 to 5 or P to G) results in more Friday or more Monday TAQ responses, respectively. Another experiment in the same study reported similar findings when participants read a story that ended in a countdown either forward (i.e., one to five) or backward (i.e., five to one), although results were statistically significant for forward sequences but not for backward sequences. It could be argued that the factors involved were directional conventions rather than spatio-temporal metaphors, and that participants were merely responding in a way that was consistent with the directional primes. If this is not the case, that is, if the results are not due to directional priming effects, then such results have been held to show that the direction of an abstract form of sequential “motion,” that is, forwards or backwards, evokes congruent directional spatio-temporal metaphors.

Taken together these studies demonstrate that spatial representations of time are fundamentally conceptual and that the influence of motion on temporal understanding goes beyond the physical experience of motion itself extending to thoughts and attributions of motion.

Conclusion

The purpose of this chapter was to detail how our apprehension of time is grounded in our experiences with space and motion. We do not perceive time, but, rather, we perceive objects located in space and moving in space. To avoid misinterpreting how individuals understand time the reference point (i.e., Ego, Time) and referent (i.e., temporal events, human) combination must be considered carefully. The TAQ has been shown to be an effective means of uncovering which of two Ego-RP spatio-temporal metaphor perspectives individuals use when thinking about time. The influence of spatial and motion primes as reflected via TAQ responses demonstrates support for a conceptual, as opposed to merely linguistic, interpretation of the metaphorical responses. Moreover, perceptions of time appear to be influenced not only by actual physical motion but also by imagined, abstract, and even fictive motion.

If motion is a significant factor in spatial representations of time, it is reasonable to expect that whatever influences motion may also play a role. Motion and emotion are related lexically; the term *emotion* derives from the Latin *emovere*, which means *to move*, *to excite*, *to stir up*, or *to agitate*. Beyond lexical considerations, empirical evidence provides support for a relationship between motion and emotion (e.g., Cacioppo, Priester, & Bernston, 1993; Chen & Bargh, 1999; Krieglmeyer, Deutsch, De Houwer, & De Raedt, 2010). Therefore, it is possible that emotion, by virtue of its close connection with motion, will influence perceptions of time. This possibility is worthy of closer theoretical and empirical scrutiny. The next chapter will examine the links between emotion, motion, and perceptions of time.

CHAPTER 4

Links between Emotion, Motion, and Perceptions of Time

The shift in cognitive science to embodied cognition perspectives has seen a renewed focus on the role of emotion (Stapleton, 2013). Our emotional state is related in predictable ways to bodily movement; if an event makes us happy we tend to move towards it or pull it towards us; if an event makes us unhappy, we tend to want to avoid it or push it away. This relation between emotion and movement is reflected also in our views of time. It has long been remarked that our perception of time and the speed of temporal events appears to be influenced by our emotional state. When we are having fun, time flies. When we are engaged in an aversive task, or awaiting a pleasant event, time seems to crawl; when we are engaged in a pleasant task, or awaiting an aversive event, time seems to fly. For a five-year old child counting "the sleeps" to an exciting event like Christmas, it seems as though Christmas is taking ages to arrive. That dreaded dental appointment, in contrast, is upon us in what seems like no time at all. These phenomena suggest that spatio-temporal metaphorical perspectives may well be related not only to our experiences of movement but also to our emotional state.

This chapter explores the interconnections between these three themes: emotion, movement and time-perception. It begins with the question of the nature of emotion, its relation to affect and mood, and the problems of naming and classification. Next, there is an examination of the link between emotion and motion in terms of approach and avoidance motivations and an exploration of how such motivations relate to a distance-change view of time-perception. There is also a discussion regarding the concept of valence and the importance of distinguishing an emotion resulting from a valued object or event (i.e., valence) and an emotion resulting from an incidental cause (i.e., emotion-induction). As will be shown in the present chapter, the existing literature investigating the link between emotion and spatio-temporal understanding is sparse and faces some conceptual problems. Seven critical questions are identified to help address these issues.

Emotion

William James (1884) asked: “What is an emotion?” This seemingly simple question still perplexes contemporary psychology. For Joseph LeDoux “one of the most significant things ever said about emotion may be that everyone knows what it is until they are asked to define it” (1996, p. 23). According to *The Penguin Dictionary of Psychology*, emotion “has proven utterly refractory to definitional efforts” (Reber & Reber, 2001, p. 236). Despite this, there are some recurring themes, specifically relating to the involvement of brain and body, in many attempts to define emotion.

For James “[a] purely disembodied human emotion is a nonentity” because emotions are “constituted by, and made up of…bodily changes” (1890, p. 452). For example, we see a bear charging towards us and our emotion of fear is our bodily changes (e.g., increased heart rate, shallow breathing, stomach churning, piloerection) plus the feeling of those changes. James was ahead of the late twentieth century EC curve when stressing “how much our mental life is knit up with our corporeal frame” (p. 467). More recently, Parrot (2004) defines emotions as “a reaction to personally significant events, where ‘reaction’ is taken to include biological, cognitive, and behavioral reactions” (p. 6). The phrase “personally significant events’ implies that any one event will not elicit the same emotional reaction from everyone while leaving room for an event to be external (i.e., a particular situation) or internal (i.e., thinking about an event, real or imagined). This latter definition is similar to emotions being “[A] relatively brief episode of coordinated brain, autonomic, and behavioural changes that facilitate a response to an external or internal event of significance for the organism" (Davidson, Scherer, & Hill Goldsmith, 2003, p. xiii).

Stressing evolutionary foundations Neese and Ellsworth define emotions as "modes of functioning, shaped by natural selection, that coordinate physiological, cognitive, motivational, behavioral, and subjective responses in patterns that *increase the ability to meet the adaptive challenges of situations* that have recurred over evolutionary time" (2009, p. 129). Many researchers hold this view of emotions as adaptive survival responses that enable organisms to interact with each other and with their environment (e.g., Cosmides & Tooby, 2000; Damasio, 2000; Panksepp, 1998; Schore, 2003). For instance, the fear response of fight or flight on perceiving ourselves to be in danger is an adaptive response to a situation that may be potentially harmful to us. The danger may be in the guise of a bear charging toward us or in our understanding of the emotion displayed by another individual toward us (e.g., a clenched fist as an expression of aggression). Freud (1915/1981) treats emotions as evolved drive-ancillary structures that motivate action. Most contemporary psychologists agree that emotions are motivators, with Tomkins (1981) claiming them as our primary motivators. One prominent exception is Skinner (1953) who views emotions as "excellent examples of the fictional causes to which we commonly attribute behaviour" (p. 160). Overall, in psychology today there is a general acceptance that our emotions and our discerning of the emotions of others help us navigate our world.

Moreover, it appears that emotions are innately provided responses that are triggered (Damasio, 2000; Panksepp, 1998). Evolutionary selection has meant some environmental stimuli, particularly those that may be potentially harmful to our survival, appear to elicit innate emotional responses (Öhman, 1986; Öhman & Mineka, 2001). Other emotions are learned. For example, at around four years of age children begin to show *theory of mind*, the ability to recognise that others have certain mental states (e.g., beliefs, desires, knowledge) similar to their own (Astington & Gopnik, 1991), and such cognitive development allows children to be aware that others may be evaluating them; what others think about us are important elements of emotions such as guilt and shame (Leary, 2014; Muris & Meesters, 2014). During our lifetime, any number of objects may come to elicit emotion (e.g., via conditioning). In addition, an object need not be physically present to elicit an emotion. For example, "one may get angrier in thinking over one's insult than at the moment of receiving it" (James, 1890, p. 442). The object of the emotion may be physically present, remembered, or imagined.

During the twentieth century there was much debate within psychology concerning whether an emotion is always consciously known. Freud (1915/1981) argues that we may *have* but not necessarily *feel* an emotion. That is, emotions or their targets may be unconscious; we may be angry at someone close, but not be aware of that anger – perhaps feeling, instead, overly solicitous (reaction formation). After much debate (e.g., Lazarus, 1982, 1984; Zajonc, 1980, 1984), most contemporary psychologists agree that emotions can occur outside conscious awareness.

In addition to emotion occurring within or outside of conscious awareness neurological investigations into emotion show the involvement of distributed neural networks rather than specific emotion-only brain areas (Panksepp, 1998, 2003; Phan, Wager, Taylor, & Liberzon, 2002; Schore, 2003; Schulkin, Thompson, & Rosen, 2003). Nevertheless, many researchers focus their efforts concerning emotions on specific brain areas, such as the amygdala (LeDoux, 1996), the subcortex (Damasio, 2000; Panksepp, 1998) and the right hemisphere (Schore, 2003), while acknowledging that no specific brain area has sole responsibility. Also, what brain areas are used may depend on a person's sex. For example, functional magnetic resonance imaging (fMRI) reveals that females and males use different neural pathways when processing images of facial expressions of sadness, anger, fear, and happiness (Weisenbach et al., 2014). Recognising that emotions serve an evolutionary purpose, that is, to help organisms adapt to and survive challenges in the environment, Panksepp (1998) argues that ancient brain areas may provide a stronger foundation for understanding emotion than do relatively younger brain structures. Despite a brain-oriented focus neuroscience acknowledges the role of the body by claiming that "emotion and motor behaviour are inextricably linked" (Purves et al., 2012, p. 650), thus echoing James's view that emotions involve "the bodily sounding-board" (1890, p. 471).

While there is general consensus regarding the involvement of brain and body in emotion, there remains the question how emotion is related to affect and mood.

Emotion, Affect, and Mood

Owing to the lack of consensus regarding the relation between emotion, affect, and mood, there appears to be significant variation in the way that these terms are used. Some researchers refer to primary emotional systems as *affect programs* (e.g., Griffiths, 1997; Panksepp, 1998; Tomkins, 1981). The term *affect* is used interchangeably with the terms *emotion* and *mood* (Reber & Reber, 2001, p. 14) and as a term denoting the pattern of observable behaviours that express an individual's emotions (American Psychiatric Association, 2000; Westen, Burton, & Kowalski, 2006). Academic psychologists favour the term *emotion*, whereas clinicians favour *affect*, employing the term *emotion* when discussing an emotional disorder (Plutchik, 2000). On the one hand, the use of *affect* as an umbrella term that includes *emotions*, *moods*, and *feelings* is demonstrated in *affective science*, a discipline that "subsumes emotion but is not restricted to it" (Davidson et al., 2003, p. xiii) (see Appendix A) and in the title of Jaak Panksepp's (1998) influential book *Affective Neuroscience: The Foundations of Human and Animal Emotions*. On the other hand, in a therapeutic setting *emotion* is the umbrella term (Coffey, 2007). Overall, emotion and affect are interchangeable terms with different disciplines and settings within psychology favouring one over the other.

In general, most researchers distinguish *emotion* from *mood* based on (i) having/not having an intentional object and (ii) duration (DeLancey, 2006). Emotions appear to have an intentional object whereas moods have no object or have so many objects that moods appear objectless (Baier, 1990; Frijda, 1986; Morris & Reilly, 1987). For example, Jane who is pointing a loaded gun at you may be the object of your fear (an emotion), whereas you may be experiencing anxiety (a mood) about life in general and nothing in particular. Moods appear to differ in duration, with “emotions...held to be brief, while moods last longer” (Davidson, 1994, p. 51). However, the distinction between brevity (i.e., seconds to minutes) and non-brevity (i.e., hours to days) is an arbitrary one (Allen & Potkay, 1981), which makes it unclear as to when exactly an emotion changes into a mood. Adding to such unclarity concerning emotion are the problems of naming emotions and classifying emotions.

Emotions: Problems of Naming and Categorising

James noted that for anyone seeking to name every different emotion experienced by an individual across a lifespan “the limit to their number would lie in the introspective vocabulary of the seeker” (1890, vol. 2, p. 485). The naming of an emotion appears dependent on the considered importance of that emotion within a given culture. To illustrate, there are no single English words for emotions such as the Japanese *amae*, “a feeling of dependency akin to that which infants feel toward their mothers” (Prinz, 2004, p. 131), or the German *schadenfreude*, “the malicious enjoyment of another’s misfortunes” (Australian Oxford Dictionary). This is not to say that these emotions are not experienced by people in English-speaking cultures. Indeed *schadenfreude* is now commonly used in English-speaking cultures. Rather, in Japanese and German cultures these emotions are considered important enough to name.

Furthermore, the words we use to name emotions may be adequate for everyday purposes, but those same words may be a hindrance when attempting to explain emotional phenomena scientifically (Griffiths, 1997; Kagan, 2003). For example, there may be misunderstandings between the meaning of the everyday word and the meaning of that same word as adopted by researchers (Bell & Staines, 2001). One way to avoid such a misunderstanding is seen in the work of neuroscientist Jaak Panksepp (1998) who highlights his technical use of everyday words for discussing brain emotional systems via the use of capitalisation; for example, FEAR system (avoidance of pain and destruction), PANIC system (feelings of loneliness and separation distress), and RAGE system (mediates anger and is aroused by frustrations). Once an emotion has been named it may then be classified, and how emotions are classified influences how emotion is studied.

Dichotomous categories of emotion include division along dimensions such as exciting-depressing (Darwin, 1872/1998), coarse-subtle (James, 1890), and approach-avoidance (Davidson, Ekman, Saron, Senulis, & Friesen, 1990). Moving beyond dichotomous groupings, Tomkins (1962) discusses three distinct classes of emotion, or, to use his favoured terminology, affect: affect for the preservation of life (e.g., individuals fear threats to their own lives), affect for people (e.g., individuals respond to emotional displays of others – smiling in response to another's smile), and affect for novelty (e.g., becoming excited by new information). These examples are sufficient, I believe, to demonstrate that it is possible to group emotions on a variety of criteria. Given such variety, the founding question for any taxonomy of emotions should be “does this grouping or that suit our purpose best?” (James, 1890, p. 485). That is, what are the best emotion categories for addressing the scientific question of interest? In this thesis the scientific question of interest is: Does emotion, by virtue of its close connection with motion, influence perceptions of time? As such, the emotion categories of interest are those related to movement.

Emotion, Motion, and Time: Approach and Avoidance Motivations

Empirical evidence supports a relation between emotion and motion. For instance, dynamic facial images produce greater recognition of basic emotions when compared to static facial images (Back, Jordan, & Thomas, 2009; Wehrle, Kaiser, Schmidt, & Scherer, 2000), even when facial features are obscured (Bassili, 1978, 1979) or subtle (Bould, Morris, & Wink, 2008). In addition, bodily (excluding facial) movements or positions facilitate recognition of basic emotions (Atkinson, Dittrich, Gemmell, & Young, 2004; Coulson, 2004; Pollick, Paterson, Bruderlin, & Sanford, 2001). An area where the relationship between emotion and motion is categorised along dichotomous categories of emotion is in individuals’ approach-avoidance responses to affectively valenced (i.e., positive or negative) stimuli.

The term *approach* comes from the Latin word *appropiare* (to draw near). When we talk about approaching an object, we mean that we are coming nearer to that object spatially or temporally. For instance, “Jane is approaching the car” or “Jane is approaching her birthday.” The term *avoid* comes from the Old French word *esvuidier* (to empty out, to quit). When we talk about avoiding an object, we usually mean we do not want to encounter it and, typically, we move away from that object or move the object away from us. For instance, “Jane sidestepped the puddle” or “Jane postponed her dental appointment.” Of course, if an individual cannot move away from an object or move an object away from him/herself, then a third avoidance option is that the individual does not move. For example, the freeze response of the flight part of the fight or flight system is a form of avoidance. Tendencies to approach an object, avoid an object, or freeze are behavioural components of the emotion triggered in us by that object. Our current emotional states moderate these behavioural tendencies.

All motivational tendencies are contingent on either approaching or avoiding a given stimulus and are evolutionarily adaptive (Elliot & Covington, 2001). Whether we physically move or elicit movement from another (e.g., smiling to encourage another person to come closer), we are acting to effect a change in our environment. Avoiding dangerous stimuli (e.g., rotten food, predatory animals) and approaching valuable stimuli (e.g., nutritious food, a potential mate) facilitate an organism's survival. Our basic motivational orientations of approach and avoidance are organised along an appetitive-aversive dimension (Lang, Bradley, & Cuthbert, 1990). Appetitive stimuli facilitate approach behaviours and are categorised as positively valenced stimuli. Aversive stimuli facilitate avoidance behaviours and are categorised as negatively valenced stimuli. Consequently, we would expect that individuals would be faster to pat (approach) a pussycat than a lion.

Having reviewed categories of emotion related to motion, we can now turn to the issue of how emotions are assessed.

Assessing Emotion

Numerous methods are employed to assess emotion including self-report, physiological response, neurological response, and behavioural response. Awareness of the advantages and the limitations of each method in conjunction with the question being investigated facilitates a better choice of emotion assessment method.

Self-reports are an individual’s descriptions of his or her own emotions. Ways of recording subjective emotional experience include but are not limited to using own words (e.g., diary notes) or using rating scales (e.g., “How anxious are you feeling now?” answer from 1 *not at all anxious* to 5 *very* anxious). However, an individual’s own words may involve precise or global terms (Barrett, 2004) and rating scales depend on the respondent’s own standard. These issues limit self-reports as an accurate assessment of emotional experience. Another limitation is that emotions may be unconscious (Berridge & Winkielman, 2003; Freud, 1915/1981; Zajonc, 1968) and an individual cannot report on an emotion of which he or she is unaware. In addition, individuals may lie on self-reports, perhaps to adhere to social norms or to appear more socially desirable to either themselves or to others (i.e., social desirability). Despite such limitations, self-reports provide, by definition, one way of assessing the “how do I feel” component of an emotional experience.

Physiological assessment and assessment of brain activity are useful methods for assessing unconscious emotional experiences or for where people would have difficulty understanding and providing self-reports. For example, physiological assessments (e.g., heart rate, skin conductance – Vos et al., 2012; heart rate, respiration - Vos, De Cock, Petry, Van Den Noortgate, & Maes, 2013) are effective assessors of emotion in individuals with intellectual disabilities. Researchers usually examine changes in physiology from a baseline condition to post-emotion-inducing condition as the intensity of physiological responses differs between individuals (e.g., your resting heart rate differs from your friend’s resting heart rate). No one brain area has been linked to all emotional states, but multiple neurological studies reveal patterns of brain activation associated with emotional processing (Phan et al., 2002; Schulkin et al., 2003). For example, fear responses utilise the amygdala (Åhs et al., 2009; Damasio et al., 2000; Morris et al., 1998). Data patterns across studies provide a more objective understanding of brain activity during emotional processing as any one study is open to subjective interpretation of the found data.

Facial expressions are one form of emotional behaviour response (Darwin, 1872/1998; Ekman, 1972) with facial expressions of basic emotions recognised cross-culturally (Ekman & Friesen, 1971; Ekman et al., 1987). As behavioural responses occur relatively quickly, they are less susceptible to demand characteristics. However, assessment of emotional experience via facial expressions may be difficult if a person deliberately masks his/her true emotional state or when social norms dictate emotional expression (Ekman, 2001; Friesen, 1972).

What type of emotion assessment technique should be utilised depends on many factors, but there are four that are especially important. First, whether or not participants will be conscious of the emotion(s) must be considered. The second point follows on from the first, and is whether or not participants are likely to fake responses. The answers to these two factors will help determine whether forms of assessment should be implicit (i.e., can tap into unconscious emotions and as participants cannot tell what is being assessed they are unable to fake responses), explicit (i.e., participants can conclude what is being assessed so may fake responses), or a combination of the two. Third, the emotion assessment technique must be relevant to the question being investigated. For example, a self-report questionnaire would be an inappropriate method if a researcher were interested in assessing the brain's spontaneous electrical activity underpinning emotion. Finally, the sample used influences the choice of assessment technique. For example, one-year old children would be incapable of completing a self-report questionnaire. In addition to what type of emotion assessment technique is employed it is also important to consider what type of emotional phenomenon is being investigated. Specifically, is the emotion of interest that which occurs in reaction to an object or event (valence), or that which occurs as a result of incidental/experimenter induction, or both?

The Issue of Event Valence versus Induced Emotion

The categorisation of stimuli as positively or negatively valenced raises the question of the nature of valence. It is standard practice to refer to valence as if it were an intrinsic quality or property of the valenced object or event (Frijda, 1986). However, an opposing argument is that the basis of an object's valence, its positivity or negativity, is whether an organism is motivated to approach or avoid it (Lewin, 1935). According to this position, the valence of an object is not an inherent property of it, but, rather, an aspect of the *relationship between* that object and the organism evaluating it. This latter understanding is congruent with the origin of the term *valence* from the Latin word *valeo* (to be strong) and that word's idiomatic use in Latin as meaning "to be of value to". So in relational terms if an organism is motivated to approach an object then the object is positively valenced. In contrast, if an organism is motivated to avoid an object then the object is negatively valenced. Therefore, an organism's motivations label an object as positive or negative; valence is parasitic on motivational orientations of approach and avoidance.

Imagining oneself to be the object that is valenced helps to clarify the point that valence is a relative and not an absolute concept. To illustrate, not everyone will find you desirable nor will everyone find you undesirable. There are individuals for whom you are positively valenced, so they tend to approach you (e.g., family, friends), whereas for other individuals you are negatively valenced, so they tend to avoid you (e.g., enemies, disgruntled co-workers). This suggests that you are not innately positively valenced or innately negatively valenced, but, rather, that others enter into a relation with you based on their own motivational orientations of approach and avoidance.

When investigating emotion it may be important to distinguish between an emotion resulting from a *valued* object or event (i.e., valence) and an emotion resulting from an incidental cause (e.g., emotion-induction). Such a distinction allows investigation of what occurs when event or object valence and emotion-induction are congruent (i.e., positive and positive, negative and negative) or incongruent (i.e., positive and negative, negative and positive).

Approach and Avoidance Motivations: Empirical Research

The research examining the relationship between valenced stimuli and approach-avoidance behaviour suggests the embodiment of positive affect in approach behaviour and the embodiment of negative affect in avoidance behaviour. For instance, Cacioppo et al. (1993) found that participants rate images of Chinese ideographs (i.e., graphical symbols) more positively during arm flexion, an approach-related motor behaviour, than during arm extension, an avoidance-related motor behaviour. In addition, pulling actions (approach-related behaviour) occur faster in response to positive than to negative stimuli, and pushing actions (avoidance-related behaviour) occur faster in response to negative than to positive stimuli. This same pattern of congruent stimulus-response mappings, positive-approach and negative-avoid, has been found with many different stimuli: words (Chen & Bargh, 1999), goals and temptations (Fishbach & Shah, 2006), spider phobia (Rinck & Becker, 2007), attitudes toward stigmatised groups including people with AIDS and the elderly (Neumann, Hülsenbeck, & Seibt, 2004; Seibt, Neumann, Nussinson, & Strack, 2008), and when stimulus valence was either a task-irrelevant feature (De Houwer, Crombez, Baeyens, & Hermans, 2001; Neumann et al., 2004) or masked so that participants reported seeing flashes of light only (Alexopoulos & Ric, 2007). Taken together these studies provide evidence that (a) physical movements come to bias us toward positivity or negativity, (b) stimulus valence influences motoric responses, and (c) the evaluation of valenced stimuli may be conscious or nonconscious.

The bidirectional relationship between approach-avoidance behaviour and valence supports the embodiment of positivity as approach behaviour and negativity as avoidance behaviour. However, this does not mean that every part of the person's body will involve a motor bias of "moving towards" a positive stimulus or "moving away from" a negative stimulus. For instance, irrespective of the arm movement involved (flexion or extension), participants were faster to move a positive word toward, and a negative word away from, their name on a screen than vice versa (Markman & Brendl, 2005). Similar results were found when the participant's name on the screen was replaced with a positive word (i.e., love), a negative word (i.e., hate) or no word at all (i.e., an empty block) (van Dantzig, Zeelenberg, & Pecher, 2009). In these studies the same motoric responses indicated different approach-avoidance behaviours (e.g., pull-move toward, pull-move away). Thus, approach-avoidance behaviour cannot be simply a motor-bias. So what else can it be? Common to these studies was the fact that, regardless of the direction of arm movement, approach behaviour decreased distance whereas avoidance behaviour increased distance. The distance-change outcome supersedes the "moving towards" or "moving away" motor bias, that is, the outcome is more important that the method (i.e., specific movement) required achieving the outcome.

The importance attached to distance-change in approach-avoidance tasks is demonstrated with a zooming effect. When a presented image increases or decreases in size depending on a participant's joystick action, the increase or decrease is interpreted by participants as reducing or increasing respectively the distance between them and the image regardless of whether the joystick action is one of pushing or pulling (Rinck & Becker, 2007). In addition, data suggest that approach-avoidance behavioural tendencies facilitate *ultimate*, rather than *immediate*, distance-change objectives (Krieglmeyer, De Houwer, & Deutsch, 2011), with faster congruent stimulus-response mappings (i.e., positive-approach, negative-avoid) even when initial movements may be stimulus-response incongruent (that is, when ultimately avoiding an object may require an initial movement towards it). These studies highlight the importance both of distance-change in approach-avoidance tasks, and that approach-avoidance behaviour occurs within a context, and involves responding to the constraints of that context.

Approach and avoidance motivations: A distance-change view. A *distance-change* view explains approach and avoidance behaviour in terms of their distance-changing consequences, decreasing or increasing, respectively (Carver, 2006; Krieglmeyer et al., 2011; Strack & Deutsch, 2004). Distance-change as the crucial feature of approach-avoidance motions mirrors our embodied experiences. That is, we tend to move closer to positively valenced entities and to move away from negatively valenced entities (Lang et al., 1990; Schneirla, 1959). Decreasing the distance between oneself and a desired object is approach regardless of whether that distance-reduction is achieved via pulling an object toward oneself or extending one's arm away from one's body via reaching out toward an object. Similarly, increasing the distance between oneself and an undesired object is avoidance regardless of whether that distance-increase is achieved via pushing an object away from oneself or withdrawing from an object. Furthermore, in cases where it is not possible to increase the distance the between oneself and an undesired object avoidance may take the form of freezing. Psychological freezing or being "cold" can occur when one is physically close but, consequently, perceived as "distant". Distance-change is the behavioural manifestation of motivational orientations to approach or avoid. Thus, a distance-change view is synonymous with a motivational perspective of approach-avoidance.

Nonetheless, not all researchers agree on distance-change as the crucial feature of approach-avoidance behaviour. For instance, Eder and Rothermund (2008) argue that evaluative-compatibility facilitates approach-avoidance behaviour, that is, positively labelled behaviour will occur faster in response to positively labelled stimuli and negatively labelled behaviour will occur faster in response to negatively labelled stimuli, irrespective of any distance-change or direction of motion consequences. In a series of experiments, Eder and Rothermund found support for the evaluative-coding view with faster responses to positive stimuli for positively labelled joystick movements (“towards” or “upwards”) and faster responses to negative stimuli for negatively labelled joystick movements (“away” or “downwards”) than vice versa. These results occurred irrespective of joystick directional movements being forward, backward, right, or left in relation to the joystick operator. However, a recent study (Krieglmeyer et al., 2010) demonstrates that the evaluative-compatibility effect disappears when stimulus valence is a task-irrelevant feature. Participants responded to the grammatical category of a word presented in the centre of a screen by pressing buttons to move a manikin upward when the word was a noun and downward when the word was an adjective. For each trial, the manikin initially appeared in the top half or the bottom half of the screen and provided visual feedback of distance-change to participants as it moved closer to, or farther away from, the presented word. Such visual feedback provides a more sensitive test of approach-avoidance behavioural tendencies (Krieglmeyer & Deutsch, 2010). Results showed a motivational effect, faster responses moving closer to positive words and moving away from negative words than vice versa. Importantly, this effect occurred irrespective of whether the manikin moved upward or downward in relation to the presented word. There was no effect of faster upward responses to positive words or faster downward responses to negative words, hence, no evaluative-compatibility effect. Such findings strengthen support for a distance-change view of approach-avoidance. Another challenge to a distance-change view of approach-avoidance is in seemingly inconsistent findings, but, as we will see, such a challenge is typically based on neglecting the fact that behaviour occurs within a context.

Some exceptions to positive-approach and negative-avoidance. Understanding context helps to explain approach-avoidance findings that appear inconsistent. Consider the seemingly inconsistent findings that anger-related stimuli facilitate both approach tendencies (Alexopoulos & Ric, 2007) and avoidance tendencies (Marsh, Ambady, & Kleck, 2005). Anger is a negative emotion that prompts negative approach behaviour (i.e., attack). So, from an evolutionary perspective, not all approach motivation is accompanied by positive emotion or is directed at a positively-valenced stimulus. Alexopoulos and Ric (2007) employed word stimuli to elicit anger in participants so the participant's own anger-related approach behaviour helps explain that study's finding that anger-related stimuli facilitate approach tendencies. Marsh et al. (2005) used pictures of facial expressions as stimuli to convey another individual's anger to participants so the participants' response to that other individual's anger-related approach behaviour, that is, to move away from possible attack, helps explain that study's finding that anger-related stimuli facilitate avoidance tendencies. However, it is worth noting that another study involving the use of facial expressions to assess anger-related approach-avoidance motivation found that angry facial expressions facilitate approach-related behaviour (Wilkowski & Meier, 2010). So why the difference in approach- and avoidance-related findings between these two studies? Wilkowski and Meier (2010) speculate that Marsh et al. may have been mistaken to link participants' arm extension movements solely with avoidance-related behaviour (i.e., pushing the angry face away) because it is possible that on seeing an angry face participants' seek to overcome a social challenge and as such an arm extension movement may represent a "punching movement" (p. 207), a movement that is consistent with approach-related (i.e., attack) motivation. Context also helps to explain findings that sadness-related stimuli facilitate both approach tendencies (Seidel, Habel, Kirschner, Gur, & Derntl, 2010) and avoidance tendencies (Alexopoulos & Ric, 2007). Seidel et al. (2010) used pictures of facial expressions as stimuli to convey another individual's sadness to participants. And as facial expressions of sadness typically communicate a signal for help (Horstmann, 2003) such expressions elicit the negative emotion of sadness but also elicit positive emotions (e.g., caring, sympathy) and these positive emotions facilitate approach tendencies whereby the individual is attempting to dispel that sad feeling in themselves and in others. In contrast, Alexopoulos and Ric employed word stimuli to elicit sadness in participants so participants seeking to withdraw from something that is making them feel sad helps explain that study's finding that sadness-related stimuli facilitate avoidance tendencies. Being aware of context allows us to recognise findings as being coherent with regard to approach-avoidance behaviour although appearing as inconsistent behaviours.

These considerations reveal that, while stimuli evaluated as positively or negatively valenced typically facilitate approach or avoidance behavioural tendencies respectively, there is nevertheless an asymmetry in relations between emotion-eliciting stimuli and approach-avoidance behaviour tendencies. Positive emotion-eliciting stimuli facilitate approach (reduce distance). Negative emotion-eliciting stimuli facilitate *either* avoidance (increase distance) *or* approach (attack – decrease distance). Approach behaviour tendencies indicate *either* positive *or* negative emotion-eliciting stimuli. Avoidance behaviour tendencies indicate negative emotion-eliciting stimuli. The only two direct relations here are: Nobody avoids something positive, and nobody sees as positive something they avoid.

The relationship between motion (i.e., distance change) and emotion, as demonstrated here, and the relationship between motion and perceptions of time, as shown earlier, suggest that emotion may also influence an individual's spatially based understanding of time.

Emotion and Spatial Representations of Time: Empirical Research

To date, there have been only four published studies investigating the role of emotion on the metaphoric understanding of time: Hauser et al. (2009), Lee and Ji (2014), Margolies and Crawford (2008), and Richmond et al. (2012). All studies contained experiments involving one or both of the following: an emotion manipulation procedure; a manipulation of event valence (viz. the psychological value [positive or negative] an individual places on an event). Table 3 presents details of these four studies. All four studies employed a TAQ referring to an event in the participants' future. Unless stated otherwise the studies construed MT perspective TAQ responses (i.e., Monday) as indicative of avoidance-related behaviour and ME perspective TAQ responses (i.e., Friday) as indicative of approach-related behaviour.

Table 3

Published Experiments Investigating the Role of Emotion (priming emotion and/or event valence) in Spatio-Temporal Understanding

Study*	Exp. Conditions	Emotion-inducing event	TAQ
Margolies and Crawford (2008)	1: Enthusiasm or dread 2: Enthusiasm or dread	Own event[ac] Trip to favourite place (enthusiasm) or visit to dentist (dread)[ac]	Exact wording of TAQ not given. Based on article quote of TAQ on p. 1402 it's assumed TAQ was worded similar to: "Next Wednesday's event has been moved forward two days. What day is the event now that it has been rescheduled?" (p. 1404)
Hauser et al. (2009)	2: Anger-inducing or control	Meeting[ad]	"You are scheduled to attend a meeting next Wednesday….The meeting has been rescheduled and moved forward two days. What day is the meeting now that it has been rescheduled?" (p. 1172)
Richmond et al. (2012)	4: Happiness-induced, happiness-noninduced, anxiety-induced, anxiety-noninduced, sadness-induced, or sadness-noninduced	Meeting with friend (happiness), head of university department (anxiety), or ex-partner (sadness)[adf]	Happiness conditions: "You have planned to meet your friend on Wednesday….Your friend has rescheduled meeting you, and moved the meeting forward two days." (p. 818) Anxiety conditions: "You have been asked to attend a meeting with the head of the department here at the University next Wednesday….The meeting has been rescheduled and moved forward two days." (p. 818) Sadness conditions: You have planned to meet with your ex-partner next Wednesday whom you split up with 3 weeks ago in order to get your things back that you had left at their house….Your ex has had to move meeting up with you forward two days." (p. 818) All conditions: "What day is the meeting now that it has been rescheduled?" (p. 815)
Lee and Ji (2014)	1: Embraced or rejected 3: Proud or ashamed 4: Cheerful or sad	Own event[be] Own event[be] Own event[ae]	"The meeting originally scheduled for next Wednesday has been moved forward two days. Which day has the meeting been rescheduled for?" (p. 22)

Note: *Studies listed in chronological order. [a]Future event. [b]Past event. [c]Think about an event. [d]Read scenario about an event. [e]Write about an event. [f]Induced conditions only also employed film clips as emotion-inducing stimuli.

In the first study, Margolies and Crawford (2008) gave four reasons why positive affect is related to an ME perspective whereas negative affect is related to an MT perspective. First, as discussed earlier, there is the embodiment of positive affect as approach behaviour and negative affect as avoidance behaviour. Second, they argue that, as the moving ego in an ME perspective is moving toward a temporal event, this movement is construed as approaching the event and, as such, is an approach-related behaviour. It is worth noting, however, that this claim conflicts with the definition of approach in approach-avoidance studies investigating affect (e.g., Cacioppo et al., 1993; Krieglmeyer et al., 2011; van Dantzig et al., 2009). Specifically, approach-related behaviour concerns actions that appear to reduce the distance between a person and a stimulus whereas an ME perspective response to a TAQ moves the event farther into the future, thus increasing the distance between observer and event. Third, Margolies and Crawford argue that an MT perspective has temporal events moving toward a passive ego and avoidance usually occurs when one is being approached. Finally, they claim that an MT perspective's stationary ego reflects the passivity associated with learned helplessness (Seligman, 1975) and external locus of control (Peterson, Maier, & Seligman, 1993), states associated with negative affect. Again, however, in response to the last two claims it could be argued that, similar to the pushing actions associated with avoidance behaviour in earlier motor and affect studies (e.g., Chen & Bargh, 1999), when thinking about time an observer may choose to push away events farther into the future so as to avoid them for as long as possible. These objections foreshadow problematic issues in the Margolies and Crawford findings.

Margolies and Crawford (2008) predicted that events perceived as having a positive emotional valence would produce more ME perspectives whereas events perceived as having a negative emotional valence would produce more MT perspectives. Participants were asked to imagine a possible future event (either one that they felt enthusiastic about [positive], or one that they dreaded [negative] with the event being their own event [Exp. 1] or a prescribed event [Exp. 2]) and subsequently answered a TAQ referring to their "event". No significant differences were found. Both positively valenced and negatively valenced event conditions resulted in more MT than ME perspectives (i.e., more Monday than Friday responses). These trends were in the opposite direction to their prediction for the positively valenced condition but consistent with the direction of prediction for the negatively valenced condition. Margolies and Crawford speculated that the unexpected TAQ findings for a positively valenced event, that is, more MT than ME perspectives, may be due to an overriding of an ME perspective by the wish to bring a desired event closer. An alternative possibility is that the results are consistent with a distance-change view concerning a tendency to decrease distance between an organism and a desired object.

In the second study examining emotion and spatio-temporal metaphor, Hauser et al. (2009) examined the influence of anger on how individuals think about time. Unlike other negative emotions, anger can be associated with approach- rather than avoidance-related behaviour (Carver & Harmon-Jones, 2009). Therefore, using logic similar to that of Margolies and Crawford (2008), more ME perspectives were predicted for approach-related behaviour. Participants read either an anger-inducing scenario or an emotionally-neutral scenario before answering a TAQ. The findings revealed no statistically significant difference in TAQ responses between the two groups. In fact, both groups resulted in more MT than ME perspectives (i.e., more Monday than Friday responses). This trend was in the opposite direction to the researchers' prediction for the anger-inducing condition. These findings are similar to those of Margolies and Crawford (2008), and the researchers merely echo the earlier study's suggestion that an event associated with approach (positive in the earlier study and anger-inducing in the present study) might lead to an overriding of an ME perspective by the wish to minimise the distance between the present and the future event.

In the third study, Richmond et al. (2012, Exp. 4) hypothesised that a positive emotion-induced condition (i.e., happiness) would produce more ME perspectives and negative emotion-induced conditions (i.e., anxiety, sadness) would produce more MT perspectives when each condition is compared against its equivalent emotion "non-induced" (p. 818) condition. Participants viewed a film clip (emotion-induced conditions only), read a scenario, and then answered a TAQ. There was a greater amount of detail in the emotion-induced conditions' scenarios than in the emotion non-induced conditions' scenarios, but the events for each emotion condition, induced and non-induced, were the same: a meeting with either "your friend" (happiness), "the head of the department…at the University" (anxiety), or "your ex-partner…whom you split up with 3 weeks ago" (sadness).[16] As the researchers predicted, there was a difference in TAQ responses between each emotion-induced condition and its comparative emotion non-induced condition. However, the researchers' claim that this difference resulted from comparing an outcome from an "emotion-producing condition" to an outcome from an "emotionally neutral condition" (p. 819) is inaccurate, since every condition contained some emotion-eliciting material; there was no emotionally neutral condition. Richmond and colleagues acknowledge the lack of emotionally neutral condition when noting a potential confound of valence with each scenario event being potentially "different in… attractiveness or aversiveness"

[16] It is worth nothing that reading a scenario depicting you meeting up with "your ex-partner…whom you split up with 3 weeks ago in order to get your things back that you had left at their house" (p. 818) may elicit emotions other than sadness (and the avoidance tendency facilitated by feeling sad). For instance, you may have split up with them because they were a terrible partner (you are happy with the split) or they cheated on you (you are angry regarding the split) with either instance facilitating approach behaviour, positive approach or negative approach (attack), respectively.

(p. 819). Across all conditions there was potential for emotion resulting from a *valued* event (i.e., valence of the scenario event) and in the emotion-induced conditions there was potential for emotion resulting from incidental causes (i.e., film clip and the more detailed scenario). As such, it follows that the findings of Richmond et al. were based on comparing outcomes between conditions that differ in the *intensity* of an emotion (high versus low) rather than, as those researchers claim, based on comparing outcomes between an "emotion-producing condition" and an "emotionally neutral condition" (p. 819).

The most recently published study investigating the role of emotion on choice of temporal perspective by Lee and Ji (2014) includes three experiments involving a TAQ. In two of those experiments participants were asked to recall a *past* experience where they had felt either rejected or embraced (Exp. 1) or had felt either proud or ashamed (Exp. 3) before answering a *future* day TAQ (i.e., Next Wednesday's meeting). The researchers expected that an event perceived as having a negative emotional valence (rejected, ashamed) would produce more ME perspectives because "recalling a bad past…makes people move away…[prompting] the ego-moving perspective" (p. 22) whereas an event perceived as having a positive emotional valence would produce more MT perspectives because there is "little incentive to move away quickly from sources of happiness" (p. 23). This reasoning demonstrates that the temporal location of the event stimulus (i.e., future or past) must be considered when determining what spatio-temporal metaphors are expected to be employed. Hence, there is a problem with the earlier Margolies and Crawford (2008) claim that "emotional states will tap into…metaphoric structures such that positivity will be associated with the ego-moving whereas negativity will be associated with the time-moving spatiotemporal metaphor….because the ego-moving perspective implies moving toward something, which clearly maps onto approach" (p. 1403). For each experiment, Lee and Ji found a statistically significant difference in TAQ responses between the two conditions with negative emotional conditions having more Friday than Monday TAQ responses.[17] These findings are consistent with the suggestion by Lee and Ji that an ME perspective may be associated with avoidance when the event being avoided is in the past.

In another experiment, Lee and Ji (2014, Exp. 4) asked participants to describe a future experience (either one that they felt cheerful about [positive], or one that they felt sad about [negative]) before answering a TAQ. The researchers expected, as did the earlier researchers (i.e., Hauser et al., 2009; Margolies & Crawford, 2008; Richmond et al., 2012), that events perceived as having a positive emotional valence would produce more ME perspectives whereas events perceived as having a negative emotional valence would produce more MT perspectives. Both conditions resulted in more ME than MT perspectives (i.e., more Friday than Monday responses) meaning that the results were consistent with the direction of prediction for the positively valenced condition but in the opposite direction to that expected for the negatively valenced condition. In addition, these results are in the opposite direction to the results from a similar study by Margolies and Crawford (2008, Exp. 1). Lee and Ji do not discuss why the negatively valenced condition did not, as expected, "*let time do the moving* [emphasis added], rendering the time moving perspective more likely" (p. 24). One possible explanation is that participants were inadvertently primed for forward motion when, prior to answering the TAQ, they were asked to "indicate how soon this event [i.e., the event involved in the emotion induction procedure] would happen (in days)" (p. 24). Specifically, if participants had gone through an ascending sequence of numbers before settling on their indicated number of days this

[17] Having a conflicting temporal dimension between an emotion-induction procedure and a TAQ (e.g., recalling a past event and then answering a future TAQ) may potentially introduce a confound especially when considering the lack of conformity concerning TAQ responses across the four published studies in this area to date (i.e., Hauser et al., 2008; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012).

direction of sequential motion may have evoked a congruent directional spatio-temporal metaphor similar to the Matlock et al. (2011) study where counting forward resulted in more Friday TAQ responses (i.e., more ME perspective responses).

Regarding a TAQ, three of the emotion-related studies (Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008) do not specify who moves the event forward, whereas Richmond et al. (2012, Exp. 4) have the event moved forward by a third person, that is, "your friend" or "your ex" in the happiness or sadness conditions, respectively (see Table 3). Recent evidence (Feist & Duffy, 2015) suggests that the wording of a TAQ may influence responses. Feist and Duffy (2015) found that a TAQ claiming that an event had been moved forward by a third person (e.g., he/she) elicits more Monday than Friday responses compared with an event moved forward by a first or a second person (i.e., I or you, respectively).

The Approach Question (AQ)

In addition to providing the first published study to investigate the role of emotion on spatio-temporal understanding, Margolies and Crawford (2008) introduced an additional question, the *approach question* (AQ). Having answered a TAQ, participants were then asked to select one of two sentences that better expressed how they felt: either "I am approaching this event" (defined as approach and interpreted as an ME perspective) or "The event is approaching me" (defined as avoidance and interpreted as an MT perspective). As predicted, there was a significant difference in responses across event valence conditions (i.e., positive vs. negative): a positively valenced event resulted in more ME perspectives (i.e., "I am approaching this event" responses) than did a negatively valenced event. For negatively valenced events only, the results were equivocal: when participants imagined their *own* event the response "The event is approaching me" was more likely, as the researchers predicted; however, when participants imagined a *prescribed* event (i.e., wisdom tooth extraction) the majority responded, “I am approaching this event”, contrary to prediction. Margolies and Crawford do not address these conflicting AQ findings with respect to a negative event.

The later three studies examining emotion and choice of temporal perspective (i.e., Hauser et al., 2009; Lee & Ji, 2014; Richmond et al., 2012) also involve experiments employing an AQ, subsequent to a TAQ, as a dependent variable. Each study specifies the same relationship between AQ responses and indicators of spatio-temporal understanding, viz., “I am approaching” indicates an ME perspective whereas “The event is approaching” indicates an MT perspective. Table 4 presents the breakdown of TAQ responses and AQ responses across the four published studies.

Table 4

Breakdown of TAQ and AQ Responses in Published Studies Investigating the Role of Emotion in Spatio-temporal Understanding

Study*	Exp.	*n*	Condition	TAQ Responses (%) Monday (MT)	TAQ Responses (%) Friday (ME)	AQ Responses (%) Event is approaching (MT)	AQ Responses (%) I am/we are approaching (ME)
Margolies and Crawford (2008)	1[a]	152	Enthusiasm	58.9	41.1	39.0[c]	61.0
			Dread	70.5	29.5	64.1	35.9
	2	183	Enthusiasm	57.8	42.2	30.8[c]	69.2
			Dread	61.3	38.7	47.3	52.7
Hauser et al. (2009)	2	62	Anger-inducing	*58.6*	41.4	45.16[c]	54.84
			Control	*71.0*	29.0	70.97	29.03
Richmond et al. (2012)	4	232	Happiness-induced	*35.4*[c]	64.6	*26.0*[c]	74.0
			Happiness-noninduced	*60.8*	39.2	*8.8*	91.2
			Anxiety-Induced	69.0[c]	*31.0*	59.5[c]	*40.5*
			Anxiety-Non-induced	18.6	*81.4*	27.5	*72.5*
			Sadness-Induced	72.0[c]	*28.0*	54.7[c]	*45.3*
			Sadness-Non-induced	38.2	*61.8*	35.3	*64.7*
Lee and Ji (2014)	4[ab]	100	Cheerful	*24.1*[c]	75.9	*18.5*	81.5
			Sad	*45.7*	54.3	*34.8*	65.2

Note: Figures in italics have been calculated from information provided in the article.
*Studies listed in chronological order. [a]Imagine/describe own event. [b]AQ involved rearranging words into a sentence rather than selecting from a series of statements. [c]Results were statistically significant when comparing one experimental condition against another experimental condition. In Richmond et al. (2012) each induced condition was compared against its non-induced counterpart condition.

For Hauser et al. (2009) AQ responses were as predicted, that is, more ME perspectives for an anger-inducing (i.e., approach-related behaviour) condition when compared with a control condition. As expected, Richmond et al. (2012) found that negative emotions such as anxiety and sadness (avoidance-related) produced more MT perspectives than their "non-induced" counterparts. However, contrary to prediction for happiness (approach-related), the non-induced condition produced more ME perspectives than did the induced condition. The researchers note that their contrary AQ findings may be due to a “potential confounding variable…the valence of the scenarios” (p. 819). However, if this were the case and if responses to a TAQ and an AQ represent equivalent MT and ME perspectives then it is unclear why the breakdown in TAQ responses for those two happiness conditions (induced, noninduced) was not consistent with the breakdown in AQ responses. The researchers do not address this question. Lee and Ji (2014) found, contrary to prediction, no difference in AQ responses between the two conditions (cheerful, sadness), with an ME response more likely than a MT response in both conditions. They do not address their unexpected AQ findings. However, as discussed earlier, it is possible that asking participants to “indicate how soon this event would happen (in days)” (p. 24) unwittingly primed for forward motion similar to the Matlock et al. (2011) study where counting forward resulted in more Friday TAQ responses (i.e., more ME perspective responses).

Furthermore, Lee and Ji (2014) appear to have inadvertently introduced a confounding factor. They expected an emotion induction procedure that involved describing events that were either positively (i.e., cheerful) or negatively (i.e., sad) valenced to have an effect on participants’ responses to a TAQ and an AQ. Yet at the same time there was no explicit consideration of any effect that the valence associated with the different events in the two questions (TAQ – *meeting* event, AQ – *deadline* event) might have had, nor was there any explanation provided as to why each question specified a different event. Regarding the failure to consider the effect of event valence associated with a TAQ or an AQ, Lee and Ji are no different from any other earlier studies investigating this same area (i.e., Hauser et al., 2009; Margolies & Crawford, 2008; Richmond et al., 2012). However, unlike those other studies, Lee and Ji are inconsistent regarding positivity and negativity across the induction procedure and the events mentioned in the TAQ and AQ. Specifically, participants in the cheerful condition (positively valenced) answered an AQ concerning a *deadline* event, an event that can be viewed negatively as it typically involves some pressure to complete tasks in a timely manner. It is possible that using this event in the AQ dampened participants' emotional reaction to their own cheerful event. Giving weight only to the emotion induction procedure obscures any influence the valence associated with the events in the TAQ and the AQ may have on responses to those questions. Indeed, there is also the possibility that individual differences in emotional traits will play some role. These questions have not yet been explored in the research.

Two of the studies (i.e., Hauser et al., 2009; Margolies & Crawford, 2008) conclude that a significant effect of emotion on temporal understanding for approach behaviours was found via AQ responses but not found via TAQ responses. When combined with the fact that TAQ responses were contrary to prediction for approach-related emotions, Hauser et al. (2009) conclude that the TAQ "only accurately assesses time representation" when the event is neutral, but when the event is positive or negative the AQ "might be more appropriate" (p. 1173). This clearly suggests that the researchers regard both TAQ and AQ to be measuring the same thing: time representation. Moreover, the use of both TAQ and AQ in later emotion-related studies of spatio-temporal understanding (i.e., Lee & Ji, 2014; Richmond et al., 2012) suggests that this assumption is being accepted uncritically within the literature. However, the assumption is questionable when one considers that the empirical evidence lacks consistency regarding MT and ME breakdowns across TAQ responses, across AQ responses, and when comparing TAQ responses with AQ responses. In addition, attempts to account for the anomalies appear ad hoc and unconvincing.

In sum, a consideration of these four studies together with the earlier theoretical discussion gives rise to seven critical questions.

Seven Critical Questions

The inconsistent findings and the problems discussed above with respect to the four published studies converge onto seven critical questions that need to be addressed in any subsequent research. To summarise, the first question asks whether a TAQ and an AQ measure the same thing, that is, temporal perspective. The second and third questions relate to interpreting TAQ responses. Should approach-related behaviour be mapped onto an ME perspective? Is it always appropriate to map avoidance-related behaviour onto an MT perspective? The fourth and fifth questions pertain to emotion. If emotion does have an influence, will being in an incidentally induced emotional state and being in an emotional state vis-à-vis some event (i.e., the event specified in the TAQ and AQ) have different effects on temporal perspectives? If an emotion induction procedure is employed, is it safe to assume that the procedure has been successful? The sixth critical question asks how the effects of experimental manipulations should be evaluated when there is no control condition for comparison. Finally, if emotion is expected to have some effect on temporal perspective, would not individual differences (e.g., in traits such as anxiety) also have possible effects? Each of these questions will now be addressed in more detail.

Critical question 1: Do TAQ and AQ measure the same thing? First, the researchers have been assuming uncritically that a TAQ and an AQ measure the same thing, namely, temporal perspective. This assumption is clear from the fact that they describe a TAQ and an AQ as being ‘two time-movement questions” (Hauser et al., 2009, p. 1172) that “measure temporal perspective” (Lee & Ji, 2014, p. 24). But is this so? Certainly, it appears that TAQ responses provide information on how individuals think about time via metaphor specifically with respect to the ego-referenced direction of movement of an event *moved forward*. An ME perspective moves the event forward in the ego's typical forward direction; the event moves futureward. An MT perspective moves the event forward in the event's typical forward direction; the event moves pastward. For either TAQ response the event's movement results in temporal distance change between the observer and the event: an ME perspective increases the distance whereas an MT perspective decreases the distance. However, in contrast to the TAQ, *both* AQ response alternatives ("I am approaching the event"; "The event is approaching me") indicate a *reduction* in temporal distance between observer and event. An AQ asks for information solely regarding agency assignment. Now, it has been found that individuals are more likely to assign temporal agency to themselves when describing pleasant events whereas temporal agency is more likely to be assigned to events when describing unpleasant events (McGlone & Pfiester, 2009). That is, pleasant events elicit human agency whereas unpleasant events elicit event agency. Hence, AQ responses may be viewed as conveying, via temporal agency, how an observer feels about the event in question. For this reason, it is misleading and potentially confusing for empirical research to use MT and ME perspectives to describe AQ responses. The temporal distance between observer and event is reduced for both AQ responses. Instead, AQ responses require a different categorisation, one that reflects the identified moving agent, that is, an ego-agency perspective (EA) or a time-agency perspective (TA). Thus, with regard to approach and avoidance motivations, positivity or negativity regarding an event may be indicated via temporal distance change (in the TAQ response) or via temporal agency assignment (in the TAQ response, in the AQ response). Therefore, it would be inappropriate to use them as alternatives. Furthermore, it is worth considering that asking an AQ *after* a TAQ may either prime a TA perspective or be confusing, depending on what response has been given to the TAQ. A TAQ makes reference to an event's *having been moved* forward. This means that if the TAQ is answered with Monday, one might expect selection of the TA answer to the AQ ("The event is approaching me"). In contrast, if the answer to the TAQ has been Friday, a response that indicates an increase in the temporal distance between observer and event, the AQ response alternatives, with their use of the word "approaching" (i.e., drawing nearer) would be puzzling, as would certainly a TA answer. Another possibility, one not considered in the literature, is that having answered a TAQ and moved an event *forward* indicating either an MT or ME spatio-temporal perspective, a participant may then view both entities (i.e., observer and event) as stationary and want to reply "Neither" to a subsequently asked AQ.[18] Thus, even if the TAQ and AQ are not appropriate alternative questions that does not mean that priming effects will not be operative if the two assessments are presented consecutively. Figure 5 presents an overview of possible AQ responses based on event valence or on TAQ responses. Before presenting an overview concerning TAQ responses it is necessary to consider the next two critical questions.

[18] It could be argued that a fourth response option to an AQ is that a participant believes "I am approaching the event" and "The event is approaching me". However, this seems unlikely because "such cases have not been empirically observed in natural language" (Núñez & Sweetser, 2006, p. 411). In other words, when the two entities are organisms we may say that "I am approaching Jane" and "Jane is approaching me", but when one entity is an organism and the other entity is an event, as in the TAQ and the AQ, we do not tend to use such linguistic expressions.

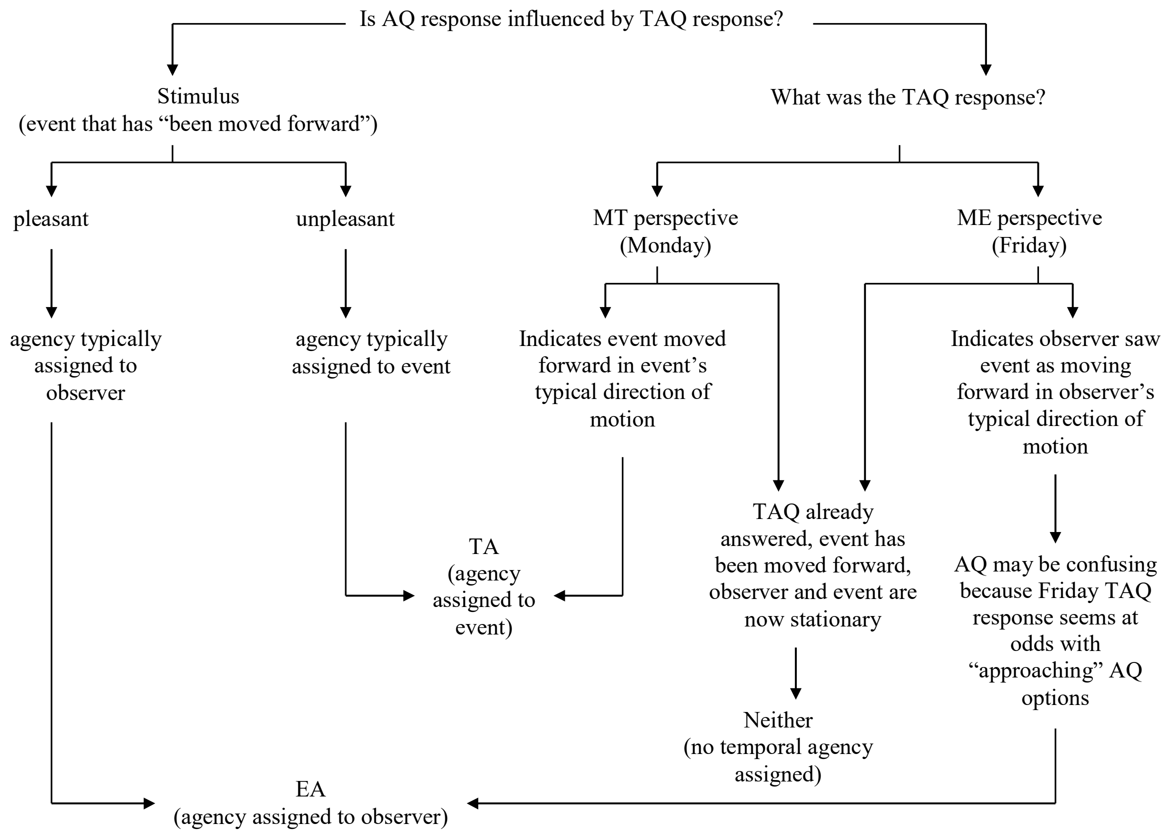

Figure 5. Schematic of AQ responses in response to positive (i.e., pleasant) or negative (i.e., dangerous, unpleasant) stimuli or to an influence of TAQ responses.

Critical question 2: Is an ME perspective always mappable onto an approach-related behaviour? The second critical question relates closely to the first. Given that approach is concerned with reducing the distance (physical or temporal) to a desired endpoint (Carver, 2006), does it make sense, in the case of a TAQ response, to map an ME perspective onto approach-related behaviour? In other words, are Margolies and Crawford correct to claim that, in relation to TAQ responses, "the ego-moving perspective implies moving toward something, which clearly maps onto approach" (2008, p. 1403)? The original ME and MT perspectives have two entities, observer and temporal event, and when one moves the other is stationary (Clark, 1973; Lakoff & Johnson, 1980, 1999). Temporal events are considered to move pastward whereas an observer moves futureward. Regardless of which entity moves, the result is a decrease in temporal distance between observer and temporal event. The interpretation of Friday TAQ responses as an indicator of an ME perspective deviates subtly but importantly from the original spatio-temporal metaphor definition in terms of distance change between observer and event. That is, a Friday TAQ response increases rather than decreases the temporal distance between these entities. It could be argued that approach may *either* lead a person to see himself or herself as moving toward an event (person's forward motion is projected onto the event so that the event is moved futureward—an ME perspective) *or* as wanting to reduce the distance to an event (event is moved pastward—an MT perspective). Therefore, as with the answer to the previous question, how approach behaviour relates to spatio-temporal perspectives is unclear and requires further investigation.

Critical question 3: Is it always appropriate to map avoidance-related behaviour onto an MT perspective? This question follows from the second. The Margolies and Crawford (2008) avoidance-related results were inconsistent for experimentally prescribed negatively valenced events (i.e., more Monday TAQ responses [claimed as MT perspective] coupled with more "I am approaching the event" AQ responses [claimed as ME perspective]). It could be argued that avoidance may *either* lead a person to see an event as "coming at" them (person passively waiting) *or* make a person want to "push it away" (person actively responding). Therefore, how avoidance behaviour relates to spatio-temporal perspectives is unclear and requires further investigation.

Figure 6 presents an overview of possible TAQ responses (for a future event) based on approach- and avoidance-related motivations. This overview also acknowledges that, as discussed earlier, not all approach motivation is accompanied by positive emotion or is directed at a positively-valenced stimulus. For instance, anger is a negative emotion that prompts negative approach behaviour (i.e., attack).

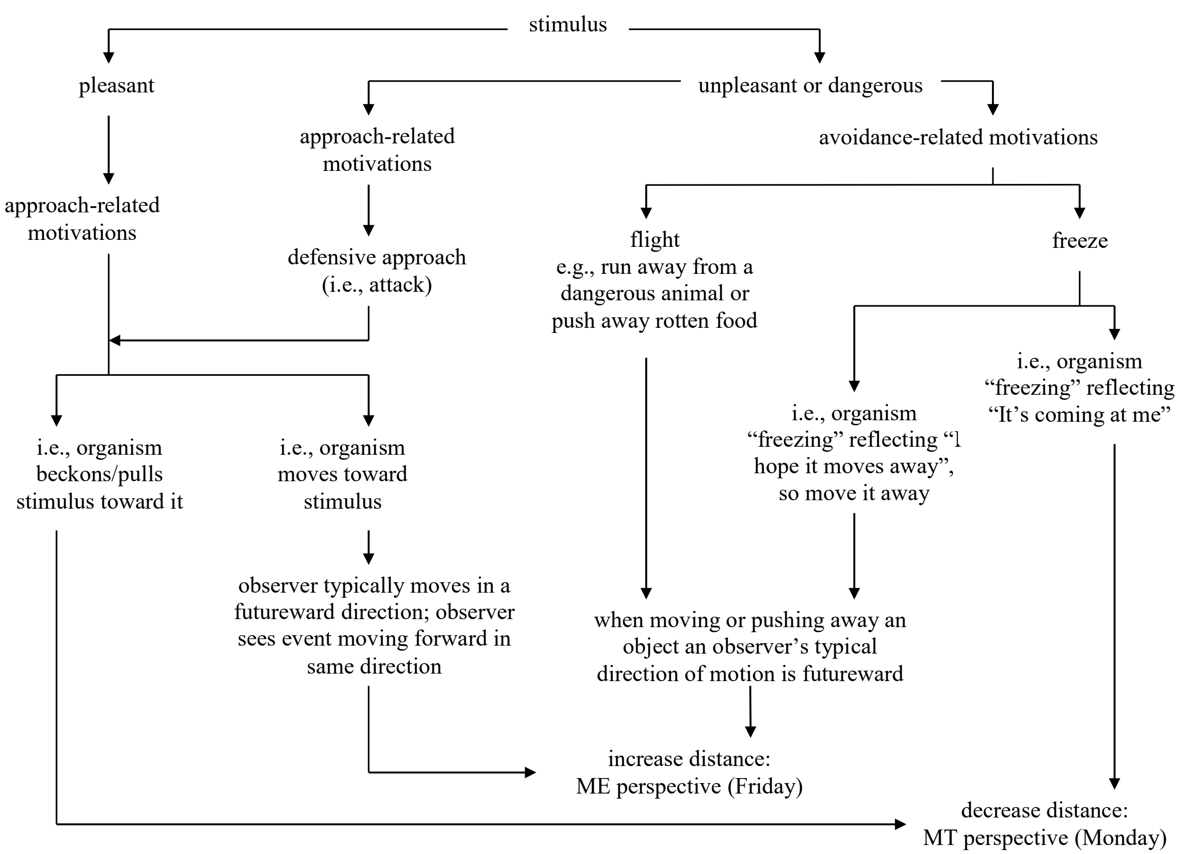

Figure 6. Schematic of approach- and avoidance-related motivations via TAQ responses in reaction to positive (i.e., pleasant) or negative (i.e., dangerous, unpleasant) stimuli.

Critical question 4: Does the source of the emotion matter? While it has been argued that no event is intrinsically valenced, since valuing is a relation, there remains the question whether – if emotion does have an influence - being in an incidentally-induced emotional state and being in an emotional state vis-à-vis some event referred to in a TAQ, have different effects on spatio-temporal metaphorical perspective. In other words, is there any difference in effects between an emotion elicited by an event and a prior emotional state elicited independently? If so, would these effects be summative or interactive? Would a positive TAQ event override a negative induced emotion or vice versa? Or would they cancel each other out? These questions have not yet been investigated.

Critical question 5: Can we ascertain that the desired emotion has been experimentally induced? The fifth critical question relates closely to the fourth. Expecting induced emotional states to influence participants' responses necessitates demonstrating that the relevant emotion has indeed been induced. This can be done via pre- and post-emotion manipulation checks. Of the four published studies surveyed, three had a single-item post-emotion manipulation check (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) whereas the remaining study had no emotion manipulation checks (Hauser et al., 2009).[19] However, without pre- and post-manipulation checks, it remains unclear whether the emotion manipulation did in fact result in eliciting the desired emotional state.

Critical question 6: Is it necessary to have a control condition? The sixth critical question concerns control conditions. Without a control condition it is not possible to assess accurately the effects of experimental manipulations. In other words, if there is a significant difference in TAQ responses between a negative emotion condition and a positive emotion condition, is that difference produced by one of those emotion conditions only (and, if so, which), or by the two together? Of the four published studies investigating the role of affective phenomena in spatio-temporal understanding via conceptual metaphor only one study (i.e., Hauser et al., 2009, Exp. 2) includes a control condition.

[19] Hauser et al. (2009) ran a pilot test on 13 participants which found that the anger-inducing event induced more anger than the neutral event. The study does not state whether the pilot test included a pre-manipulation check.

In an earlier study (O'Gorman, 2011), I included a control condition, and like Hauser et al. (2009) found an unusually large bias under control conditions for TAQ responses towards the MT perspective (Monday), in contrast to earlier TAQ studies that had shown a roughly even split between MT and ME perspectives (e.g., Boroditsky, 2000; Núñez et al., 2006). I speculated that, in presenting the AQ immediately following the TAQ on the same page, participants may have read the AQ before answering the TAQ. Hence, the word "approaching" which appears twice in the AQ may have primed participants to think in terms of approach, of *reducing* the distance. Such a priming effect would explain TAQ responses skewing toward an MT perspective as this spatio-temporal metaphor perspective *decreases* the temporal distance between observer and event. I subsequently contacted Meier (the researchers had not commented in publication on their unusual control condition findings), and discovered (Hauser, personal communication, February 29, 2012; Meier, personal communication, February 28, 2012) that they too had presented the TAQ and AQ on the same page, and that they agreed with my hypothesis regarding the possible confounding.

Critical question 7: Should individual differences be taken into account? This question concerns individual differences in relevant emotional traits. In relation to time representation as indicated by TAQ responses, trait anger has been associated with a higher likelihood of an ME perspective than an MT perspective (Hauser et al., 2009, Exp. 1) as has personal agency (Richmond et al., 2012, Exp. 2), and trait anxiety has been associated with a higher likelihood of an MT perspective than an ME perspective (Richmond et al., 2012, Exp. 3). Furthermore, McGlone and Pfiester (2009) noted that individual difference factors might moderate the relationship between event valence and agency assignment, meriting further study. To examine further such individual differences, it is worth asking: If a negative event (such as an exam) elicits avoidance behaviour, which may be reflected in preferred spatio-temporal metaphor perspective, is this likely to be exacerbated in cases of higher trait test anxiety, which would constitute a more enduring negative affect with respect to the event? To date, this question also has not been investigated.

Table 5 presents an overview of the seven critical questions including how they are answered in the literature (if at all) and what answers and strategies are proposed by the present study.

Table 5

Seven Critical Questions regarding the Role of Emotion in Temporal Perspective

Critical question	Answer in literature	Answer in present study and proposed solution/strategy/prediction
1. Do TAQ and AQ measure same thing?	Yes.	Answer: No. TAQ assesses *distance change*. AQ assesses *agency assignment*. TAQ reply Monday (MT) → consistent with AQ reply TA ("event is approaching me"), TAQ reply Friday (ME) → puzzling (not consistent with either "I" or "event" approaching). Solution/strategy: Avoid priming, and do not present TAQ and AQ consecutively.
2. In TAQ response, is an ME perspective always mappable onto an approach-related behaviour?	Yes.	Answer: No. If positive emotion (induced and/or event-related) prompts approach, then either observer's forward motion is projected onto event (Friday – ME) *or* there is a desire to decrease the distance between observer and event (Monday – MT). Prediction: Unclear, not known, worth investigating to see *which* response occurs.
3. In TAQ response, is it always appropriate to map avoidance-related behaviour onto an MT perspective?	Yes.	Answer: No. If negative emotion (induced and/or event-related) prompts avoidance, then *either* event is seen as "coming at me" (Monday – MT) *or* event is "pushed away" (Friday – ME). Prediction: Unclear, not known, worth investigating to see *which* response occurs.
4. Does the source of the emotion matter?	None. Has not yet been systematically investigated.	Prediction: Unclear, not known, worth investigating.
5. Can we ascertain that the desired emotion has been experimentally induced?	Yes – we can assume so.	Answer: Assumption could be false. Manipulation check has not been consistently done in the research. Solution/strategy: *Must* do manipulation check by assessing pre- and post-induction emotion.
6. Is it necessary to have a control condition?	Typically no – except where a neutral/control condition is included and results are assessed relative to that.	Solution/strategy: *Must* include a control condition.
7. Should individual differences be taken into account?	None.	Answer: Not known, not yet systematically investigated. Solution/strategy: Investigate.

Summary

The previous chapters outlined the conceptual and theoretical bases for conceptual metaphors and how they provide an explanation for spatio-temporal understanding. This chapter (Chapter 4) has explored the links between motion and emotion, motion and spatio-temporal understanding, and between emotion and spatio-temporal understanding relating to approach and avoidance motivations. Taken together the findings from the four published studies reviewed here do not provide a clear view of the role of emotion in temporal perspective. In particular seven critical questions were raised. It was decided that addressing the seven critical questions would be a worthwhile strategy for an empirical investigation.

Before embarking on that investigation, however, the next chapter conducts a research synthesis examining methodological and statistical issues in the spatio-temporal metaphor literature and raises three further critical questions.

CHAPTER 5

TAQ Studies – Problems Concerning Control Conditions, Statistical Analyses, and Reporting

The seven critical questions raised at the end of the previous chapter are not the end of the story—they are supplemented by closer scrutiny of various methodological issues in the empirical research. Specifically, is there a control condition against which to assess the experimental condition(s) results? And, are there any statistical reporting errors? Addressing these questions will help provide a clearer picture of what has (and what has not) been supported empirically concerning TAQ study effects. As will be shown in the present chapter, a paucity of control conditions within TAQ research has led to the unwarranted assumption that TAQ responses break down at chance level in the absence of experimental manipulation(s). Also, there are instances of statistically significant results from inappropriate statistical tests biasing the literature. Three critical questions are identified to help address these issues.

The first methodological issue concerning whether there is a control condition against which to assess the experimental condition(s) results is one that has been raised in the previous chapter. That is, do we need a control condition in order to assess whether emotion (positive or negative) has had an effect on TAQ and AQ responses (Critical Question 6)? It is generally acknowledged within the experimental design literature that to claim that an experimental manipulation is causing an effect, it is necessary to know what effect, if any, would have occurred in the absence of that manipulation. Hence, an experiment seeking to study the cause-effect relationship between independent and dependent variables requires a control condition against which to assess its experimental condition(s) results. A control condition closely corresponds to the other experimental condition(s) except that it does not involve manipulation of the independent variable(s) under investigation (Reber & Reber, 2001). As such, a control condition is a *special* type of experimental condition, a manipulation-free condition.

To illustrate with respect to the present focus, imagine investigating whether moving sideways influences how individuals respond to the TAQ, and imagine conducting the investigation by having two experimental groups: one group takes three steps to the right before answering the TAQ and the other group takes three steps to the left before answering the TAQ. Statistical analysis may reveal a significant difference between the two groups, but without a control group, a group that is stationary before answering the TAQ, it is impossible to determine whether one (and, if so, which) or both of the sideways movements were effective manipulators of TAQ responses. In other words, there is no way of knowing whether moving to the right or moving to the left has an effect different from an effect had the participants been standing still before answering the TAQ. Logic entails that the *full* effect of experimental manipulations may be known only when these manipulations are compared to what would happen in the absence of any such manipulation. This raises the question: Is that logic being followed in empirical research concerning TAQ responses?

In this chapter it will be shown that most TAQ studies have not been conducted according to this logic in assessing the efficacy of experimental manipulation(s) on TAQ responses. Empirical evidence for this conclusion can be found in three closely related design practices in this research area: (a) the paucity of TAQ control condition experiments, (b) the practice of assessing one experimental condition result against the result of another experimental condition as evidence of manipulation efficacy, and (c) the unwarranted assumption that TAQ responses break down at chance level in the absence of experimental manipulation(s). Each of these issues will be considered in turn, and will be presented in the context of a research synthesis investigation.

For the second methodological issue, that is, whether or not there are statistical reporting errors in the literature, the research synthesis will be extended to include an "analysis of analyses" (Glass, 1976, p. 3) of TAQ studies. This analysis examines the data available in the published literature for accuracy by replicating the statistical analysis employed (where possible), and comparing the recalculated result against the original reported result. A recent analysis of statistical reporting errors across eight journals (258,105 results from 30,717 articles) identified 49.6% of articles as having at least one inconsistency (e.g., *p* value, *df* value) and 12.9% of articles as having at least one gross inconsistency (i.e., original *p* value was significant whereas recalculated *p* value was nonsignificant, or vice versa) (Nuijten et al., 2015). Those findings are consistent with other examinations of statistical reporting errors in psychology (e.g., Bakker & Wicherts, 2011, 2014; Caperos & Pardo Merino, 2013; Veldkamp, Nuijten, Dominguez-Alvarez, van Assen, & Wicherts, 2014; Wicherts et al., 2011). Recently there have been a number of cases of scientific misconduct (e.g., data fabrication, data falsification) within psychology including Marc Hauser ("FAS Dean," 2010), Diederik Stapel (Callaway, 2011), Dirk Smeesters (Erasmus University Rotterdam, 2014), and Michael LaCour (McNutt, 2015).[20] The prevalence of statistical reporting errors coupled with these recent high profile scientific misconduct cases raises the question of how much confidence can be placed in the published results comprising a particular body of research in psychology. It also suggests that, consistent with the broader view of scientific method proposed at the outset (see Chapter 1) such meta-analyses are desirable as a preliminary to any serious empirical investigation. For these reasons, it was not unreasonable to expect that the current investigation might identify irregularities that

[20] Such misconduct is not limited to psychology; it occurs across scientific disciplines including anaesthesiology, biomedicine, chemistry, immunology, and physics (for reviews see, Fanelli, 2009; Fang, Steen, & Casadevall, 2012; Katavić, 2014; Martinson, Anderson, & de Vries, 2005; Stroebe, Postmes, & Spears, 2012).

include discrepancies in participant numbers, misreporting of degrees of freedom and *p* values, problems concerning the type of statistical analysis conducted, clarity in reporting, and other problems relating to accurate reporting of results.

A Research Synthesis Investigation of TAQ Studies

Definitions and Focus Area for Database Search

To date, no published meta-analyses or research synthesis articles concerning studies that involve TAQ responses has been published. Hence, this thesis is the first to present such a review, including a research synthesis investigation, focusing on empirical studies that are a "conjunction of a particular set of literature review characteristics" (Harris & Hedges, 2009, p 6). The primary characteristic here is that the study includes a TAQ response as a dependent variable.

In order to survey fully the body of research involving TAQ studies, it is first necessary to identify TAQ experiments in the literature. A TAQ experiment is defined as any experiment that includes a TAQ as a dependent variable. The TAQ itself may be future-oriented (e.g., Next Wednesday) or past-oriented (e.g., Last Wednesday). In addition, TAQs may differ between or within experiments in terms of the assigned unit the event is said to have moved (e.g., day, hour, month).

Given the aim to provide a comprehensive investigation of the TAQ literature in terms not only of what has been (and claimed to have been) empirically supported but also of secondary claims regarding what others have found, it is important to identify other areas in the literature where the breakdown of TAQ responses under a control condition is mentioned. After all, a study does not have to empirically investigate TAQ responses under a control condition in order to discuss what those responses may be. That is, TAQ responses may be discussed with or without citing other studies that included a control condition. Although the former may involve misunderstanding or misrepresentation and the latter is evidentially weak, nevertheless, both may potentially become accepted uncritically within the body of research literature. Therefore, the specific aim of the initial literature search in this research synthesis investigation was to identify TAQ experiments and any other non TAQ study that nevertheless discussed the outcome of TAQ responses under a control condition.

Investigation of empirical studies focuses the literature search primarily on journal articles. Targeting journal articles is justified because published literature is the principal source of scientific information for most researchers, and journals typically publish empirical findings. Research falling into the category known as *grey literature* was excluded. Scientific grey literature is anything “not identifiable through a traditional index or database” (McKimmie & Szurmak, 2002, p. 72) and includes “newsletters, reports, theses, conference papers, government documents, bulletins, fact sheets, and other formats distributed free, or available by subscription or for sale” (Weintraub, 2000, p. 54). It is important to note that focusing on published journal articles was not done without some reservation, particularly in view of the well-known phenomenon of publication bias.

Publication Bias

Publication bias occurs when studies on a topic published in the literature differ in their results in some way from the unpublished research on the same topic (Rothstein, Sutton, & Borenstein, 2005). To illustrate, journals are more likely to publish studies with statistically significant results rather than studies with statistically nonsignificant results (Atkinson, Furlong, & Wampold, 1982; Coursol & Wagner, 1986; Dwan et al., 2008; Ferguson & Brannick, 2012;

Gerber & Malhotra, 2008b; Greenwald, 1975; Ioannidis, 2005; Mahoney, 1977; McDaniel, Rothstein, & Whetzel, 2006; Sterling, 1959; Sterling, Rosenbaum, & Weinkam, 1995; Stern & Simes, 1997). Publication bias is a human failing rather than a problem inherent in the publication process itself, because it rests on the publisher's selection of what is to be published.

An empirical demonstration of the human quality in publication bias was provided in a study by Atkinson et al. (1982). They asked consulting editors from two different psychology journals to review a set of three manuscripts for publication. The three manuscripts were identical except for one detail, an interaction effect reported as statistically significant, approaching statistical significance, or statistically nonsignificant. The editors' rates of recommended rejection for publication of the statistically nonsignificant and approaching statistical significance manuscripts were more than three times that of the statistically significant manuscript. These rejection versus acceptance rates of the almost identical manuscripts demonstrates the human factor involved in publication bias.

Outside the domain of psychology, publication bias impacts other scientific areas including, but not limited to, economics (e.g., De Long & Lang, 1992; Doucouliagos & Stanley, 2009; Stanley, 2005), health policy (e.g., Buntin, Burke, Hoaglin, & Blumenthal, 2011; Costa-Font, McGuire, & Stanley, 2013), medical research (e.g., Anderson, Atkinson, Peacock, Sweeting, & Marston, 2005; Begg & Berlin, 1988; Higgins & Spiegelhalter, 2002), organisational sciences (e.g., Banks, Kepes, & McDaniel, 2012; Kepes, Banks, McDaniel, & Whetzel, 2012), political science (e.g., Gerber & Malhotra, 2008a; Sigelman, 1999) and social work (e.g., Epstein, 1990, 2004). Furthermore, where statistically nonsignificant studies *are* accepted, they have a longer time-lag between submission and publication than statistically significant studies (Decullier, Lhéritier, & Chapuis, 2005; Hopewell, Clarke, Stewart, & Tierney, 2007; Stern & Simes, 1997). Thus, publication bias encompasses not only what studies are published but also the duration of the publication process.

However, it could be argued that responsibility for publication bias does not lie solely with journal reviewers and editors. Researchers must also share culpability for publication bias, as journal editors can select for publication only from those articles that have actually been submitted for publication. Within psychology, there is reason to believe that researchers are more likely to submit articles for publication that report statistically significant results, hence biasing the potential pool of publications. Forty years ago, Greenwald (1975) reported that studies rejecting the null hypothesis were submitted for publication 59% of the time whereas studies that accepted the null hypothesis were submitted 6% of the time. A decade later, similar findings showed researchers to be submitting statistically significant results for publication 82% of the time compared with a 43% submission rate for results that accepted the null or were in an opposite direction (Coursol & Wagner, 1986). This phenomenon of researchers refraining from submitting null findings for publication has been dubbed the "file drawer problem", with Rosenthal noting that the "the extreme view of this problem…is that the journals are filled with the 5% of the studies that show Type I errors, while the file drawers…are filled with the 95% of the studies that show nonsignificant (e.g., $p > .05$) results" (1979, p. 638). Even when presented with an avenue for publishing null findings researchers appear reluctant to disseminate such findings, as evidenced by the *Journal of Articles in Support of the Null Hypothesis* having published only 53 articles from its inception in 2002 until 2016. In addition, a researcher may be concerned that if an article with null findings is published readers may "think he is unable to prove the obvious statistically" (McNemar, 1960, p. 299). Reviewers and editors could claim that they are not being made aware of the relatively large number of studies with nonsignificant results and that, if they had a more balanced pool from which to select, they would be less likely to reject the nonsignificant results on the grounds of their relative scarcity. Regardless, it does appear that all parties—researchers as well as journal reviewers and editors—are "genuflecting at the altar of $p < 0.05$" (Osborne, 2010, p. 3).

It appears that change is afoot with some high-impact journals (e.g., *Cognition and Emotion, Experimental Psychology, Psychological Science*) being more open to studies with nonsignificant statistical findings. Open access journals are also welcoming such studies; for example, BMC Psychology whose "remit unquestionably includes the consideration of null results and replications" (Laws, 2013). But what matters for the purposes of the current investigation is less the reason for the bias and more the consequence – namely, that the bias in the available literature misrepresents the real situation and thus impedes genuine scientific progress.

While this is certainly a problem that needs to be acknowledged, it does not necessarily follow that a research synthesis is thereby rendered pointless. Rather, it means keeping in mind the likely bias and thus a possible limitation of scope in the available literature. In the light of publication bias, therefore, it was expected within the current research synthesis that there would be a greater number of empirical studies involving TAQ responses reporting statistically significant results.

Search Criteria and Results

Three widely referenced databases, psycINFO, SCOPUS, and Google Scholar were the search domains. The initial search parameters were those studies already known to have a TAQ control condition. These were six journal articles and one poster: Ballinger et al. (2007), Boroditsky (2000), Hauser et al. (2009), Kranjec, Cardillo, Schmidt, and Chatterjee (2010), McGlone and Harding (1998), Motz and Núñez (2004), and Núñez et al. (2006). These comprised the seven base articles for the research synthesis investigation.

The three databases were searched for articles published in English citing at least one of the seven base articles. At this early stage of the search citing did not necessarily pertain to the breakdown of TAQ responses. Studies were also identified via cross-referencing citations. The search, conducted during February 2014, yielded 344 original articles[21] (including six of the base studies, excluding the poster session). Appendix B presents a full listing of the journal articles found, the database(s) on which they were located, and which base article(s) were cited. While acknowledging that the search may not necessarily have captured all TAQ studies on those three databases at the time of the search, it is worth noting that during the course of all the investigations reported in this thesis, no other TAQ studies or studies discussing TAQ responses under a control condition published prior to February 2014 were found. As such, the current search sample was deemed sufficient for the research synthesis investigation.

The search was further refined to identify those studies that dealt with TAQ responses in general, and those that included a TAQ control condition in particular. Here, there were two broad questions. First, did the researchers include a control condition and assess the efficacy of experimental manipulation(s) on TAQ responses against TAQ responses occurring in the absence of any such manipulation(s)? Second, if not, then what types of comparison were made?

[21] One article was a book chapter by Núñez (2007) as cited by Duffy and Feist (2014).

Paucity of Control Conditions

Of the 344 articles, 47 experiments across 23 articles utilised some form of a TAQ response as a dependent variable, with 39 experiments specifically investigating the breakdown in TAQ responses within or across experimental conditions. Of those 39 identified TAQ experiments, only eleven experiments across nine articles included a control condition, although one of them (Boroditsky, 2000, Experiment 1) did not appear to make use the control condition result in the statistical analysis; the study compared prime-consistency effects between two experimental conditions (ego-moving versus object-moving) but there was no reported comparison between the control condition results and either of the experimental conditions results. This brings the number of studies employing a control condition to ten in total.

It is worth noting that the wording used to describe a control condition differs across the literature. For example, some authors employ the word "control" (e.g., Boroditsky, 2000, p. 9; Núñez, 2007, p. 113; Núñez et al., 2006, p. 141), whereas others use words such as "baseline" (e.g., Ballinger et al., 2007, p. 10; Sullivan & Barth, 2012, p. 1104), "mixed-context" (e.g., McGlone & Harding, 1998, p. 1218), "non-FM sentences" (e.g., Matlock, Ramscar, & Boroditsky, 2005, p. 658), and "NFM sentences" (e.g., Ramscar et al., 2010, p. 607).

Table 6 presents all 47 TAQ experiments, highlighting those that included a control condition and noting what type of comparison analyses were performed for experimental conditions.

Table 6

Experiments with TAQ Responses as a Dependent Variable

			Experimental condition(s) compared with…			
Author(s) (Year) ^	Exp.s	Has own control?	Own Control?	Other Control?	Chance?	Experimental condition(s)?
Ballinger et al. (2007)	1[2], 2[2]	*	*		*	*
Bender, Beller, and Bennardo (2010)	1[e]					*
Bender, Roth-Wulf, Hüther, and Beller (2012)	1[7bc]					
Boltz and Yum (2010)	Pretest					*
Boroditsky (2000)	1	*				*
	2					*
Boroditsky and Ramscar (2002)	1, 2, 3, 4					*
Duffy and Feist (2014)	1[d]					*
	2[c], 3[c]					
Duffy et al. (2014)	1[d], 3[6d]					*
	2[c]					
Elvevåg, Helsen, De Hert, Sweers, and Storms (2011)	3[c]					
Hauser et al. (2009)	1[c]					
	2	*	*			
Kranjec et al. (2010)	1[3]	*	*		*	*
Lai and Boroditsky (2013)	1[d]					*
Lee and Ji (2014)	1, 3, 4					*
Margolies and Crawford (2008)	1, 2					*
Matlock et al. (2011)	1, 2, 3				*	*
Matlock et al. (2005)	1	*	*			
	2, 3					*
McGlone and Harding (1998)	2[a]	*	*			*
Motz and Núñez (2004)	1[1]				*	
Núñez (2007)	1	*	*			
Núñez et al. (2006)	1[4]			*		*
	2[5]	*	*			
Ramscar et al. (2010)	1, 2, 4					*
	3	*	*			
Richmond et al. (2012)	1, 4					*
	2[c], 3[c]					
Sullivan and Barth (2012)	1	*	*			

Note: ^ Experiments are found in journal articles published prior to March 2014. Unless otherwise specified participants answered a single TAQ (i.e., a Future Day TAQ), the number of units "moved forward" in all TAQ types is two (i.e., two days, two hours, two months), and the experiment is a true experimental design. [1] Future Day TAQ and Future Hour TAQ, [2] Future Day TAQ or Future Hour TAQ, [3] Future Day TAQ or Future Hour TAQ or Future Month TAQ, [4] Future Day TAQ or Past Day TAQ, [5] Future Day TAQ and Future Hour TAQ or Past Day TAQ and Past Hour TAQ, [6] Future Hour TAQ or Future Month TAQ, [7] Future Day TAQ and Past Day TAQ and Future Hour TAQ and Past Hour TAQ. [a] Answers three TAQs. [b] Hour TAQ moved forward three hours. [c] Experiment does not analyse TAQ responses in isolation. [d] Natural groups. [e] Quasi-experiment.

Having only 11 out of 39 TAQ experiments use a control condition demonstrates the paucity of control conditions within the current research literature in this area. It then raises the question: Why so few control studies? Perhaps researchers believe it unnecessary to investigate what everyone already “knows”, which is that TAQ responses break down at an even fifty-fifty split in the absence of any experimental manipulation. But that raises a further question: Is that “knowledge” supported empirically or does it amount to an unwarranted assumption? Either way, we would expect to find experimental conditions tested against the fifty-fifty split as the assumed control. If not, how was the efficacy of an experimental manipulation being assessed? I examined these issues by first asking the general question: Excluding the ten studies that used a control condition, how was the effect of the experimental manipulation being assessed? The investigation revealed three answers: (a) against other experimental conditions from the same experiment; (b) against a control condition from a different study; and (c) against chance level (i.e., a fifty-fifty split) (see Table 6 above).

Assessing experimental results against other experimental condition(s) in the same experiment. Within the current empirical literature concerning TAQ responses as a DV, the comparison of results from one experimental condition against the results from one or more experimental conditions is the most popular type of results comparison (see Table 6 above). While such comparisons may reveal a difference in the effects of different experimental manipulations on the DV - in this case, which spatiotemporal metaphor an individual adopts when thinking about time - they cannot reveal which of the experimental conditions’ effects, if any, were different from a manipulation-free effect.

For example, in the Lee and Ji (2014) investigation into the influence of event valence on temporal judgements, participants recalling a negative past event (being rejected by friends) responded with more Friday than Monday TAQ responses whereas the opposite response pattern occurred for participants recalling a positive past event (being embraced by friends). The difference in TAQ responses between the two experimental conditions was statistically significant, with the authors claiming that those differences "depended on the valence of the events…recalled" (p. 22). This interpretation suggests both that a positive past event *caused* participants to take an MT perspective and respond to a TAQ with more Monday than Friday responses, and that a negative past event *caused* participants to take an ME perspective and respond to a TAQ with more Friday than Monday responses. However, that interpretation is premature because without a control condition it cannot be determined whether one or the other, or even both, of these situations occurred.

As can be seen earlier from Table 6 there were other examples of studies that investigated the effect of independent on dependent variables by employing a true experimental design, but yet not comparing the results from experimental conditions with a control condition (own experiment or other experiment) result. Within TAQ research, the popularity of comparing the results from different experimental conditions against each other rather than against a result from a control condition may be a case of majority rules, where new research simply follows what has been done in earlier studies.

Assessing experimental results against a control condition from another study. There was one example only where authors of an experiment ran a statistical analysis comparing results from their own experimental condition to results from a different study's control condition. Núñez et al. (2006, Exp. 1) investigated whether showing an ego-free visual display would prime Monday TAQ responses and thus provide evidence for the "psychological reality of the Time-RP [reference point] metaphor" (p. 139). The visual display consisted of five boxes sliding horizontally across a screen, with two boxes containing a ball each, and each ball moving from its original box to a neighbouring box. These priming condition results were compared against the control condition results from Boroditsky (2000, Exp. 1). Núñez et al. replicated and extended their first experiment in a follow-up experiment that included its own control condition. Although, for experimental rigour, it would be better to have a control condition and experimental condition(s) from the same experiment, nevertheless, by using a control condition in both experiments Núñez and colleagues were entitled to claim the differences in the breakdown in TAQ responses between their experimental condition and a control condition in both experiments were caused by participants viewing the "Ego-free spatial sequence" (p. 143). In other studies, however, such claims of a cause-effect relationship between independent and dependent variables were not based on comparisons against a control.

Assessing experimental results against chance level (i.e., a fifty-fifty split). One possible reason for the widespread failure to include a control condition in TAQ research is that researchers are confident that the neutral condition yields a fifty-fifty split in Monday and Friday responses. The classic case of a dichotomous variable with chance-level outcomes is the fair coin toss, which has an equal probability of landing heads or tails. However, not all dichotomous variables yield outcomes with equal probability. As an ambiguous question the TAQ is open to two different interpretations. However, that does not mean that each interpretation is as likely as the other. Consider the question: "Which do you believe you will be next Wednesday: alive or dead?". Here, an even "Alive"/"Dead" split in responses seems unlikely, with the majority of expected responses being "Alive". Thus, it is a mistake to assume uncritically that TAQ response probabilities are distributed according to chance level. Indeed, a fifty-fifty split in TAQ responses among participants was not found in any of the eleven experiments identified in this investigation as containing a control condition. Some experiments came close to a fifty-fifty split. For example, responses to a "Next Wednesday…moved forward" question were split between Monday 45.7% and Friday 54.3% (Boroditsky, 2000) and Monday 57.1% and Friday 42.9% (McGlone & Harding, 1998). However, *close to* chance level is not *at* chance level. So, where was this assumption coming from? What empirical evidence were researchers appealing to in order to support the assumption of the breakdown in TAQ responses being at chance level? These inquiries raise a new critical question

Critical question 8: Is a chance level (i.e., fifty-fifty) split between Monday and Friday TAQ responses warranted? To answer this question, a two-step approach was taken. Step one identified the evidence researchers were citing when making claims about the breakdown in TAQ responses in the absence of any experimental manipulation. Step two examined the citing article's claim(s) for congruence with the cited article's result(s). These two steps provide the information necessary to establish whether the chance-level fifty-fifty split assumption for TAQ responses is warranted.

From the database search, 16 articles were identified as containing claims about the breakdown in TAQ responses in the absence of experimental manipulation or priming. Table 7 presents those 16 studies and details which studies, if any, were cited as empirical support for these claims. As noted earlier, none of the control conditions in TAQ experiments produced a breakdown in TAQ responses at chance level with a fifty-fifty split. Despite that, there were TAQ experiments comparing experimental condition(s) result(s) against chance level. The assumption of chance level TAQ responses in the absence of any experimental manipulation must be coming from somewhere. One possibility is that errors were somehow creeping into the literature when researchers were citing the TAQ control condition results from other studies and doing so in a rather loose way. Therefore, to examine whether the citing articles were reflecting correctly the findings of the cited articles, each of the cited articles as listed in Table 7 was scrutinised, allowing for comparison between the citing article's claim and the original article's finding.

Table 7
Articles Making Claims about TAQ Responses in the Absence of Any Experimental Manipulation(s) and the Studies Cited as Empirical Support

Articles making claims [a]		Cited empirical support [a]										
Year	Author(s)	1998 - McGlone and Harding	2000 - Boroditsky	2002 - Boroditsky and Ramscar	2002 - Gentner, Imai, and Boroditsky	2006 – Núñez et al.	2007 - Ballinger et al.	2007 - Núñez[c]	2010 – Kranjec et al.	2010 – Ramscar et al.	2012 - Sullivan and Barth	No citations
2002	Boroditsky and Ramscar	*	*									
2004	Motz and Núñez [b]		*									
2005	Matlock et al.		*									
2006	Núñez et al. [b]	*	*	*								
2007	Ballinger et al. [b]	*	*			*						
2007	Núñez [c]		*									
2009	Bin											*
2010	Bender et al.	*	*		*	*	*					
2010	Boltz and Yum				*							
2010	Kranjec et al. [b]											*
2010	Ramscar et al.		*									
2011	Kranjec and McDonough											*
2011	Matlock et al.	*										
2012	Bender et al.	*										
2012	Sullivan and Barth					*			*	*		
2014	Duffy and Feist		*	*				*			*	

Note: [a] Articles presented in chronological order. [b] One of seven base search articles. [c] Book chapter.

Articles citing McGlone and Harding (1998). The first study in the published literature to employ a TAQ response as a dependent variable was McGlone and Harding (1998). In an investigation of spatio-temporal perspectives, McGlone and Harding (Exp. 2) employed three experimental conditions: MT, ME, and "mixed-context" (p. 1218). For each condition, participants completed three trial blocks with each block consisting of four unambiguous context questions (MT condition questions were MT-consistent, ME condition questions were ME-consistent, mixed-context condition contained two MT-consistent questions and two ME-consistent questions) followed by a "Next Wednesday" TAQ. The mixed-context condition was used as a control condition on the grounds that it "supports both ME and MT interpretations" (p. 1220). Table 8 presents the breakdown of the control condition results from that study.

Table 8

Control Condition Results from McGlone and Harding (1998)

	Response (%)	
Temporally ambiguous question	MT-consistent	ME-consistent
The *meeting* originally scheduled for next Wednesday has been *moved forward* two days.	57.1* (Monday)	42.9 (Friday)
The *reception* originally scheduled for next Wednesday has been *advanced* two days.	64.3 (Monday)	35.7 (Friday)
The *party* originally scheduled for next Wednesday has been *pushed back* two days.	57.1 (Friday)	42.9 (Monday)
Overall	59.5	40.5

Note: $n = 28$. The italics have been added to highlight the different events and language used in each TAQ sentence. *The original article shows this figure incorrectly as 59.1% (Table 3, p. 1219).

Six articles cited the McGlone and Harding (1998) study as support for claims concerning the breakdown in TAQ responses in the absence of any priming. Four of these citing articles claimed that for the "Next Wednesday's meeting has been moved forward" TAQ McGlone and Harding found that Monday responses and Friday responses were "as likely" (Boroditsky & Ramscar, 2002, p. 185; Núñez et al., 2006, p. 140) or "roughly half" (Bender et al., 2010, p. 283; Bender et al., 2012, p. 2). Were these claims reasonable? That is, did the original article's split among TAQ responses of 57.1% (Monday) versus 42.9% (Friday) imply "roughly half" or that either response was "as likely"?

The term "roughly half" is, strictly speaking, vague. There is no consensus regarding at what point a breakdown between two possibilities becomes or ceases to be "roughly" half as compared to "exactly" half. Taking the McGlone and Harding (1998) breakdown figures for next Wednesday's *meeting* TAQ responses (i.e., 57.1% and 42.9%) as an example, imagine that your boss gave you $4,290 telling you this was your share of a bonus that had been split "roughly half" between you and a colleague. Later you learn that the bonus was worth $10,000 meaning that your colleague received $1,420 more than you. Would you still believe you had received "roughly half", or would you be likely to believe you had been given the rough end of the deal? Not only is "roughly half" vague, but also its context can determine whether or not the difference is considered negligible. Hence, although "roughly half" does indicate that the results were not split fifty-fifty, it also allows different readers to form different interpretations. Moreover, it is problematic from a statistical perspective. Even if there is no significant difference between the 57.1%-42.9% split and a fifty-fifty split, that does not legitimise statistically the substitution of fifty-fifty for the original split. It seems, however, that it has been all too easy for "roughly half" to slide into being treated as if it meant "exactly half".

On the other hand, the phrase “as likely” is not vague (when used, as it clearly is, to mean “equally likely”). Therefore, in this context the phrases “as likely” and “at chance” are interchangeable. Applying either to a TAQ response indicates a 50% chance of one response (e.g., Monday) and a 50% chance of the other response (e.g., Friday). This fifty-fifty breakdown is unambiguous; there is no room for interpretation. Thus, claiming that a split of 57.1% (Monday) versus 42.9% (Friday) means that either response was “as likely” is incorrect and alters, even if unintentionally, what were the original study’s findings.

In addition, as shown earlier in Table 8, participants’ responses across all three TAQs favoured an MT perspective, motivating McGlone and Harding (1998) to query “why readers might generally prefer MT-consistent interpretations of ambiguous temporal sentences” (p. 1220). This clearly demonstrates that the authors of the cited study did not consider their own results to be “roughly half” or “as likely”. Of course, it is open to researchers to interpret results differently from the way they have been interpreted by the original study’s authors. However, the citing of actual results, in terms of scientific study, do not admit of variation. Thus, in the four citing articles (i.e., Bender et al., 2010; Bender et al., 2012; Boroditsky & Ramscar, 2002; Núñez et al., 2006), what was being claimed was not supported by the accompanying citation(s). Such subtle language creep may account for why some TAQ researchers believe that there is empirical justification for comparing experimental condition(s) result(s) against chance level.

The same language creep is more obvious when Matlock et al. (2011, p. 265) report an experimental result saying: “Chi-square goodness-of-fit tests also showed that the proportion of responses differed reliably from chance (i.e., 50% Monday, 50% Friday; see McGlone & Harding, 1998)…” Matlock et al. have placed the McGlone and Harding (1998) result at chance level, a fifty-fifty split. Here, the “as likely” of earlier reports (i.e., Boroditsky & Ramscar, 2002,

p. 185; Núñez et al., 2006, p. 140) has become "at chance level, a fifty-fifty split". There is, of course, a considerable time span of thirteen years between the two articles (i.e., Matlock et al., 2011; McGlone & Harding, 1998) and a number of other studies have cited the McGlone and Harding study (see Table 7 earlier and Appendix B), so the situation lends itself to typical time and interference distortions of recall (cf. Bartlett, 1932).[22]

Others have simply provided inaccurate reports. For example, Ballinger et al. (2007, p. 16) claimed that McGlone and Harding (1998) found "a baseline bias towards Friday answers". However, such a bias was found only in "Next Wednesday's party has been pushed back" TAQ responses (McGlone & Harding, 1998). Given that Ballinger and colleagues employed a "Next Wednesday's meeting has been moved forward" TAQ, it seems unlikely they would choose to refer to the results of a different TAQ ("pushed back") from another study. It is more likely that they simply made a mistake.

In summary, the articles citing McGlone and Harding (1998) for claims regarding the breakdown of TAQ responses in the absence of any experimental manipulation demonstrate how the assumption of a fifty-fifty split (i.e., chance level), although empirically unsupported, has entered into the TAQ research literature.

Articles citing Boroditsky (2000). Similar errors can be seen in claims based on the Boroditsky (2000) TAQ control condition results that were reported by that author as "about evenly split between Monday (45.7%) and Friday (54.3%)" (p. 9). In the Boroditsky study itself any uncertainty as to what counts as "about evenly split" is dispelled by the inclusion of the actual result figures. However, it allowed others, such as Ballinger et al. (2007) to describe the

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[22] Bartlett's (1932) famous *War of the Ghosts* experiment demonstrates the positive correlation between the number of interim recounts of a story and the number of errors (e.g., transformations, omissions) in the recalling and retelling of that story.

findings as “roughly half” (p. 10), without including the actual figures. Soon, again, “roughly half” became something more exact. Hence, the Boroditsky results were reported as being “at chance” (Matlock et al., 2005, p. 657), “as likely” (Boroditsky & Ramscar, 2002, p. 185; Núñez et al., 2006, p. 140), and “equally likely” (Ramscar et al., 2010, p. 592). The phrase “equally likely” is interchangeable with “as likely” and “at chance”. These examples demonstrate again how an empirical finding can be transformed via loose reporting and, in this case, help to cement the false assumption of empirical support for TAQ responses being at chance level in the absence of any experimental manipulation.

Four studies avoided any problems when citing Boroditsky (2000) either by using direct quotations (Motz & Núñez, 2004; Núñez, 2007) or by reporting that the TAQ breakdown demonstrated a “preference for answering *Friday*…54%” (Duffy & Feist, 2014, p. 33) or a “slight preference for futurewards answers” (Bender et al., 2010, p. 302).

Citations for Boroditsky (2000) and for McGlone and Harding (1998) were the most popular citations for claims concerning the breakdown in TAQ responses in the absence of any experimental manipulation (see Table 7 earlier). As such, they have carried the greatest load in propagating the misconceptions. Nevertheless, those two studies were not the only ones involved.

Articles citing Boroditsky and Ramscar (2002). The two studies discussed so far (i.e., Boroditsky, 2000; McGlone & Harding, 1998) contained a TAQ control condition. Boroditsky and Ramscar (2002) did not include a TAQ control condition, yet two studies (Núñez et al., 2006; Duffy & Feist, 2014) cited that research as empirical support regarding the breakdown of

TAQ responses in the absence of any experimental manipulation. It is unclear whether this error resulted from a misreading or from a misremembering of the original article.

In the introduction section of the original article, Boroditsky and Ramscar (2002) state the following:

> In a neutral context, people are as likely to think of themselves as moving through time as they are to think of time as coming toward them, and so are as likely to say that the meeting has been moved to Friday (the ego-moving answer) as they are to say that it has been moved to Monday (the time-moving answer) (Boroditsky, 2000; McGlone & Harding, 1998). p. 185

This quote clearly shows Boroditsky and Ramscar (2002) making a claim regarding the breakdown of TAQ responses under a control condition based on the empirical findings of earlier studies. The problem here, again, is the use of “as likely” to describe those earlier empirical findings which were clearly not at chance level.

Quotes from the two studies citing Boroditsky and Ramscar (2002) are given below:

> In a neutral context people are about as likely to think of “next Wednesday’s meeting” being moved forward to Monday as to Friday (Boroditsky & Ramscar, 2002; McGlone & Harding, 1998). (Núñez et al., 2006, p. 140)

> These two metaphors are argued to be equally common in English speakers’ conceptualizations of time: “In a neutral context, people are equally likely to think of themselves as moving through time as they are to think of time as coming toward them” (Boroditsky & Ramscar, 2002: p. 185). (Duffy & Feist, 2014, p. 30)

In both quotes, the cited article (i.e., Boroditsky & Ramscar, 2002) serves as an authoritative basis for the breakdown in TAQ responses in lieu of any priming being at chance level. But this is misleading because, to repeat, Boroditsky and Ramscar (2002) did not include a

TAQ control condition, and were themselves merely citing earlier studies. Whatever the reasons for the misrepresentations, the effect was to contribute towards the assumption of empirical support for a fifty-fifty breakdown in TAQ responses under a control condition.

Articles citing Gentner et al. (2002). As shown earlier in Table 7, two articles (Bender et al., 2010; Boltz & Yum, 2010) cited Gentner et al. (2002). According to Boltz and Yum (2010):

> In the course of everyday behavior, people vary in the extent to which they adopt one perspective or the other and analyses of naturalistic speech have found that references to time and ego motion perspectives occur with roughly the same frequency (Gentner et al., 2002). (Boltz & Yum, 2010, p. 897)

The cited Gentner et al. (2002) study includes two laboratory experiments involving priming conditions only (questions on a computer screen) and one experiment in a "natural setting" (p. 554), Chicago's O'Hare airport. As the airport setting involved participants who were unaware of engagement in a psychological experiment when talking with an experimenter, it seems likely this is the experiment Boltz and Yum (2010) were referring to as incorporating "everyday behavior" and "analyses of naturalistic speech". In the airport setting, an experimenter asked participants a question on time zone differences between Chicago and Boston (i.e., a setting question) and whether the experimenter's watch should be turned "forward or back" (p. 554) when travelling to Boston (i.e., a test question). The setting question was asked in either an MT or an ME context and the test question was asked in an ME context only. Gentner et al. found that participants' responses to the test question were faster when the context for both questions was consistent (i.e., ME setting question and ME test question) than when it was inconsistent (i.e., MT setting question and ME test question). Furthermore, when inconsistent, 60% of participants "converted to the ego-moving metaphor when answering the setting question" (p. 555), with these participants responding quicker to the test question compared to those participants who did not convert. None of the participants converted an ME setting question to an MT perspective when answering that question. This tendency for participants to convert the MT-phrased setting question to an ME perspective before answering that question, coupled with no opposing conversion pattern for participants answering an ME-phrased setting question, suggests a preference for ME over MT perspectives. Indeed, Gentner and colleagues interpreted their results (all three experiments) as seeming to "suggest that the ego-moving metaphor is somehow easier or more natural for English speakers" (p. 559). Given this, Boltz and Yum were incorrect to cite Gentner et al. as support for the claim that MT and ME perspectives "in the course of everyday behaviour" are of "roughly the same frequency". In contrast, the claim that the Gentner et al. findings provides support for a "slight preference for futurewards answers" (Bender et al., 2010, p. 302) is an acceptable interpretation.

Articles citing Núñez et al. (2006). As indicated earlier in Table 7, three articles cited Núñez et al. (2006). Two of these (Ballinger et al., 2007; Sullivan & Barth, 2012) illustrate how a citation may mislead in another sense, when the claim and its cited support appear congruous but deeper examination reveals otherwise. Table 9 presents the results from Núñez et al. and details the variety of TAQs employed. Participants answered two TAQs, a Day TAQ and an Hour TAQ, with both set in the future or in the past. These results were claimed to be showing a "strong tendency" (p. 10), a "bias" (p. 16) (Ballinger et al., 2007), "an apparent preexisting tendency" (p. 1105) and a "high baseline rate" (p. 1107) (Sullivan & Barth, 2012) for Friday (i.e., ME) responses to a TAQ. However, looking at the Núñez et al. results, this interpretation could apply only to their Past TAQ control condition results.

Table 9

Control Condition Results from Núñez et al. (2006)

	Response (%)	
Temporally ambiguous questions	Earlier	Later
Future and Past	52	48
Past only	40	60
Future only	N/A	N/A

Note: n = 45. N/A "Not available." Figures are for participants whose responses were consistent (i.e., "Earlier" means "Monday" and "10 a.m.", "Later" means "Friday" and "2 p.m.").
Future TAQs: "Next Wednesday's meeting has been moved forward 2 days. On what day will the meeting now take place?" and "Tomorrow's 12:00 p.m. (noon) meeting has been moved forward 2 hours. At what time will the meeting now take place?"
Past TAQs: "Last Wednesday's meeting got moved forward 2 days. On what day did the meeting take place?" and "Yesterday's 12:00 p.m. (noon) meeting got moved forward 2 hours. At what time did the meeting take place?"

Now, if both studies were indeed referring only to the Núñez et al. (2006) Past TAQs control condition results, then the combination of articles cited by Ballinger et al. (2007) and Sullivan and Barth (2012) as empirical support for their claims is incongruent. This disharmony stems from the different TAQ types (i.e., different temporal alignment) employed as dependent variables in the cited articles. Specifically, the other studies cited as supporting the authors' claim for a Friday preference in TAQ responses under a control condition employed Future Day TAQs only: Boroditsky (2000) and McGlone and Harding (1998) were cited by Ballinger et al. (2007, p. 10 and p.16, respectively) whereas Ramscar et al. (2010) were cited (incorrectly, although more on this later) by Sullivan and Barth (p. 1105 and p. 1107). To date, no empirical studies have demonstrated that responses to Future Day TAQs and responses to Past Day TAQs would be the same day. Indeed, Friday may be preferred for Past Day TAQ responses in Núñez et al. but when Future Day TAQ responses and Past Day TAQ responses are combined Monday responses are favoured. Therefore, it was incorrect to claim empirical support by citing articles involving a Future Day TAQ alongside articles involving a Past Day TAQ. Moreover, why would the citing authors select only the Past TAQ response results and ignore the combination of Future and Past TAQ responses? Can it be because these latter results were in the *opposite* direction? Since both studies, Ballinger et al. and Sullivan and Barth, used Future TAQs in their experiments (Future Hour/Day TAQ and Future Day TAQ, respectively) and cited Future TAQ studies, it is reasonable to believe that a reader of either study, if unfamiliar with the cited Núñez et al. study, may inadvertently assume the cited Núñez et al. results were also for a Future TAQ. Such a conclusion would be a mistake on the reader's part, but a mistake that the citing authors did nothing to discourage. Giving the impression that a cited article employed the same type of dependent variable(s) as other studies cited for the same claim or as the citing study itself is misleading at best. It misleads as to the weight of empirical support that exists for a claim. In this case, the misdirection was empirical support for a preference toward Friday TAQ responses (i.e., Ego-Moving) under a control condition rather than the fifty-fifty split discussed so far. However, the differences in preferences aside, the outcome was the same, to muddy the TAQ research waters.

Bender et al. (2010) claim that a "slight preference" (p. 302) for pastward answers was found by Núñez et al. (2006) and by McGlone and Harding (1998). Again, however, this claim refers to findings from different types of TAQ. That is, for the Núñez et al. (2006) study the claim appears to refer to findings concerning the combination of Future and Past TAQs (Day TAQ, Hour TAQ) (see Table 9 earlier) whereas for the McGlone and Harding (1998) study the claim can refer to a Future Day TAQ only (see Table 8 earlier). Again, the impression is given that a cited article employed the same type of dependent variable(s) as other studies cited for the same claim thus effectively misleading the reader as to the weight of empirical support that exists for a claim.

Articles cited as support only once. As indicated earlier in Table 7, five articles were cited as support just once (i.e., by one article each). Amongst these there were similar problems.

For example, when citing articles that “indicate a slight preference for futurewards answers” (p. 302) Bender and colleagues (2010) indicated that the Ballinger et al. (2007) findings were somehow different by enclosing their citation for Ballinger et al. in parentheses. The use of parentheses might be expected to encourage the reader to review the Ballinger et al. source material to determine why it was different. It turns out that, under control conditions, Ballinger et al. found Friday responses at levels of 85% and 94.1%, in Experiments 1 and 2, respectively, indicative of a strong tendency for futurewards responses rather than a slight preference. In addition, Bender et al. should have been alerted to the need to provide a control condition within their own study as they cited five TAQ control condition studies only and findings from one of those five (i.e., Ballinger et al., 2007) differed markedly from the other four studies (see Table 7 earlier).

Again, Sullivan and Barth (2012), when reporting figures from a study by Kranjec et al. (2010), transform the original result of *more than 70%* Friday responses (as shown on a bar graph) into the exact “70% of participants” (Sullivan & Barth, 2012, p. 1107), misleadingly suggesting that this was the exact percentage value reported in the original study. As noted earlier, Sullivan and Barth (2012) also cited Ramscar et al. (2010) as empirical support for their claim that for TAQ responses under a control condition there was “an apparent preexisting tendency to take an ego-moving perspective" (p. 1105). However, the breakdown of TAQ responses in Ramscar et al. control condition (Exp. 3, non-fictive motion sentences) was Monday 51% and Friday 49%. In other words, and contrary to the Sullivan and Barth claim, the TAQ responses demonstrated, if anything, a slight preference toward Monday responses, an MT perspective.

Duffy and Feist (2014) avoided problems with the studies they cited by providing the figures from the cited articles, that is, reporting Núñez (2007) and Sullivan and Barth (2012) as showing "a preference for answering Friday...61% and 77%, respectively" (p. 33).

Articles that do not cite others to support claim(s). As indicated earlier in Table 7, three studies made a claim about the breakdown of TAQ responses under a control condition being at, or close to, chance level, but did so without any supporting citation or offering their own empirical evidence. These three studies noted that in the absence of any experimental manipulation(s) Monday and Friday responses to a future Day TAQ are "about half and half" (Bin, 2009, p. 160) or in "approximately equal proportions" (Kranjec et al., 2010, p. 113; Kranjec & McDonough, 2011, p. 737). In these examples, the omission of citations gives the impression that the truth of the claim being made is so well established as to warrant being accepted uncritically. The propagation of such "unstated but crucial assumptions" (Machado & Silva, 2007, p. 671) in the TAQ literature serves only to hamper the scientific progress of TAQ research.

As has been shown the chance-level fifty-fifty split assumption for TAQ responses under a control condition is seemingly accepted in the literature, but this assumption is not supported empirically. Thus, for the critical question (Critical Question 8) is it legitimate, for the purposes of a TAQ control condition, to assume a chance-level split between Monday and Friday responses, the answer is no. To address the difference between what is assumed and what is supported empirically, more empirical evidence regarding the split between TAQ responses under a control condition is needed.

The problems of control conditions discussed here are not, however, the full story. The situation is unfortunately made worse by problems relating to statistical analysis and reporting in TAQ studies. These problems include discrepancies relating to participant numbers, misreporting of degrees of freedom and *p* values, problems with the type of statistical analysis conducted, clarity in reporting, and other problems related to accurate reporting of results. Identifying such problems involved extending the research synthesis to a meta-analysis.

A Meta-analysis of TAQ Studies: Problems with Statistical Analysis and Reporting

The meta-analysis involved examining each reported statistical analysis for accuracy and appropriateness. To do this, three steps were followed: (a) the type of statistical analysis used was identified; (b) the statistical analysis employed was, where possible, subjected to attempted replication; and (c) the replicated statistical analysis result was checked to compare to the result reported in the original experiment.

Review of Statistical Analyses Results: Investigation Constraints

There were three constraints regarding what statistical analysis replications were or could be attempted. One constraint was self-imposed whereas the other two constraints were unavoidable.

The first constraint was a voluntary one. Only results addressing directly the proportion of TAQ responses were replicated, because anything else was deemed to be beyond the scope of this investigation. For example, a replication of results was attempted for the Duffy and Feist (2014) experiment comparing the proportions of administrator TAQ responses to student TAQ responses but no replication was attempted for another experiment in the same study which reported levels of procrastination scores based on participants' adopted spatiotemporal perspective (i.e., responses to a TAQ). Focusing on results addressing directly the proportion breakdown of TAQ responses ensured that any problems identified were relevant to all types of future TAQ research, including that of this thesis.

The second constraint, an unavoidable one, involved discrepancies in the published articles themselves (e.g., incorrect participant numbers). A discrepancy in an article did not necessarily prevent a statistical analysis replication attempt of that article's results. However, when a discrepancy was present such an attempted result replication was more likely to be unsuccessful, that is, the result originally reported and the result of the replication were unlikely to agree.

The third constraint, also an unavoidable one, was that the original article needed to contain sufficient information to facilitate a statistical analysis replication attempt. That is, the number of participants' TAQ responses needed to be known. Articles rarely provide the raw data on TAQ responses, with exceptions being experiments by Ballinger et al. (2007) (e.g., future Day TAQ baseline condition "3 Monday, 17 Friday" [p. 11]), Elvevåg et al. (2011) (e.g., future Day TAQ moving-ego condition "ten patients and seven controls…claimed…Friday" [p. 209]), and Richmond et al. (2012) ("Thirty-nine participants (41.5%)…'Friday'…and 54 participants (57.4%)…'Monday'" [p. 815]). Typically, articles provide information regarding the number of participants per condition and percentage figures concerning how those participants responded to a TAQ. The raw data may be calculated from these figures. To illustrate, when investigating the effect of language, English and Mandarin, on spatiotemporal understanding Lai and Boroditsky (2013) noted there were "sixty-six native English speakers" (p. 4) and "fifty-five ME [Mandarin-English] bilinguals" (p. 5) with each group responding Friday to a future Day TAQ "68.2, 38.2…percent…respectively" (p. 6). Using this information a reader can calculate the raw data breakdown in Monday/Friday responses as 21/45 for English speakers and 34/21 for Mandarin-English bilinguals. Such raw data figures allow for a replication attempt of the original authors' statistical analysis comparing TAQ responses between these two language groups. In some cases, insufficient information prevented a replication attempt. For instance, it was impossible to calculate the raw data breakdown in TAQ responses when the number of participants assigned to each experimental condition was omitted from the original study report (e.g., Lee & Ji, 2014; Margolies & Crawford, 2008).

Investigation Outcomes

The 47 experiments across 23 articles identified as utilising some form of a TAQ response as a dependent variable were assessed in terms of the accuracy of each reported statistical analysis and the appropriateness of the analysis itself. This gave rise to two additional critical questions.

Critical question 9: Can the statistical analyses conducted in TAQ research be successfully replicated? Statistical analysis replication attempts were performed for results reported via statistical notation (e.g., "$\chi^2_{1,45} = 4.500$, $p = .034$" Duffy et al., 2014, pp. 8-9) and for results reported via claims (e.g., "no bias towards Monday or Friday" Ballinger et al., 2007, p. 11). To assess the accuracy of the statistical analysis performed, for each result or claim of interest in a TAQ experiment, the type of analysis used was identified, the reported result or claim was replicated if possible using the statistical software SPSS (IBM, version 22.0), and the results, reported and replicated, were compared. See Appendix C for a summary.

Critical question 10: Does the choice of statistical test matter? Considering that TAQ responses are categorical, was the correct chi-square analysis performed? Typically, TAQ experiments employed a chi-square analysis to compare the proportions of found TAQ responses across multiple experimental conditions (which may or may not have included a control condition) or against a hypothesised distribution. In terms of replicating chi-square test for independence results SPSS produced up to five chi-square test for independence values: Pearson Chi-Square, Continuity Correction (a.k.a., Yates-corrected), Likelihood Ratio, Fisher's Exact Test, and Linear-by-Linear Association. Appendix D highlights those studies that included a statement concerning the statistical analyses performed on TAQ responses. In lieu of a clear statement regarding which chi-square test for independence value was reported by the original study, a statistical analysis result replication was considered successful when the chi-square value and p value from any one of the SPSS-produced chi-square test values matched the reported values. Based on data from the original articles, 80 statistical analysis result replications were attempted, of which 48 (what some may call "roughly half") were successful. However, even where successful, there were problems and these are also examined.

Statistical analysis replication: Problems with participant numbers and misleading language. A discrepancy in participant numbers occurred when the number of participants reported as part of a statistical analysis differed from the expected number of participants. This occurred in 11 of the 47 experiments. The expected number of participants is the initial number of participants less any participants excluded from the analysis. Table 10 presents a summary of discrepancies in participant numbers identified in TAQ experiments (see Appendix E for details as to how those discrepancies were identified). As mentioned earlier such discrepancies, while not necessarily preventing replication of statistical analysis results, meant that it was less likely that the result originally reported and the result of the replication would agree.

Table 10

Summary of TAQ Experiments Containing Discrepancies in Participant Numbers

Study			Participant numbers		
Year	Author(s)	Experiment	Initial	Excluded	Total specified in analysis
2004	Motz and Núñez	Poster	34		33
2005	Matlock et al.	2	127	1	124
		3	74	1	71[a]
2007	Ballinger et al.	1	275		273
		2	197	9	193[a]
2008	Margolies and Crawford	1	157	5	150[b]
		2	184	1	182[c]
2010	Kranjec et al.	1	180		360
2010	Ramscar et al.	2	399	7	399
2012	Richmond et al.	2	128		77
2012	Sullivan and Barth	1	198	8	188[a]

Note: [a] Figure not specified by experiment author(s) but calculated from other information provided in the experiment. [b] Participants claimed to number 154 for subsequent responses calculations (AQ, filler question). [c] Participants claimed to number 183 for subsequent AQ responses calculation.

Earlier in this chapter it was demonstrated how, when reporting findings from other studies, linguistic looseness resulted in an uneven split between TAQ responses becoming "roughly half" or that either response was "as likely". Two examples were found showing that authors have also varied their own TAQ findings via similar linguistic license: Ballinger et al. (2007, p. 14, Exp. 2 “time-moving”) reported a breakdown in responses to an Hour TAQ (i.e., “Tomorrow’s noon meeting has been moved forward two hours.”) of 21 (10:00 a.m.) and 18 (2:00 p.m.) as either response being “equally likely”; Elvevåg et al. (2011, Exp. 3) reported inconsistently that responses for a “moved forward” TAQ “were at chance level” (p. 209) and “most responses are at (or close to) chance level” (p. 210).

Successful statistical analysis replication but problems with degrees of freedom. The degrees of freedom value was misreported in two experiments where the chi-square values were replicated successfully: Ramscar et al. (2010, Exp. 2 and Exp. 3). Degrees of freedom (*df*) are calculated as “$(r - 1)(c - 1)$…r is the number of rows and c is the number of columns” (Field, 2013, p. 723). In these two experiments, c had a value of 2, as the columns were populated by two TAQ responses (Monday, Friday). In Experiment 2, the *df* value was misreported as 1, but the correct value was 4: $(r - 1)(c - 1)$ becomes $(5 - 1)(2 - 1)$ as the r variable *number of trees* had five levels (i.e., 10, 11, 12, 19, 100). In Experiment 3, the *df* value was misreported as 3, but the correct value was 1: $(r - 1)(c - 1)$ becomes $(2 - 1)(2 - 1)$ as the r variable *sentence type* had two levels (FM, nonFM). In these examples, however, discrepancies in *df* values did not prevent successful replication of the reported results.

Successful statistical analysis replication but problems with p values. For three TAQ experimental results, statistical analysis replication attempts revealed misreported p values. Specifically, the chi-square values were replicated successfully but, in each case, the originally reported p value was *less than* the p value found at replication. In other words, the reported p value indicated greater statistical significance than did the replicated p value. Statistical analysis replication attempts calculated the p value to 3 and 4 decimal places by employing both SPSS and the online chi-square calculator GraphPad software (http://graphpad.com/), respectively. Replicated *p* values are written here as SPSS/GraphPad values. The misreported *p* values were: "$p < .03$" (Ramscar et al., 2010, p. 603, Exp. 2 [scan points 10 vs. 11 vs. 12 vs. 19 vs. 100]) when the replicated *p* value was .032/.0317; "$p < .0001$" (Matlock et al., 2011, p. 266, Exp. 2, alphabet-forward) when the replicated *p* value was .001/.0007; and "$p < 0.001$" (Duffy & Feist, 2014, p. 38, Exp. 1, administrators vs. students) when replicated *p* value was .001/.0013. In terms of statistical significance, each reported *p* value was more favourable than the replicated *p* value.

Successful statistical analysis replication but problems with choice of chi-square analysis. Initial attempts to replicate the statistical results from three experiments failed because the statistical analysis assumed in the replication to be the appropriate one was not the statistical analysis performed originally. The three experiments were: Kranjec et al. (2010 [Prep/Hour vs. NoPrep/Hour, Prep/Month vs. NoPrep/Month]), Núñez et al. (2006, Exp. 2 [primed vs. control]) and Núñez (2007 [moving cubes vs. control]). In each experiment, a chi-square goodness-of-fit was the original statistical analysis performed whereas the replication analysis was a chi-square test for independence. The original analysis was identified by reported results matching replicated results via a chi-square goodness-of-fit test. However, a chi-square test for independence analysis was used initially in the replication attempt because this is the appropriate analysis to perform when the proportion of TAQ responses from two categorical variables in the same experiment are compared as is the case in all three experiments.

In none of the three experiments did the authors (Kranjec et al., 2010; Núñez et al., 2006; Núñez, 2007) indicate why a chi-square for goodness-of-fit analysis was conducted. The closest any came to an explanation was acknowledgement of the variables as categorical and with "this kind of data the statistical test we can use…is the *one-way* χ^2 (*Chi-Square*) test" (Núñez, 2007, pp. 113-4). Although it is true that the data were categorical, the choice of analysis in each experiment was inappropriate because none of the experiments involved a hypothesised distribution or values “obtained previously from a comparison population” (Pallant, 2013, p. 223). Common across all three experiments was the comparison of responses from an experimental condition to responses from a control condition. It is possible that such a comparison led the experiments’ authors to adopt a chi-square goodness-of-fit analysis as appropriate. However, the correct analysis was a chi-square test for independence, because a control condition is merely a special type of experimental condition (i.e., manipulation-free).

The choice of an unsuitable analysis in the original experiments raises an interesting question: What would the statistical analysis results have been had the appropriate test, as argued here, been performed? In other words, would the experiments’ results, specifically *p* values, have been different had the authors of the three experiments performed a chi-square test for independence rather than a goodness-of-fit test? For two of the three experiments, the answer is yes; a statistically significant chi-square goodness-of-fit test result became a statistically nonsignificant chi-square test for independence result. Here, *p* values changed from “$p = 0.01$” (Núñez et al., 2006, p. 143, Exp. 2 [primed vs. control]) to a *p* value of .056 (Pearson chi-square) and “$p = 0.01$” (Kranjec et al., 2010, p. 114) for two results, Prep/Hour vs. NoPrep/Hour and Prep/Month vs. NoPrep/Month, became *p* values of .069 (Pearson chi-square) and .063 (Pearson chi-square), respectively. For one experiment, the answer is no. A chi-square test for independence analysis on Núñez (2007) produced a *p* value of .006, a result similar to the reported goodness-of-fit result of a “.01% level of significance” (p. 115).

A successful statistical analysis replication involves employing the original statistical analysis technique and achieving the original reported finding. When the original finding is reported as a claim rather than via statistical analysis notation the original analysis-finding combination may be obscured. To illustrate, it is possible to replicate the claim that the "difference between DAY and ON + day was not significant" (Kranjec et al., 2010, p. 114) by conducting either a chi-square goodness-of-fit test or a chi-square test for independence. Had this claim been that experiment's only claim I would have assumed incorrectly that the original statistical analysis performed was a chi-square test for independence (the appropriate analysis for comparisons of categorical variables across multiple experimental conditions) and the successful replication attempt would have reinforced that assumption. However, investigation of the Kranjec et al. (2010) other results, as discussed earlier, showed that these authors favoured a goodness-of-fit test in such situations, so it is likely that such an analysis was conducted for this claim also. The point is that congruence between claims (original and recalculated) may not necessarily indicate a successful replication of the original analysis performed.

Another problem with statistical analysis and reporting occurred when a single experiment by Ramscar et al. (2010, Exp. 2) reported different chi-square test for independence analysis values across different experimental conditions without any clear rationale as to why different values were chosen. When comparing TAQ responses across four experimental conditions (scan points 4, 8, 20, and over 80 [n = 111]) Ramscar and colleagues reported a "linear-by-linear association" (p. 603) value; that result could not be replicated here. For a comparison of TAQ responses across another five experimental conditions (scan points 10, 11, 12, 19, and 100 [n = 287]) no specific chi-square value label was identified in the original study, but a statistical analysis replication revealed a match for a Pearson Chi-Square value. One chi-square test for independence value may be preferred over another value depending on the sample size involved. For instance, the continuity correction value may be favoured when instances of a variable value are five or less—such a value was reported by Ballinger et al. (2007, Exp. 1) when comparing TAQ responses between a control condition (3 Monday, 17 Friday) and an MT condition (17 Monday, 21 Friday)—although the merits of each test are debatable (Field, 2013; Howell, 2013). However, small sample sizes were not a problem for Ramscar et al. leaving it unclear why different chi-square values were reported. This kind of unclarity contributes to muddying the TAQ research waters.

The examples above demonstrate three points regarding whether it matters if the statistical test for comparing TAQ responses is a chi-square goodness-of-fit or a chi-square test for independence (Critical Question 10). The first point is that, in the literature, there are instances where it does not appear to matter which of the two types of chi-square tests are employed. The second point is that, despite instances to the contrary in the literature, it does matter which tests are used because, as argued above, these tests are not interchangeable. Finally, a point that emerges from the reporting of chi-square test for independence results only is that it is important to provide a clear rationale for why different values are being reported (e.g., Pearson Chi-Square, Linear-by-Linear Association). The main thing here is that to analyse TAQ responses across two conditions the chi-square test for independence is the appropriate analysis.

Unsuccessful statistical analysis replication: Why? Some result replications failed despite the available data appearing sufficient to facilitate successful replications. Such cases occurred across various studies: Ballinger et al. (2007), Duffy et al. (2014), Matlock et al. (2005), McGlone and Harding (1998), Núñez et al. (2006), and Ramscar et al. (2010). Each study was examined further in an attempt to determine the reason(s) for the unsuccessful replications.

Attempts to replicate the statistical analysis results from McGlone and Harding (1998, Exp. 2), where TAQ responses from two experimental conditions were compared against one another, were unsuccessful. It was reasonable to expect these result replication attempts to succeed, as those same data were used in the successful results replication comparing TAQ responses across three (i.e., Moving Ego vs. Mixed Context vs. Moving Time), rather than two, experimental conditions. To check whether the initial assumption of a chi-square test for independence analysis was mistaken (see earlier discussion on studies by Kranjec et al. [2010], Núñez et al. [2006], and Núñez [2007]), a goodness-of-fit analysis was conducted for each two-condition comparison, but again without success. With nothing to suggest a discrepancy in participant numbers reported or any other statistical technique other than chi-square test for independence being used, there were no obvious explanations for why the two-condition comparisons' results could not be replicated.

A discrepancy in participant numbers was the most likely reason for the unsuccessful replication of statistical analyses results from two studies: Matlock et al. (2005, Exp. 2 & Exp. 3) and Ramscar et al. (2010, Exp. 2). For example, of the "399 participants….responses from seven participants were discarded" (Ramscar et al., 2010, Exp. 2, pp. 603-4), leaving data from 392 participants available for further analyses. However, the total number of participants involved in the experiment's analyses amounted to 399, suggesting that the raw data figures provided by Ramscar and colleagues included for some mysterious reason the discarded participants. Appendix E presents a detailed breakdown of discrepancies in participant numbers for both studies.

There were no obvious discrepancies in participant numbers involved in the unsuccessful replication of other results from three other separate experiments: Duffy et al. (2014, Exp. 3, Hour TAQ), Matlock et al. (2005, Exp. 1) and Ramscar et al. (2010, Exp. 4). All three experiments provide the total number of participants per experimental condition and a breakdown of TAQ responses in terms of percentages, allowing for the calculation of TAQ responses in terms of raw data. Each statistical analysis replication attempt employed a chi-square test for independence because, as discussed earlier, this is the appropriate analysis for a categorical DV (i.e., TAQ responses) across more than one experimental condition. In addition, this type of statistical analysis replicated successfully the result reported by Ramscar et al. (Exp. 3)—an experiment that differed from Matlock et al. (Exp. 1) only in that participants did not sketch the image conveyed by the sentences presented (i.e., fictive motion or nonfictive motion)—and the result reported by Duffy et al. (Exp. 3, Month TAQ). The reason for an unsuccessful replication of these results is unclear. A discrepancy in the published articles themselves (e.g., participant numbers) seemed a likely cause but based on the information available this remains speculative.

Another unsuccessful replication attempt where some discrepancy in the published study may be responsible was the Núñez et al. (2006, Exp. 1) comparison of TAQ responses (Future Day TAQ and Past Day TAQ) to the breakdown in TAQ responses found by Boroditsky (2000). The original result was "$\chi^2(1, N = 66) = 8.56, p = 0.0034$" (Núñez et al., 2006, p. 140) whereas the replicated statistical analysis result was $\chi^2(1, N = 66) = 8.80$ $p = .003$ ($p = .0030$ when using GraphPad). The replication result was close to the original report, but a close result is not a successfully replicated result. A possible typographical error(s) in the published study was assumed for two reasons. First, the statistical analysis employed in the replication attempt—a chi-square goodness-of-fit—was deemed appropriate because: (i) responses from the single experimental condition were "compared against these [Boroditsky, 2000] proportions" (Núñez et al., p. 140) and comparing proportions of responses from one experiment against proportions of responses from another study/population typically requires a chi-square goodness-of-fit test (Pallant, 2013), (ii) Núñez et al. appeared to favour this type of analysis, even performing it when comparing two experimental conditions (primed vs. control, Exp. 2), an inappropriate analysis, as discussed earlier, and (iii) the sample size (i.e., 66) reported in the original result matches the number of participants Núñez et al. state as being in their single experimental condition. Second, it seems unlikely that an error was introduced when calculating the raw data for the statistical analysis result replication. The raw data for the Núñez et al. single experimental condition (Monday 42, Friday 24) were calculated from the total number of participants (n = 66) and the breakdown of TAQ responses in terms of percentages provided, "Monday (63.6%)...Friday (36.4%)" (p. 140). Support for the raw data calculations being correct was that those same figures allowed for a successful statistical analysis result replication when comparing the Future Day TAQ responses to the Past Day TAQ responses. The hypothesised distribution (Monday 30, Friday 36) was calculated from the total number of participants (n = 66) using "Boroditsky (2000) reported…proportions…45.7% [Monday] and 54.3% [Friday]" (Núñez et al., p. 140). The percentages quoted by Núñez and colleagues are accurate accounts of the Boroditsky findings. Based on the above, it is assumed that the statistical replication attempt used the correct figures and the appropriate analysis, so a failure to replicate the original statistical result suggests a discrepancy within the published study (e.g., typographical error(s) within the statistical notation reporting the original result).

It was not possible to replicate six chi-square goodness-of-fit analysis results, reported using statistical notation, from a study by Ballinger et al. (2007). Discrepancies with participant numbers in the Ballinger et al. study were discussed earlier and may be part of the replication problem here although this seemed unlikely for the following reason. Using the number of participants per condition as stated in that study a chi-square test for independence analysis successfully replicated an original result comparing Day TAQ responses between two conditions, Time-Moving vs. Baseline (Exp. 1). However, utilising those same Day TAQ baseline data with a chi-square goodness-of-fit test failed to replicate the reported result for the Day TAQ Baseline condition only (Exp.1). In other words, using the same data it was possible to replicate a chi-square test for independence analysis but not a chi-square goodness-of-fit analysis. So, did the problem lie with the analysis?

The statistical analysis replication attempts for TAQ responses from a single experimental condition employed a chi-square goodness-of-fit. This was the appropriate test. A hypothesised data distribution at chance level (i.e., a fifty-fifty split) was assumed for the statistical analysis replication attempts because the original study provided no information to the contrary and this was the most common hypothesised distribution employed within the TAQ literature. It was possible that the hypothesised data used in the goodness-of-fit analyses differed between the original study and the result replication attempts. However, based on the available information, there was no way of knowing whether or not this was the case.

Confusion regarding the hypothesised distribution employed by Ballinger and colleagues (2007) extended to those claims not expressed via statistical notation (e.g., Hour TAQ baseline "no significant difference" p. 14). Most statistical analysis replication attempts using chi-square goodness-of-fit tests agreed with the wording of the original claims but agreement on words does not mean that the original result and the replicated result matched. One statistical analysis replication did not agree with the wording of the Ballinger et al. study. Specifically, they claim that a difference in TAQ responses "did not quite reach statistical significance (6 Monday, 12

Friday)" (Ballinger et al., 2007, p. 11, Exp 1, Ego-Moving-Right condition). Putting these figures into a chi-square goodness-of-fit calculation against a hypothesised distribution at chance level produced the result, $\chi^2(1, 18) = 2.00$, $p = .157$. Assuming an alpha set at .05, the result was clearly nonsignificant and the Ballinger et al. claim revealed to be somewhat misleading.

To summarise, possible reasons for failing to replicate results included discrepancies in the reported participant numbers, an issue with the statistical analysis conducted, a lack of sufficient information within a study (e.g., sample size [overall, per condition], type of analysis conducted clearly stated), or a typographical error in the original reported result. Although the utmost care was taken, the possibility of error introduced during the replication process itself cannot be discounted. Importantly, a failure to replicate does not mean that the reported results are incorrect. What has been demonstrated is that using the information provided in the original published articles some results could not be replicated, suggesting an error(s) somewhere in those experiments. Therefore, the answer to "can the statistical analyses in TAQ research be successfully replicated (Critical Question 9)" is no, not always.

Conclusion

The two aspects of this review (research synthesis, meta-analysis) allow for a clearer picture of research practiced in the TAQ literature. As this research synthesis investigation has demonstrated, there is strong evidence that the current TAQ research design and reporting practices have, for the most part, failed to follow the required logic. This evidence has come in three related forms: a paucity of TAQ control condition experiments, the practice of assessing one experimental condition result against the result of another experimental condition as evidence of manipulation efficacy, and the unwarranted assumption of the breakdown of TAQ responses being at chance level in the absence of experimental manipulation(s). These have been supplemented by the practice of reporting and citing the research results of others in ways that are at best simply inaccurate and at worst misleading.

This review has demonstrated that statistical analysis and reporting problems obscure the true state of TAQ research. Within research “things [such] as obscurity or confusion may indicate error” (Popper, 1960/1985, p. 55) and this has been shown to be the case here with confusion arising from “mundane ‘regular’ misbehaviours” (Martinson et al., 2005, p. 737) including the misreporting of participant numbers, *df* values, sample sizes, or *p* values, the performing of inappropriate statistical analyses, and the use of loose language. It might be objected that the material presented in this meta-analysis amounts to nothing more than obsessive nit-picking. Certainly it could be conceded that any one of these problems when considered in isolation, is not substantial. However, when considered as a package and combined with the material on control condition problems, there is good evidence to believe that the research practiced in the TAQ literature, and in many other areas in psychology (e.g., Bakker & Wicherts, 2011; Nuijten et al., 2015; Veldkamp et al., 2014), suffers from scientific shortcomings. And the overall picture that emerges is one of unclarity, omission, confusion, miscalculation, and misreporting. For the researcher who plans to enter the TAQ domain and extend empirical knowledge in this area, this situation is cause for concern.

Given these problems in the research literature in this area, it is difficult to obtain a clear and accurate picture of exactly what has, and what has not, been empirically supported. However, three things are clear. First, there is no empirical justification for treating TAQ responses under neutral conditions as being similar to those of a fair coin toss; that is, there is no justification for assuming a fifty-fifty split in Monday versus Friday responses. Therefore, researchers should include a control condition to help determine what is empirically supported concerning TAQ responses under neutral conditions. Second, the data in published studies should be checked for accuracy. Third, the data in published studies should be assessed regarding the appropriateness of the statistical test(s). Each of these are important points and have been added to the initial seven critical questions, bringing the total number of critical questions to ten (see Table 11).

The ten critical questions and their associated solutions, strategies, or predictions influence the design of the proposed research investigating the role of emotion on choice of time perspective. For instance, in response to whether there is any difference between incidentally induced emotion and emotion as felt in response to an event that has been moved forward (Critical Question 4), the proposed research will use three separate events referred to in the TAQ and the AQ (i.e., friend's party [positive], exam [negative], or meeting [neutral]), and will cross these with an experimentally induced emotion (positive, negative, neutral), via an emotion induction procedure prior to asking the TAQ and the AQ. The question to be asked regarding this emotion induction procedure is twofold. In the first place, how can we be sure that an incidentally induced emotion has actually been induced (Critical Question 5)? In the second place, is any one emotion induction method better than another? These questions are the focus of the next chapter.

Table 11
Ten Critical Questions regarding the Role of Emotion in Temporal Perspective

Critical question	Answer in literature	Current study
1. Do TAQ and AQ measure same thing?	Yes.	Answer: No. TAQ assesses *distance change*. AQ assesses *agency assignment*. TAQ reply Monday (MT) → consistent with AQ reply TA ("event is approaching me"), TAQ reply Friday (ME) → puzzling (not consistent with either "I" or "event" approaching). Solution/strategy: Avoid priming, and do not present TAQ and AQ consecutively.
2. In TAQ response, is an ME perspective always mappable onto an approach-related behaviour?	Yes.	Answer: No. If positive emotion (induced and/or event-related) prompts approach, then either observer's forward motion is projected onto event (Friday – ME) *or* there is a desire to decrease the distance between observer and event (Monday – MT). Prediction: Unclear, not known, worth investigating to see *which* response occurs.
3. In TAQ response, is it always appropriate to map avoidance-related behaviour onto an MT perspective?	Yes.	Answer: No. If negative emotion (induced and/or event-related) prompts avoidance, then *either* event is seen as "coming at me" (Monday – MT) *or* event is "pushed away" (Friday – ME). Prediction: Unclear, not known, worth investigating to see *which* response occurs.
4. Does the source of the emotion matter?	None. Has not yet been systematically investigated.	Prediction: Unclear, not known, worth investigating.
5. Can we ascertain that the desired emotion has been experimentally induced?	Yes – we can assume so.	Answer: Assumption could be false. Manipulation check has not been consistently done in the research. Solution/strategy: *Must* do manipulation check by assessing pre- and post-induction emotion.
6. Is it necessary to have a control condition?	Typically no – except where a neutral/control condition is included and results are assessed relative to that.	Solution/strategy: *Must* include a control condition.
7. Should individual differences be taken into account?	None.	Answer: Not known, not yet systematically investigated. Solution/strategy: Investigate.

(continued)

Critical question	Answer in literature	Current study
8. Is a chance level (i.e., fifty-fifty) split between Monday and Friday TAQ responses warranted?	Yes.	Answer: No. This is widely assumed in previous studies, but nothing in the research literature supports that assumption. Solution/strategy: Use control condition and assess experimental manipulations against the control results.
9. Can the statistical analyses conducted in TAQ research be successfully replicated?	Assumed to be yes, but had not been investigated.	Answer: No. In the present study a series of statistical analysis replication attempts have failed. Solution/strategy: Conduct a series of statistical analysis replication attempts.
10. Does the choice of statistical test matter?	Apparently not.	Answer: Yes. The appropriate test is a (two-way) chi-square test for independence, but sometimes a (one-way) chi-square goodness-of-fit has been used in the research, biasing the results in favour of statistically significance (when the appropriate test would not have yielded significance). Solution/strategy: Use the chi-square test for independence to analyse the results.

CHAPTER 6

Experiment 1: Selecting an Emotion Induction Procedure: Comparing the Efficacy of Film and Text

Aim and Rationale

The preceding chapter took a more complex approach (i.e., research synthesis and meta-analysis) to reviewing the empirical literature than typically occurs in the current literature. This approach, consistent with the broader view of scientific method proposed at the outset (see Chapter 1), produced a richer view of what has (and what has not) been supported empirically in TAQ studies. Continuing with this broader view of scientific method this chapter focuses on two questions regarding emotion induction. First, how can we be sure that incidentally induced emotion has actually been induced (Critical Question 5)? The second question follows on from the first, and is whether any one emotion induction method is better than another emotion induction method? The answers to these two questions will help identify the appropriate stimulus for inducing emotion (positive, neutral, negative) in participants for use in the proposed empirical investigation of the role of emotion on spatiotemporal understanding. Inducing emotion experimentally under controlled laboratory conditions, a technique referred to as *emotion induction* or *mood induction*, is widely used by psychological researchers wishing to investigate the effects of emotion. As discussed earlier (Chapter 4), many researchers use the terms *emotion* and *mood* interchangeably, and within the discipline of affective sciences *affect* is an umbrella term that includes emotion and mood, with emotion being a relatively brief (i.e., a few seconds to several minutes) reaction to an event and mood being a longer-lasting, less intense, affective state (Davidson et al., 2003). Here, it was decided to adopt the label *emotion induction* (EI).

As discussed in Chapter 4, of the four published TAQ studies incorporating an emotion induction procedure, three had a single-item post-emotion manipulation check (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) whereas the remaining study had no emotion manipulation checks (Hauser et al., 2009). Without pre- and post-manipulation checks, it remains unclear whether the emotion manipulation did in fact result in eliciting the desired emotional state. A critic may object that, as long as participants can be shown to be in the required emotional state, it is irrelevant how they have got there; that is, it does not matter whether that emotional state was elicited by the emotion manipulation procedure. However, if a researcher wants to claim, or to suggest implicitly by virtue of employing an emotion induction method and a post-manipulation check only, that an emotion induction method was responsible for a desired emotional state then pre- and post-manipulation checks are needed. After all, if there is no expectation that an emotion induction method will be effective then why include such a procedure?

The four published TAQ studies incorporating an emotion induction procedure employed different emotion induction methods including thinking about an event (Margolies & Crawford, 2008), writing about an event (Lee & Ji, 2014), reading a scenario about an event (Hauser et al., 2009; Richmond et al., 2012), and viewing a film clip (Richmond et al., 2012). In the scientific literature more generally, other examples among the numerous laboratory methods used to induce emotion are autobiographic recollection (Philippe, Koestner, Lecours, Beaulieu-Pelletier, & Bois, 2011; Schaefer & Philippot, 2005), bodily posture (Flack, 2006; Flack, Laird, & Cavallaro, 1999; Schnall & Laird, 2003), facial expression (Duclos & Laird, 2001; Philippen, Bakker, Oudejans, & Canal-Bruland, 2012; Strack, Martin, & Stepper, 1988), self-statements (Cunningham, 1988; Frost & Green, 1982; Jennings, McGinnis, Lovejoy, & Stirling, 2000), and sounds, singing, or music (Bradley & Lang, 2000; Wendrich, Brauchle, & Staudinger, 2010; Zentner, Grandjean, & Scherer, 2008). The most popular method of EI has been the use of film. A review of 134 articles that included physiological measures of emotional states to investigate the effects of emotion on autonomic nervous system activity found that the largest number, 37% (i.e., 49 articles), utilised film (Kreibig, 2010). Likewise, a recent meta-analysis of EI studies focusing on happiness, sadness, anger, and anxiety found film the most frequent EI method with 24% (i.e., 162 articles) of the articles reviewed utilising film (Lench, Flores, & Bench, 2011).

There are many reasons for film's popularity as an experimental emotion inducer. First, there are several available standardised film clips that reliably produce different target emotions (e.g., Gross & Levenson, 1995; Hewig et al., 2005; Schaefer, Nils, Sanchez, & Philippot, 2010; see Appendix F). Second, procedures for showing film clips are easy to implement. Third, exposure to film is relatively widespread in Western society (e.g., television, mobile devices), thus reducing ethical concerns when inducing negative emotion (Philippot, 1993; Rottenberg, Ray, & Gross, 2007). Finally, being dynamic displays, films engage and capture attention visually and aurally in a manner similar to everyday experiences (Gross & Levenson, 1995; Rottenberg et al., 2007).

In addition to these reasons for film's popularity, it seems that, in selecting film over other methods, some researchers have been relying on recommendations given in a meta-analysis by Westermann, Spies, Stahl, and Hesse (1996). This meta-analysis investigated multiple EI techniques and found "…Film/Story + Instruction…the most potent procedure for the induction of both elated and depressed mood", while "…Film/Story without instruction…also can be recommended" (pp. 577-8) ("instruction" here refers to instructions to participants to imagine being in the depicted situation). These findings justify researchers' confidence that film is an effective inducer of positive and negative emotional states.

However, despite film's popularity, it is open for scientific investigation whether relative *popularity* is equivalent to relative *efficacy*. Some researchers appear to assume that they are equivalent, paraphrasing the Westermann et al. (1996) findings via a subtle label change that deletes the "Story" component of the "Film/Story" category. For example, when referring to the results of the meta-analysis, Schmid, Schmid Mast, Bombari, Mast, and Lobmaier (2011) claim that "film scenes are the most effective...way of priming mood" (p. 225), and Macht and Mueller (2007) likewise report that films are "the most effective method for mood induction in the laboratory" (p. 668). Accordingly, both of these studies employed film as the emotion inducer. In this way, the EI efficacy of film is unjustifiably (and perhaps incorrectly) inflated above that of text-based stories, which have dropped out of the picture. Given that Westermann et al. did not report on film and story separately, it is impossible to know from their meta-analysis *which* of the two is the *more* effective.

Martin (1990) highlights two difficulties that researchers face when considering the relative efficacy of different EI methods. First, few studies have employed more than one method, so there is little research on direct comparisons. A review of the literature revealed only seven exceptions (Albersnagel, 1988; Chartier & Ranieri, 1989; Ellard, Farchione, & Barlow, 2012; Jallais & Gilet, 2010; Lobbestael, Arntz, & Wiers, 2008; Salas, Radovic, & Turnbull, 2012; Stephens, Christie, & Friedman, 2010). However, restriction to a single method is understandable; if that chosen method successfully induces the desired emotional state(s) then researchers have little reason to ask whether another method might not have been better. The second difficulty highlighted by Martin is that there are multiple measures of emotional states, so that meta-analyses of EI methods, regardless of any statistical transformations, are not comparing like with like. This may not be a problem if we are interested only in effectiveness per se, but if we want to investigate which is the most effective method, whether it remains the most effective under different conditions, whether relative efficacy depends on the target emotion, and so on, then direct comparison of EI techniques is required. Either way, we are not entitled to conflate most popular with most effective. In short, what is the best laboratory method for inducing emotion is an empirical question rarely addressed but worthy of investigation.

On the rare occasions when this question *has* been addressed, film has *not* been consistently superior compared with other methods. In one study, inducing anger via film was as effective as methods using stress, punishment, or harassment, but only harassment increased both self-report and physiological ratings (Lobbestael et al., 2008). In another study, using three types of media (film, still images, music) to induce sadness, Ellard et al. (2012), found that still images resulted in significantly higher negative affect ratings than either film or music, when using experimenter selected stimuli (i.e., stimuli supported by earlier empirical research). Furthermore, autobiographical recollection produced higher ratings of joy when compared with film (Salas et al., 2012). Clearly, while film appears often to compare favourably with other EI techniques, this does not necessarily equate to its always being the *best* method.

Furthermore, film is not without its problems as a method of EI. For example, Lench et al. (2011) suggest several potential disadvantages, including the following: (a) An individual's emotional reaction may be influenced by prior experience with the film; (b) As films differ from each other in a variety of ways (e.g., number of characters, background music, camera angles) it is challenging to standardise across film clips; and (c) A film's many sights and sounds may arouse responses not considered within the emotional research but potentially influencing the outcomes. These problems are not insurmountable and their adverse impact on a study is dependent on the research question and is to some extent within the researcher's control.

Nevertheless, it is important that film's popularity not blind researchers to potential difficulties of this method.

Given these potential difficulties, it is all the more important to investigate whether a method other than film might be a more effective (or at least an equally effective) emotion inducer under certain conditions. This is why when Ellard et al. (2012) ask "Does it matter what method is used to induce emotion, so long as emotion is induced?" (p. 233), the reply is that it does matter. For instance, researchers often use the same method to induce different emotions within the one experiment and it may be that the reported differences in effects are related to the strength of the induced emotions rather than to the emotions themselves. Thus, the difference in effects between a strong positive emotion and strong negative emotion may differ from that between a strong positive emotion and a weak negative emotion. Therefore, it is important not only to compare the efficacy of different EI techniques, but also to investigate the efficacy of individual techniques across different emotional states.

Hypothesis and Research Questions

The present study sought to split film and text in the Westermann et al. (1996) "Film/Story" hybrid category and to investigate the relative efficacy of film versus text as EI methods. While it is established that both types are effective inducers of emotion (Lench et al., 2011; Westermann et al., 1996), this was the first time that the EI efficacy of film and text was directly compared using the same measure. That measure was administered pre- and post-manipulation. It is important to note that exemplars from the existing research literature were compared. That is, the chosen film clips and text passages are those that are typically used and regarded in the existing literature as the being effective EI stimuli. It was not the aim, nor would it have been ecologically valid, to take a film, say, and then "balance or equate" by producing a text version of its content, or to take a text passage and produce a film version of its content. There is nothing in the research literature that claims superiority for film under these artificial conditions. With this caveat in mind, film clips and text passages were used to induce general emotional states (i.e., positive, neutral, negative) rather than specific emotions. It was predicted that each film clip and text passage would successfully induce its target emotional state. Beyond that, there were three other questions of interest: First, is either film or text a better EI method overall? Second, for EI efficacy, is there an interaction between method and valence of induced emotion? Third, based on the answers to the preceding questions, which EI technique would be more appropriate for use in the proposed empirical investigation of the role of emotion on temporal perspective (i.e., Experiment 2 in Chapter 7).

Method

Participants

The study combined participant cohorts from two experiments. These two cohorts were exposed to either film (cohort A) or text (cohort B), with both groups receiving the same emotion assessment before and after the EI procedure.

Cohort A included 161 undergraduate psychology students (128 female, M_{age} = 20.65) from Western Sydney University recruited via an online psychology recruitment service and given course credit for their participation. Cohort B included 141 participants (103 female, M_{age} = 27.36) of which 97 were undergraduate psychology students recruited as for Cohort A and 44 were acquaintances of the researcher. In total, 302 participants (231 female, M_{age} = 23.78) were included in this study. All participants were treated in accordance with the ethical standards of the Australian Psychological Society and Western Sydney University Human Research Ethics.[23]

Materials

Film. For EI via film, three film clips (one positive, one neutral, one negative) were selected on the basis of a pilot study comparing reported emotional reactions to four positive, two neutral, and four negative film clips. Nine of the ten film clips have been identified in the research literature as effective emotion inducers (see Appendix G). The neutral category film clip AFRICA was edited specifically for the pilot study to provide a slightly pleasant film as, according to Rottenberg et al. (2007), such a film type helps avoid a neutral stimulus from being perceived potentially as boring and subsequently quite negative. Clips were created from the original film DVDs using ripper software (Aimersoft, 2012) and video-joining software (FreeVideoJoiner, 2008).[24] Appendix H presents instructions for creating the clips and information on the clips as used in earlier research. Film clips were hosted on the fee-paying video-sharing website Vimeo.com (meaning the clips were free from advertisements) and selected viewing settings removed participants' ability to pause/replay a clip, ensuring each clip was viewed continuously and once only. All surveys were hosted online by the survey software package Qualtrics (2013) with film clips presented with dimensions of 600 (width) x 400 (height) pixels.

Pilot study to determine films used. One hundred and ten University of Western Sydney undergraduate psychology students (69 female, ages ranged from 18 to 44 years, M_{age} = 21.21, SD = 5.38) participated in the pilot study. Participants rated the overall pleasantness of the

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[23] UWS HREC approval number H10036 covers Experiments 1 and 2 of this study.
[24] Edited film clips are available directly from the researcher.

feelings experienced from viewing a single film clip on a 9-point Likert scale with scores ranging from 1 (*unpleasant*) to 9 (*pleasant*). Figure 7 displays the breakdown of overall pleasantness ratings across all film clips.[25] The most effective clip from each emotion category was selected for the current study. The positive emotion clip from *Forrest Gump* shows a father meeting his son for the first time (Finerman, Tisch, Starkey, & Zemeckis, 1994 [2’37”]). The negative emotion clip from *Misery* depicts a woman breaking the legs of a man restrained on a bed (Scheinman, Reiner, & Reiner, 1990 [3’10”]). The neutral emotion clip from *All the President’s Men* shows two men talking in a courtroom followed by a scene of a reporter waiting to see a court official (Coblenz & Pakula, 1976 [3’02”]). Identical to the current experiment, the pilot study hosted the film clips on Vimeo.com and presented the clips to participants with dimensions of 600 (width) x 400 (height) pixels via Qualtrics (2013).

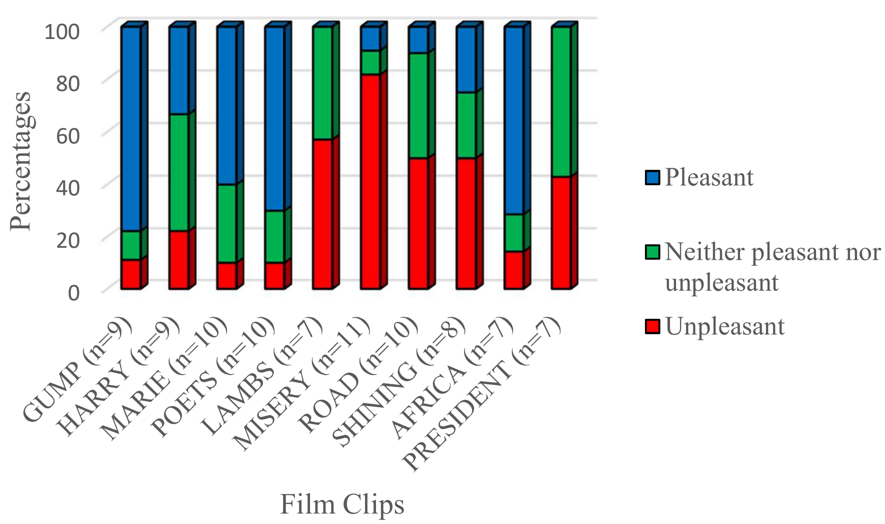

Figure 7. Overall pleasantness rating of emotional experience while viewing a film clip (pilot study).

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[25] These ratings were replicated and confirmed by an additional 18-item emotion scale (see Appendix I).

Text. For EI via text, three text passages were selected. The positive emotion (561 words) and negative emotion (565 words) passages presented a first-person description of a character in a landscape with descriptions varying only in weather conditions (e.g., clear vs. cloudy skies) and landscape details (e.g., lush vs. barren). Similar manipulations have been used in other studies (cf. Bruyneel, Dewitte, Franses, & Dekimpe, 2009). The neutral emotion passage (447 words) contained information about Luxembourg, information designed to be informative while not eliciting any strong emotional response. See Appendix J for the three emotion-related text passages including highlighted text denoting the changed terms between the positive emotion text and the negative emotion text.

Positive and Negative Affect Schedule (PANAS). The Positive and Negative Affect Schedule (PANAS: Watson, Clark, & Tellegen, 1988) was used to assess emotional state before and after the EI procedure (see Appendix K). The PANAS is comprised of two 10-item scales, one measuring positive affect (PA) the other measuring negative affect (NA). Examples of the one-word descriptors used for scale items include *excited*, *enthusiastic*, and, *strong* for PA and *distressed*, *hostile*, and *afraid* for NA. Previous studies indicate that PA and NA are largely independent dimensions so that, for example, an individual may feel ‘enthusiastic’ while simultaneously feeling ‘scared’ albeit not necessarily with the same intensity (Crawford & Henry, 2004; Schmukle, Egloff, & Burns, 2002; Tellegen, Watson, & Clark, 1999; Watson & Tellegen, 1985). Each scale’s scores range from 10 to 50 with higher scores indicating greater affect on that scale. The scales have been used over a number of different time frames, such as, “past week” and “past year” (Watson et al., 1988). In the present study, participants rated the extent to which each scale item (i.e., an affect word such as *excited* or *upset*) applied to them “at the present moment.” Items were rated on a 5-point Likert scale with scores ranging from 1 (*very slightly or not at all*) to 5 (*extremely*).

Positive affect, specifically low PA, has been found to be significantly related to depression, while NA, specifically high NA, has been found to be significantly related to both depression and anxiety (Dyck, Jolly, & Kramer, 1994; Watson, Clark, et al., 1995; Watson, Weber, et al., 1995). The PA and NA scales of the PANAS demonstrate good convergent validity by means of significant expected correlations with the related constructs of anxiety and depression in other measures, including the Beck Depression Inventory (BDI) (Watson et al., 1988), the Depression Anxiety Stress Scales (DASS), and the Hospital Anxiety and Depression Scale (HADS) (Crawford & Henry, 2004). The reliability of the PANAS for the “present moment” period as reported by Watson et al. (1988) is $\alpha = .89$ for PA and $\alpha = .85$ for NA. In the present study, the Cronbach alpha coefficient was very good at .91 for PA and .87 for NA when checked on the pre-induction PANAS scores.

With respect to the criticism that some PANAS items do not relate clearly to emotions (e.g., *strong, active, alert*) (Diener, Smith, & Fujita, 1995; Larsen & Diener, 1992; Morgan & Heise, 1988), Watson and Clark (1997) argue that the validity of the PANAS is not impacted because emotional terms (see Clore, Ortony, & Foss, 1987) and nonemotional terms (i.e., those related to longer-lasting emotional states) are typically highly correlated and “respondents appear to make no real distinction between ‘emotional’ and ‘nonemotional’ terms” (Watson & Clark, 1997, p. 276). Regarding criticism that the validity of the PANAS subscales may be compromised because they do not include items related to happiness (e.g., happy, joyful) and sadness (e.g., sad, depressed) (Larsen & Diener, 1992), Watson and Clark argue that happy and sad affect overlap with other subscale items and, as such, are “well-captured” by the current PANAS subscales.

The PANAS is a two-factor model (PA, NA). However, some researchers have suggested that a better fit is achieved using a three-factor model of the PANAS (e.g., Beck et al., 2003; Gaudreau, Sanchez, & Blondin, 2006; Killgore, 2000; Ortuño-Sierra, Santarén-Rosell, de Albéniz, & Fonseca-Pedrero, 2015) or a bifactor model of the PANAS (e.g., Leue & Beauducel, 2011). [26] Typically in the proposed three-factor models of the PANAS it is negative affect that is broken down into two separate factors, for example, upset or afraid (i.e., Killgore, 2000; Ortuño-Sierra et al., 2015), anxiety or anger and dejection (i.e., Gaudreau et al., 2006), anxiety and anger or guilt and shame (i.e., Beck et al., 2003), or, fear or distress (i.e., Allan, Lonigan, & Phillips, 2015). Recent research comparing different PANAS models (two-factor [PA, NA], three-factor [PA, fear, distress], bifactor [PA, NA, Affective Polarity]) found inconsistent results in the bifactor model (i.e., Leue & Beauducel, 2011) and, more importantly for this study, found that while a three-factor model may offer additional refinement of negative factors, the two factor PANAS adequately assesses general NA in children, adolescents, and adults (Allan et al., 2015). Taking into account this research investigating different factor structures for the PANAS and Watson and Clark’s (1997) responses to some criticisms regarding subscale items structures, overall the PANAS was deemed to be a suitable instrument for the current experiment.

[26] The term *bifactor model* is used for a model that includes a factor for PA, a factor for NA, and an additional general factor. This general factor is assumed to account for common variance among items and among the other factors (e.g., Chen, Hayes, Carver, Laurenceau, & Zhang, 2012; Chen, West, & Sousa, 2006; Reise, 2012). The bifactor model study mentioned here (i.e., Leue & Beauducel, 2011) included an additional general factor called *affective polarity* which referred to an individual’s general approach or avoidance tendencies.

Procedure

Random assignment of participants to three groups within each cohort created six experimental conditions, produced by crossing two induction methods (film, text) with three emotional states (positive, neutral, negative). The film-viewing conditions were conducted online whereas the text-reading conditions were conducted in a laboratory.

Participants read an information sheet, indicated their consent, and completed the PANAS. Next, they either viewed a film clip or read a passage of text. The text passages were titled as a "Reading and Imagination Task" for participants in the positive emotion and negative emotion conditions whereas participants in the neutral emotion condition saw the title "Reading Task". Text-reading participants were instructed to "Please read the following passage carefully", with the positive emotion and negative emotion conditions receiving the additional instruction "When reading, try and imagine yourself as the character portrayed, as vividly as possible". Imagining oneself as the character portrayed was similar to an instruction given in the effective EI "Film/Story + Instruction" category reviewed in Westermann et al. (1996). Film-viewing participants were instructed to "Please click the *Play* button to begin viewing the film clip", a statement similar to the effective EI "Film/Story without Instruction" category reviewed in Westermann et al. (1996).[27] Then, all participants completed the PANAS for a second time. Finally, all participants completed a brief demographic questionnaire and were debriefed.

[27] Participants viewing film clips did not receive an instruction to imagine themselves as one of the multiple characters portrayed because researchers were interested in a participant's own emotional reaction to the film clip overall rather than a participant's expectations of what emotion(s)an individual character was displaying.

Results

Thirty-four participants were excluded from the analysis either because (a) they completed the online study either too quickly or too slowly indicating that their post-induction affect scores were unlikely to have been an effect of the film viewed, or because (b) they left unanswered too many PANAS items. This left 302 participants for the final analysis.

Table 12 provides descriptive statistics for positive affect and negative affect scores. In addition, scatterplots showing affect scores for each experimental condition from pre- to post-induction are presented in Figure 8.

Table 12

Pre- and Post-induction Descriptive Data of Positive Affect and Negative Affect Scores on the PANAS across Medium and Emotion Valence

		Pre-induction				Post-induction			
Condition	*n*	Min.	Max.	*M*	*SD*	Min.	Max.	*M*	*SD*
Positive affect scores									
Film									
Positive	54	12	41	25.61	7.17	14	42	26.02	6.25
Neutral	52	10	42	23.85	8.14	10	37	19.23	6.89
Negative	55	10	41	25.27	8.87	10	41	21.95	6.78
Text									
Positive	46	14	45	28.83	7.34	10	46	30.85	7.68
Neutral	47	12	46	28.70	7.68	12	48	25.47	8.48
Negative	48	10	44	27.04	8.19	10	40	22.79	7.04
Negative affect scores									
Film									
Positive	54	10	30	14.70	5.22	10	28	14.48	4.73
Neutral	52	10	31	15.04	5.84	10	20	13.13	3.23
Negative	55	10	35	15.82	6.40	10	44	24.22	8.10
Text									
Positive	46	10	28	14.39	4.82	10	23	12.48	3.94
Neutral	47	10	22	13.45	3.44	10	21	12.38	3.05
Negative	48	10	22	12.48	3.13	10	40	16.50	7.97

Note. The possible range of scores was 10–50.

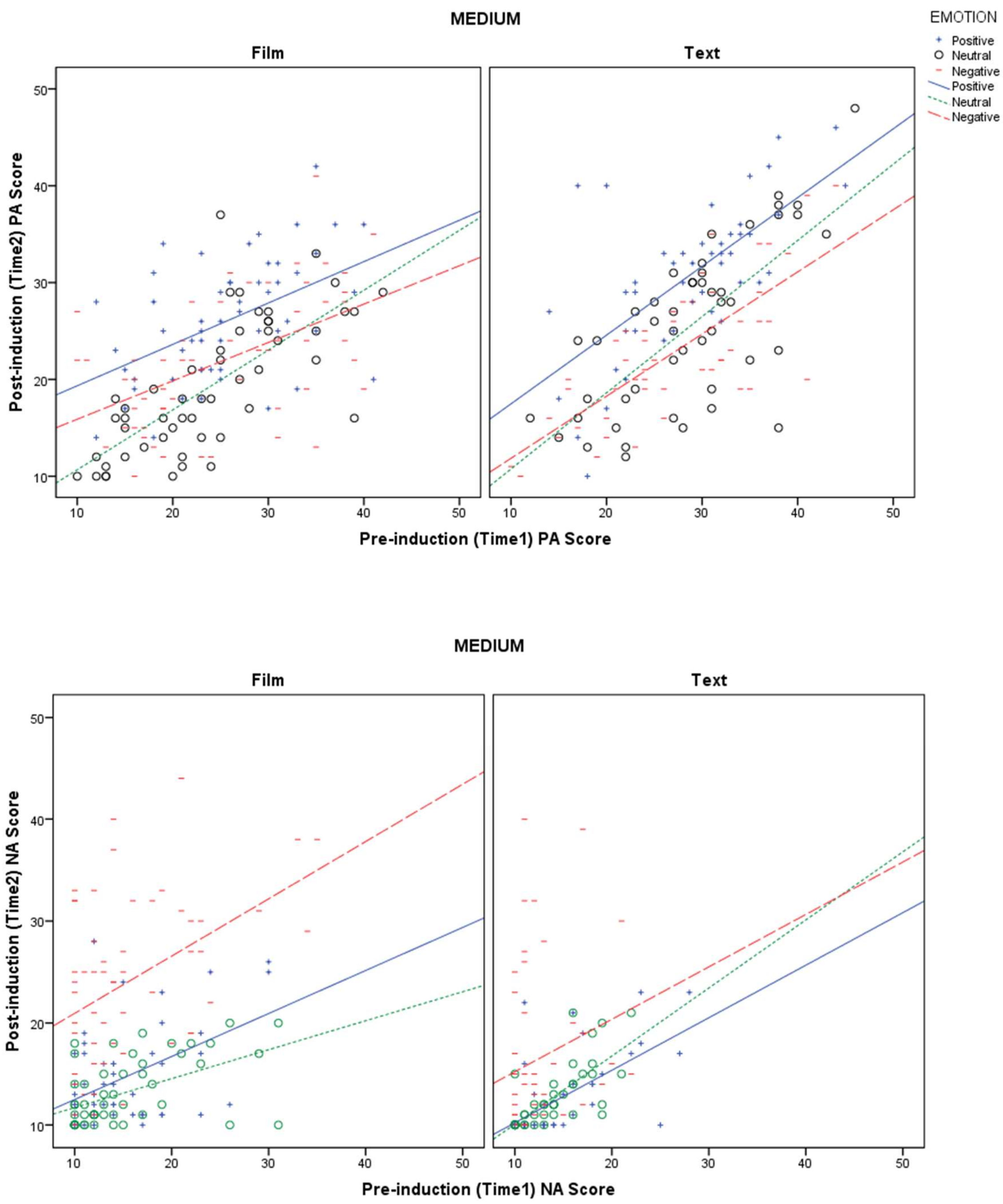

Figure 8. Interaction of medium and pre-induction affect score on post-induction affect score for each emotion condition separated by affect type, positive or negative.

Emotions

Positive emotion. Preliminary checks revealed a violation of the homogeneity of regression slopes assumption, so a 2 x 3 between-groups analysis of covariance could not be conducted to assess the effect of the two media on positive affect (PA) across positive, neutral, and negative emotion conditions. Consequently, a series of linear regression analyses were conducted to determine the simplest model for the data. For the analyses, the dependent variable was the post-induction (Time 2) PA scores, explanatory factors were medium, emotion valence, and their interaction, and covariate pre-induction (Time 1) PA scores and its interactions with the factors. The simplest model included both main effects and a two-way interaction between medium and Time 1 PA scores. That is, after adjusting for Time 1 PA scores, there was a significant medium by Time 1 PA scores effect, $F(1, 296) = 8.76$, $p = .003$, $\eta^2 = .03$. For a complete picture of what occurred the effect of medium on PA scores must be considered together with each emotion condition.

As per the data, the valence of the emotion was not significant with either medium or Time 1 PA scores (see Figure 8 earlier). As revealed in the scatterplots, film and text had similar slopes of post- versus pre-PA scores across emotion conditions with positive emotion and negative emotion conditions having similar slopes, but with the neutral emotion condition having a steeper slope for both media. For the positive emotion condition, film was more effective at increasing PA scores for participants whose Time 1 PA scores were below the mid-20s compared with participants whose Time 1 PA scores were greater than that mark. In contrast, text was effective in increasing participants' PA scores irrespective of Time 1 PA scores. As expected, in the negative and neutral film and text conditions, PA was not increased. In addition, the neutral text condition had an effect as expected, between the positive and negative text conditions, whereas the neutral film condition did not; it produced lower Time 2 PA scores than did even the negative film when the Time 1 PA scores were below 35, and then it converged with the positive film for higher Time 1 PA scores. These results suggest that neutral text is a better "neutral" for its medium than is neutral film for its medium. In summary, the data presented in Figure 8 confirm that, for each medium, the positive emotion condition was more effective in inducing PA than either of the other two emotion conditions, and that film is more effective than text when participants are initially lower in PA, but text is more effective than film across the full range of participants' initial PA ratings.

Negative emotion. A 2 x 3 between-groups analysis of covariance was conducted to assess the effect of the two media on negative affect (NA) across positive, neutral, and negative emotion conditions. After adjusting for Time 1 scores, there was a significant medium by emotion interaction effect, $F(2, 295) = 9.49$, $p < .001$, $\eta^2 = .06$. That is, the valence of the emotion influenced each medium's EI efficacy.

This significant interaction was further investigated using five simple effect analyses with a Bonferroni adjusted alpha of .01, maintaining the familywise error rate at .05. To facilitate comparisons to the earlier PA results scatterplots showing NA scores for each experimental condition from pre- to post-induction are included (see Figure 8 earlier). For the negative emotion condition, film was more effective than text at increasing NA scores, $F(1, 295) = 35.64$, $p < .001$, $\eta^2 = .11$. As expected, there was no difference in NA scores between film and text in either the positive emotion ($M = 1.86$, $SE = 1.03$, $p = .072$) or the neutral emotion ($M = .007$, $SE = 1.43$, $p = .995$) condition. Thus, film's greater efficacy relative to text is restricted to the induction of NA.

For each medium, the valence of the induced emotion had an effect on NA scores; film, $F(2, 295) = 69.19$, $p < .001$, $\eta^2 = .32$ and text, $F(2, 295) = 13.48$, $p < .001$, $\eta^2 = .08$. The negative film condition-achieved higher NA scores than either the positive film ($M_{Diff} = 9.22$, $p < .001$) or the neutral film ($M_{Diff} = 10.72$, $p < .001$) condition. And the negative text condition achieved higher NA scores than either the positive text ($M_{Diff} = 4.92$, $p < .001$) or the neutral text ($M_{Diff} = 4.57$, $p < .001$) condition. These results confirm that, for each medium, the negative emotion condition induced greater NA then did either of the other two emotion conditions. In addition, the neutral text condition had an effect as expected, between the negative and positive text conditions, whereas the neutral film condition did not; it produced lower NA scores than even the positive films. These results suggest that neutral text is a better "neutral" for its medium than is neutral film for its medium. In sum, for NA induction, the only difference between film and text is that film induces greater NA than does text.

Discussion

Apart from the neutral film condition, each film clip and text passage induced its target emotional state. That is, for both media, film and text, the positive emotion and negative emotion conditions were the most effective inducers of positive and negative emotion respectively, and the neutral text (but not the neutral film) was an effective inducer (or maintainer) of neutral emotion. We can be sure that the incidentally induced emotion has actually been induced (Critical Question 5) because pre- and post-manipulation checks were employed. These findings support earlier studies where film clips and text passages have been successfully employed as EI methods for positive and negative emotions (for reviews see, Lench et al., 2011; Westermann et al., 1996).

With respect to the question whether either film or text is a better inducer of emotion overall, the answer is not straightforward. To induce positive emotion, text was the better method overall with film's efficacy limited to those individuals initially low in positive affect, whereas to induce negative emotion film was more effective than text. Therefore, the EI efficacy of each method appears contingent on the valence of the induced emotion and, in the case of positive affect induced by film, on the level of the pre-induction emotional state. It was only by including pre- and post-induction checks that this latter point was identified.

By splitting the Westermann et al. (1996) "Film/Story" category the current findings suggest that film and text vary in relative efficacy and that, in the case of film, relative popularity may not be equivalent to relative efficacy. For the interaction found between medium and emotion valence, one possible explanation is that the superior effect of film for negative emotion may have something to do with the fact that the specific type of negative emotion induced by the film *Misery* seems to correlate with the negative affect items of the PANAS (*afraid, ashamed*, *distress*, *guilty*, *hostile*, *irritable*, *jittery*, *nervous*, *scared*, *upset*). In contrast, the negative emotion induced by the text was a mixture of sadness, depression, gloominess, and apprehension. This suggests that the present conclusions must be tempered by acknowledgement that the *specific content* of the inducing medium, together with its relationship to the *specific items* within any emotion-measuring instrument, will be an important factor in determining the efficacy of the EI method. Furthermore, if items on a certain emotion measure correlate better with some stimuli than with other stimuli, this highlights a potential problem for researchers who select the most effective induction method because of a meta-analysis where different studies employed assorted measures. There is clearly a need for future research that better allows for direct comparisons by matching more closely not only the emotional content of film and text stimuli but also the emotional content of stimuli with that of the measuring instruments.

Such a possible mismatch may help explain the failure of the neutral film condition to perform as expected, between the positive and negative film conditions. Higher negative affect ratings for the positive film compared with the neutral film may be because as Forrest Gump's son is six years old at the time of their initial meeting, this tender and loving scene may also correlate with negative emotional aspects (e.g., *upset, guilty, scared, ashamed, nervous, afraid*). In addition, higher positive affect ratings for the negative film compared with the neutral film may reflect our pleasure in being scared in nonthreatening situations (e.g., *interested, excited, attentive*). This supports Schaefer et al. (2010) regarding a cautious interpretation of emotion valence from PANAS scores.

There is also the possibility that the neutral film (*All the President's Men*), despite being used as a neutral stimulus in other studies (Hewig et al., 2005; Jenkins & Andrewes, 2012), may have been viewed as boring and subsequently quite negative (Rottenberg et al., 2007). Indeed, it was on such a view that the neutral film clip AFRICA was edited specifically for the pilot study to provide a slightly pleasant film, but that film was rated by participants too positively leaving *All the President's Men* as the more “neutral” of these two film clips (see Figure 8 earlier). The outcome of the current experiment demonstrates how difficult it is to achieve a neutral film clip, that is, a clip that elicits an emotional response that is neither too positive nor too negative.

When reviewing the discrepancy between film's popularity and its overall efficacy it is worth considering the proliferation and widespread use of mobile devices in the multi-tasking world of psychologists' favourite sample, first year undergraduate students. For this group film may not be the attention grabber or attention holder that it once was. This last point is conjecture, but open to empirical investigation. It may be objected that the discrepancy in age between the two media groups influenced the results. However, when older individuals from the text group were excluded,[28] such that the mean age of both groups was similar, results of analyses were no different. Furthermore, it is argued that text has at least two advantages over film. Firstly, standardising across film clips is an enormous challenge (Lench et al., 2011), whereas standardising across text passages may be as simple as making a few word changes. Secondly, imagining oneself as the character portrayed in a piece of text requires the psychological effort of internally generating the sights and sounds of a virtual environment, a process that may prove more engaging than passively viewing a film's externally generated dynamic displays. This last item is consistent with the greater emotional intensity found for internally generated emotion compared with externally generated emotion (Salas et al., 2012).

It is also possible that the different EI delivery methods in this study (viz. online for the film and in the laboratory for the text) may have influenced the results. For instance, online participants may pay less attention, so a within-laboratory delivery may have found film to be *more* effective. Alternatively, the presence of an experimenter and other participants in the laboratory may have been a distraction, so an online delivery of text may have found an even greater gap between film and text. Although each condition in this study did effectively induce its target emotional state, further research is needed to determine whether the different delivery methods have an impact and, if so, in what direction and to what extent.

[28] It should be noted that by excluding older individuals from this text group this also effectively excluded acquaintances of the researcher meaning that the remaining individuals were first year undergraduate students.

In focusing on splitting the Westermann and colleagues (1996) "Film/Story" category, the intention was not to suggest that film and text are the two best of the available methods of EI. Rather, this research sought to build on the limited number of other studies that have directly compared the efficacy of different EI methods (e.g., Ellard et al., 2012; Lobbestael et al., 2008). Only in this way can we come to know each method's strengths and limitations.

As to whether film or text is the better method of emotion induction, the current findings suggest that film's popularity as an EI method may not be equivalent to its efficacy and that the relative efficacy of film and text as EI methods may depend on the valence of the induced emotion. Specifically, film is the better induction method for negative emotion whereas text is better at inducing positive emotion. However, the robustness of these findings is likely to be challenged by further studies that focus more attention on the finer-grained details, in particular the specific emotional content of both media and measures.

With respect to the question whether film or text would be the more appropriate EI procedure for use in the proposed empirical investigation of the role of emotion in the metaphorical understanding of time (i.e., Experiment 2), the answer appears to be text. There are four reasons for this. First, text performed as expected across all three emotion conditions (positive, neutral, negative) whereas the neutral film condition did not perform as expected, between the positive and negative film conditions. Second, it is easier to control the emotional content of text passages rather than clips from commercially available films. Third, as motion is a potential priming factor in Experiment 2, text allows for easier control of a character's movements than does film. Fourth, standardising across text passages is easier than standardising across film clips. For these four reasons, it was decided to use text in the proposed empirical investigation of the effect of emotion on spatiotemporal perspective. That empirical investigation is the subject of the next chapter.

CHAPTER 7

Experiment 2: The Effect of Induced Emotion and Event Valence on the Metaphorical Understanding of Time

Aim and Rationale

The review of the conceptual metaphor literature on temporal perspectives presented in Chapter 3 suggests that there are two ego-reference point metaphors, namely, MOVING TIME (MT) and MOVING EGO (ME) metaphors. Chapter 4 explored the link between emotion and the metaphorical understanding of time relating to approach and avoidance motivations, including four recent studies (Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) that examined the role of emotion on choice of temporal perspective. Chapter 5 presented a research synthesis that examined methodological and statistical issues in these four studies and in the wider literature. As a result of interrogating the four recent studies, the wider literature, and the methodological and statistical issues, ten critical questions were developed (see Table 11 in Chapter 5 for a list of these critical questions). Chapter 6 reported an experimental investigation, using pre-and post-emotion manipulation checks, to evaluate the relative efficacy of text versus film as emotion-induction procedures. It was concluded that text, rather than film, appeared to be a more appropriate method. The present chapter reports Experiment 2 which was conducted with the general aim of investigating the effect of induced emotion and event valence on an individual's metaphorical understanding of time. To achieve this aim the solutions, strategies, and predictions based on the ten critical questions outlined in Chapters 4, 5, and 6 were taken into account.

Before addressing the bearing of the ten critical questions on Experiment 2, it is worth considering whether this experiment should be considered a replication. If the word *replication* is understood as an attempt to reproduce an earlier experiment then the answer is no. Schmidt (2009) called that type of replication a direct replication, but in a review of the theoretical view of replication and the practical approach to replication he also identified another type of replication, that is, *conceptual* replication. In a conceptual replication, different methods are used to test the cogency of an underlying hypothesis. Consistent with the four previous studies (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) the present study is informed by the view that conceptual metaphor theory provides an explanation for how individuals understand time and that theoretical and empirical investigations suggest that emotion should influence such an understanding. Contrary to those studies, however, this study argues that responses to the dependent variables (TAQ and AQ) used to assess such an influence decompose into a more complex relationship between approach and avoidance motivations and choice of temporal perspective than previously supposed. Testing the hypotheses and investigating the research questions in the present study also served to test the cogency of the hypotheses proposed in those other studies. It could be argued, therefore, that this study is a conceptual replication.

Experiment 2 therefore served as a conceptual replication of other studies (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) while introducing the solutions, strategies, and predictions based on the ten critical questions outlined in Chapters 4 and 5, and taking into account the emotion-inducing efficacy of text as demonstrated in the previous chapter.

Critical Question 1: Do TAQ and AQ Measure the Same Thing?

Researchers have been assuming uncritically that a TAQ and an AQ measure the same thing, namely, temporal perspective. I maintain that the TAQ and the AQ do not assess the same thing, so the expected pattern of responses would be different from those predicted in previous research (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). TAQ responses indicate how individuals think about time via the reference point assigned by spatio-temporal conceptual metaphors (i.e., Ego-RP metaphors: MT and ME perspectives; Time-RP: earlier and later perspectives; Human-RP: ancestors and descendants). The focus of this study's investigation was the Ego-RP metaphors: MT and ME perspectives. The previous research claims that positivity or negativity regarding an event was indicated via temporal agency assignment in the TAQ response, but, as argued in Chapter 4, another consideration, one not previously considered in the literature, is that positivity or negativity regarding an event may be indicated via temporal distance change (increase or decrease). The previous research also claims that the two possible AQ responses "I am approaching the event" or "The event is approaching me" are indicative of positivity or negativity and of an ME (positive) or an MT (negative) spatio-temporal perspective, respectively. While agreeing that AQ responses do reflect temporal agency assignment (see McGlone & Pfiester, 2009), I argue that they are not indicative of temporal perspective in the context of ME or MT conceptual metaphors, but, rather, should more appropriately be labelled as an EA perspective (positive – temporal agency assigned to ego) and a TA perspective (negative – temporal agency assigned to event). Furthermore, having answered a TAQ and moved an event *forward* indicating either an MT or ME spatio-temporal perspective, it is possible that a participant may then view both entities (i.e., observer and event) as stationary. This raises the possibility of a participant wanting to reply "Neither" to a subsequently asked AQ. A "Neither" option would also cater for individuals, who having answered Friday to a TAQ and who thereby feel that the distance between themselves and the event has now increased are puzzled by the two AQ options which mention "approaching", that is, "to draw near". The present study was the first to offer a third AQ option of "Neither".

To the best of my knowledge, this was also the first study to present the TAQ and the AQ on separate pages. Such a presentation was deemed necessary for two reasons. First, it reduces the likelihood that an AQ response is influenced more by the preceding TAQ response than by experimental manipulations. For example, it seems reasonable to consider the possibility that a participant who views an event positively and wants the event to be temporally closer to himself or to herself would respond Monday to a TAQ and that this TAQ response, *rather than* the view of the event as positive, may then influence the response to the AQ. That is, a participant who views an event positively and is considering only temporal agency assignment as in an AQ, would typically respond “I am approaching the event” (EA perspective). However, having answered Monday to a TAQ, the participant may well instead respond “The event is approaching me” (TA perspective). Since the AQ is asking a question about the TAQ, the two questions cannot sensibly be separated by other filler questions or tasks. Thus, presenting the two questions on separate pages is the only option available to limit the influence of a TAQ response on a subsequent AQ response, even if it does not completely remove that influence. The second reason for presenting the two questions on separate pages was to remove any possible influence of the AQ on TAQ responses. TAQ responses may be skewed if participants read the AQ before answering the TAQ and are influenced by seeing the word “approaching” such that they think of *reducing* temporal distance. As discussed in Chapter 4, the wording of the AQ as influencing TAQ responses is considered a possibility for an unusually large bias under control conditions for TAQ responses towards the MT perspective found in earlier studies (Hauser et al., 2009; O’Gorman, 2011).

Critical Question 2: Is an ME Perspective Always Mappable onto an Approach-Related Behaviour?

For TAQ responses a logical mapping of approach-related behaviour onto the ego-referenced spatio-temporal conceptual metaphors was developed (see Figure 6 in Chapter 4). This mapping revealed a more complex situation than the simple mapping of *all* approach-related behaviour onto an ME perspective as assumed in the literature (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). Regarding time perspective, the embodiment of positive emotion as approach-related behaviour or the embodiment of those types of negative emotion (e.g., anger) that manifest as approach-related behaviour (i.e., attack) now give rise to the possibility of more than one outcome. That is, an observer may wish to decrease the temporal distance between himself or herself and the event (MT perspective) or may think in terms of moving toward the event, thus, projecting his or her typical direction of forward movement (futureward) onto the event (ME perspective). The present study would test these competing theories.

Critical Question 3: Is it Always Appropriate to Map Avoidance-Related Behaviour onto an MT Perspective?

For TAQ responses a logical mapping of avoidance-related behaviour onto the ego-referenced spatio-temporal conceptual metaphors was developed (see Figure 6 in Chapter 4). This mapping revealed a more complex situation than the simple mapping of *all* avoidance-related behaviour onto an MT perspective as assumed in the literature (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). For those negative emotions that are embodied as avoidance-related behaviour there is now the possibility of more than one time perspective outcome. That is, an observer may “avoid” by pushing away the event (ME perspective) or by “freezing” either in the hope that the event moves away (ME perspective) or believing that the event is coming at him or her (MT perspective). Again, the present study would test these competing theories.

Critical Question 4: Does the Source of the Emotion Matter?

If emotion does have an effect on choice of time perspective, is there any difference in effects between an incidentally-induced emotional state and an emotion felt toward a relevant external event, which is the one that is being moved? If so, what is the effect if the incidentally-induced emotion and the event-valence emotion are consistent (both positive or both negative) or inconsistent (e.g., one positive other negative)? This was the first study to consider both separately and jointly the effects of the incidentally-induced emotion and the event-valence emotion on choice of temporal perspective.

Critical Question 5: Can we Ascertain that the Desired Emotion has been Experimentally Induced?

As demonstrated in Chapter 6 the only way to be sure that an incidentally-induced emotion has been induced is to include pre-and post-emotion manipulation checks. As discussed earlier (see Chapter 4), of the four published TAQ studies incorporating an emotion induction procedure, three had a single-item post-emotion manipulation check (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) whereas the remaining study had no emotion manipulation checks (Hauser et al., 2009). Therefore, the present study was the first TAQ study investigating the influence of emotion on choice of time perspective to include pre- and post-emotion manipulation checks. These manipulation checks facilitated an investigation of the emotion induction method both with respect to whether participants were experiencing the emotional state assumed to be congruent with their assigned experimental condition, and with respect to an assessment of the efficacy of the emotion induction procedure itself.

Critical Question 6: Is it Necessary to Have a Control Condition?

To understand the full effect of an emotion manipulation, the outcome of that manipulation must be compared against the outcome in the absence of such a manipulation, that is, against the outcome of a control condition. As demonstrated in Chapter 5 there is a lack of TAQ experiments involving a control condition in the literature in general and, as discussed earlier (Chapter 4), of the four published TAQ studies incorporating an emotion induction procedure, only one included a control condition (Hauser et al., 2009) whereas the remaining three studies had no control condition (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). Thus, there is no consensus empirically regarding the breakdown in TAQ responses under a control condition. This was the first study to provide a control condition (neutral emotion and neutral event valence) against which to compare positive emotion and negative emotion factor manipulations. In this study, neutral meant neither strongly positive nor strongly negative rather than free from any emotion or emotional influence.

Critical Question 7: Should Individual Differences be Taken into Account?

Are there individual differences in the effects of emotion on TAQ and AQ responses? For example, if the event referred to in the TAQ and the AQ is an exam (negative valence), would an individual's level of trait test anxiety increase any effect of negative emotion? Alternatively, a friend's party should be a positively valenced event for everybody but there is a possibility that for individuals who experience social anxiety their anxiety may extend to such an event, and if this were the case, would their level of social anxiety diminish any effect of positive emotion? This was the first TAQ study to include additional assessments of negative emotions (i.e., exam anxiety, social phobia, depression, stress, anxiety) to provide information concerning participants' relatively stable negative emotional states associated with an emotionally valenced event. Providing information beyond emotion induction manipulations (cf. Hauser et al., 2009, Exp. 1, trait anger; Richmond et al., 2012, Exp. 2 & 3, personal agency, trait anxiety) adds to personality-related knowledge, which Hauser et al. have claimed to be lacking in "embodied cognition research in general" (2009, p. 1178). Indeed, in a recent article, Fetterman, Bair, Werth, Landkammer, and Robinson argue that "individual differences in metaphoric thinking have received almost no attention" (2016, p. 458).

Critical Question 8: Is a Chance Level (i.e., Fifty-Fifty) Split Between Monday and Friday TAQ Responses Warranted?

As shown in Chapter 5, the chance-level fifty-fifty split assumption for TAQ responses under a control condition is seemingly accepted in the literature, but this assumption is not supported empirically. Therefore, the present study included a control condition to provide empirical evidence regarding the split between TAQ responses under a control condition.

Critical Question 9: Can the Statistical Analyses Conducted in TAQ Research be Successfully Replicated?

As shown in Chapter 5, when statistical analysis replications of TAQ studies were attempted, the results were mixed. To facilitate any future statistical analysis replication attempts of the present study, full details are provided concerning participant numbers (including exclusions from any specific data analysis) and the statistical analysis conducted.

Critical Question 10: Does the Choice of Statistical Test Matter?

As discussed in Chapter 5, a chi-square test for independence is the correct analysis to compare the proportions of found TAQ responses across multiple experimental conditions (including a control condition). Therefore, in the present study a chi-square test for independence was conducted when comparing TAQ responses from an experimental condition with TAQ responses from a control condition (the latter condition being a special type of experimental condition, that is, a manipulation-free condition).

Hypotheses and Research Questions

It was hypothesised generally that emotion influences the time perspective that individuals adopt. As shown in Chapter 5, there is no consensus empirically regarding the breakdown in TAQ responses under a control condition. Hence, it was predicted that in a control condition (neutral emotion/neutral event valence) there would be no difference between the frequency of MT and ME perspectives. There were three other questions of interest concerning the breakdown in TAQ responses. First, regarding the embodiment of positive emotion as approach-related behaviour, there was an open question as to whether such behaviour would manifest itself as an observer seeking to decrease the temporal distance between himself or herself and the event (MT perspective) or whether it would manifest as the observer thinking in terms of moving toward the event, thus, projecting his or her typical direction of forward movement (futureward) onto the event (ME perspective). To test these competing theories, it was proposed to compare the breakdown of TAQ responses from the control condition with TAQ responses from each of the following conditions: neutral emotion/positive event valence, positive emotion/neutral event valence, and positive emotion/positive event valence. Second, for those negative emotions embodied as avoidance-related behaviour,[29] there was an open question as to whether such behaviour would manifest itself as an observer pushing away the event (ME perspective) or “freezing” in the hope that the event moves away (ME perspective) or “freezing” in the belief that the event is coming at him or her (MT perspective). To test these competing theories, the breakdown of TAQ responses from the control condition was to be compared to TAQ responses from each of the following conditions: neutral emotion/negative event valence, negative emotion/neutral event valence, and negative emotion/negative event valence. Third, if emotion does have an effect on choice of time perspective, is there any difference in effects between an incidentally-induced emotional state and an emotion felt toward a relevant external event, which is the one that is being moved? To test this, the breakdown of TAQ responses from the control condition would be compared to TAQ responses from each of the following conditions: positive emotion/negative event valence and negative emotion/positive event valence.

As discussed earlier, an AQ response may indicate positivity or negativity concerning an event via temporal agency assignment or may be influenced by a prior TAQ response. Considering an AQ response as indicating only positive emotion or negative emotion produced one hypothesis and three further questions of interest concerning the breakdown in AQ responses. First, with only one published TAQ study including an AQ and a control condition (Hauser et al., 2009) there is no consensus empirically regarding the breakdown in AQ responses under a control condition. Hence, it was predicted that in a control condition (neutral emotion/neutral event valence) there would be no difference between the frequency of TA, EA,

[29] For negativity, the text is a mixture of sadness, depression, gloominess, and apprehension whereas the event is an exam; neither text nor event were expected to induce emotion (e.g. anger) related to approach behaviour.

and "neither" responses. Second, does positive emotion produce more EA than either TA or neither-agency responses? To test this, the breakdown of AQ responses from the control condition would be compared to AQ responses from each of the following conditions: neutral emotion/positive event valence, positive emotion/neutral event valence, and positive emotion/positive event valence. Third, does negative emotion produce more TA than either EA or neither-agency responses? To test this, the breakdown of AQ responses from the control condition would be compared to AQ responses from each of the following conditions: neutral emotion/negative event valence, negative emotion/neutral event valence, and negative emotion/negative event valence. Fourth, is there any difference in effects between an incidentally-induced emotional state and an emotion felt toward a relevant external event referred to in the TAQ as having been moved? To test this, the breakdown of AQ responses from the control condition would be compared to AQ responses from each of the following conditions: positive emotion/negative event valence and negative emotion/positive event valence. In contrast, considering an AQ response as being influenced by a prior TAQ response raised the question: Is there a difference in AQ responses between individuals who responded Monday to a TAQ compared with individuals who responded Friday to a TAQ?

With respect to the relation between emotion and individual differences the following questions regarding event valence were asked. When the event specified is an exam (negatively valenced) is there an influence of trait test anxiety on an individual's choice of TAQ response or choice of AQ response? When the event specified is a friend's party (positively valenced) is there an influence of social anxiety on an individual's choice of TAQ response or choice of AQ response? Finally, for all events, is there an influence of general negative emotional state, namely, depression, anxiety, and stress on an individual's choice of TAQ response or choice of AQ response?

Method

Participants

A total of 504 undergraduate psychology students (403 female)[30] from Western Sydney University volunteered via an online psychology recruitment website. Participants received course credit and an alternative to participation was available to those not wishing to be involved in a research study. Ages ranged from 17 to 56 years (M = 21.13, SD = 5.81). Anonymity was assured, with only general demographic information (age, gender, and first language) being collected in addition to experimental performance data. All participants were treated in accordance with the ethical standards of the Australian Psychological Society and Western Sydney University Human Research Ethics.

The lower the power of an analysis, the greater the chance of committing a Type II error, incorrectly retaining the null hypothesis when there is a real difference between groups (Hills, 2008; Howell, 2013). Researchers should strive for power of at least between .70 or .80, if not higher (Hills, 2008). As discussed in Chapter 5, the results from research on TAQ responses (i.e., Monday or Friday) under a control condition have been mixed. However, considering TAQ responses as likely to be fairly evenly split (e.g., Boroditsky, 2000; McGlone & Harding, 1998; Núñez et al., 2006) suggested that any proportion greater than 57% in favour of one response over the other would be of interest concerning the effect of experimental manipulations. Based on such expectations, to achieve power of .80 the present study required a sample size of at least

[30] Five participants did not provide information regarding gender and age.

399 participants (Lenth, 2015). Thus, the present sample size (*n* = 504) allowed for sufficient power.

Design and Materials

Experiment 2 consisted of a 3 x 3 between subjects factorial design. Emotion (positive, neutral, negative) and event valence (positive, neutral, negative) were the manipulated independent variables of interest. There were two dependent variables. The first was the spatio-temporal metaphor perspective employed by participants when answering a temporally ambiguous question (TAQ), operationalised as day of rescheduled event. The TAQ was worded as follows: "Imagine that you are scheduled to attend an event next Wednesday. You hear that the event has been moved forward two days. What day is the event now that it has been rescheduled?" This TAQ does not specify any person (e.g., I, you, she/he) as moving the event forward, hence avoiding an influence of personal pronouns as found by Feist and Duffy (2015). A Monday response indicated an MT perspective because moving an event forward two days from Wednesday to Monday is congruent with an event's typical direct of forward motion (i.e., pastward). In contrast, a Friday response indicated an ME perspective because moving an event forward two days from Wednesday to Friday is congruent with a person's typical direction of forward motion (i.e., futureward).[31] Such mapping of TAQ responses to spatio-temporal perspectives is consistent with other studies (e.g., Boroditsky, 2000; Duffy et al., 2014; Hauser et al., 2009; McGlone & Harding, 1998).

The TAQ involved a future day event and after participants answered a TAQ it was expected that the *moved forward* event would remain in the future relative to the participant.

[31] As shown in Chapter 4 (see Figure 6) a Friday response is also congruent with an individual pushing away an event.

However, as the experiment was to be conducted across various week days (i.e., Monday to Friday) there was a possibility that individuals participating in the experiment on a Monday or Tuesday might interpret the next Wednesday's event as being moved forward (i.e., pastward) to a day coinciding with, or one day earlier than, the day of the experiment; the moved event would then be in the present or pastward relative to the participant, respectively. To address this possibility a pilot test was conducted to assess participants' understanding of "Next Wednesday". To my knowledge this is the first time such a check had been performed. Twenty students from Western Sydney University participated across a Monday (8 female, 3 male) and a Tuesday (6 female, 3 male). Individual participants were approached on campus during lunch, some participants were walking whereas others were seated. Participants were asked the following question: If I say to you that an event is happening next Wednesday, what do you understand by "next Wednesday"? One participant was excluded because the response did not relate to the question asked. Nineteen participants said that "next Wednesday" meant the Wednesday of the following week.[32] These results indicate that when answering a "next Wednesday" TAQ the rescheduled day remains in the future relative to the respondent.

The second dependent variable was positivity or negativity as reflected in temporal agency assignments, operationalised as assignment of temporal agency to either the individual or the event when describing events. An "I am approaching the event" response indicated positivity and an EA perspective, whereas a "The event is approaching me" response indicated negativity and a TA perspective. However, this was the first study to recognise that a TAQ response may influence a subsequent AQ response, such that an "I am approaching the event" response may be

[32] Reading the phrase "the following week" and comprehending it to mean the week arriving after the current week (i.e., later) demonstrates an understanding of temporal events as typically moving forward in a pastward direction. Furthermore, it is an ego-free understanding involving what Nüñez et al. (2006) refer to as a time-reference point where one temporal event is understood in relation to another temporal event, in this case, the current week is understood in relation to the later week.

influenced by having responded Friday to a TAQ and a “The event is approaching me” response may be influenced by having responded Monday to a TAQ. Furthermore, this experiment provided a new AQ option of “Neither” allowing participants to indicate an emotional neutrality, or to indicate that the observer and the event are now stationary as the event had *moved forward* as per the TAQ response, or to indicate puzzlement regarding the two AQ options that include the word “approaching” (i.e., “to draw near”) because having answered Friday to a TAQ a participant feels that the distance between themselves and the event has now increased.

The event specified in the TAQ and the AQ depended on the assigned experimental condition: friend’s party (positive), exam (negative), or meeting (neutral). A friend’s party should avoid any social anxiety that a participant might associate either with being the centre of attention at one’s own party or with being at a stranger’s party, and so the event should be positively valenced. Most people have typically experienced exams of some kind and most would regard exams as negatively valenced events. Without any details as to its purpose, a meeting is likely to be interpreted as a neutral event. Appendices L and M display the TAQ and AQ, respectively, as presented to participants. In addition, the following were assessed for all participants: trait test anxiety, operationalised as score on an exam anxiety scale; social anxiety,[33] operationalised as score on a social anxiety scale; negative emotional states, operationalised as score on a depression, anxiety, and stress scale.

Incidentally-induced emotion. The same three text passages found to be experimentally effective inducers of emotion (positive, neutral, negative) in Experiment 1 were employed in Experiment 2. See Chapter 6 for more detail on these text passages.

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[33] Social anxiety is being assessed as it is possible that for individuals who experience social anxiety that their anxiety may extend to an “a friend’s party” event.

Two steps were taken to prevent motion (actual or imagined) influencing an individual's spatio-temporal metaphor perspective (cf. Boroditsky & Ramscar, 2002). First, in the positive and negative emotion induction text passages there was a deliberate lack of motion of the character over the landscape (i.e., the character was sitting). Second, reading the text passage ensured that each participant, regardless of assigned experimental condition, was seated for a period of time before answering the TAQ and AQ portion of the experiment.

Emotion scales: Single-item scale and multiple-items scale (i.e., PANAS). Participants' general emotion was assessed using two different scales. The single item scale asks participants how they are feeling *right now* rated on a 7-point Likert scale with scores ranging from 1 (*very negative*) to 7 (*very positive*). The only other point with a label attached was 4 (*neither positive nor negative*). This single item Likert-type scale is easy for participants to read and complete. A similar single-item scale has been used in other studies to assess the effectiveness of an emotion induction procedure (e.g., Schmid & Schmid Mast, 2010) and was used, post-manipulation only, in studies assessing the influence of emotion on TAQ responses, AQ responses, or both types of responses (i.e., Lee & Ji, 2014, Exp. 4; Margolies & Crawford, 2008, Exp. 2; Richmond et al., 2012, Exp. 3 & 4).

The multiple-item PANAS (Watson et al., 1988) asks participants to rate the extent to which each scale item (i.e., an affect word such as *enthusiastic* or *distressed*) applies to them "at the present moment." This is the same instrument as used in Experiment 1 (see Chapter 6 for more details). In the present experiment, the PANAS had good internal consistency with the Cronbach alpha coefficient being .860 for PA and .810 for NA when checked on the pre-induction scores.

These two scales presented fewer problems regarding potential confounds for this experiment than other emotion assessment instruments. That is, there is potential for other emotion assessments to prime participants regarding motion; for example, moving up and down a rating scale using a joystick-type device, as in the affect rating dial measure (Gottman & Levenson, 1985; Levenson & Gottman, 1983) or placing an "X" on a grid, as in the Affect Grid measure (Russell, Weiss, & Mendelsohn, 1989). In this experiment, the single-item measure had three numbered points only on its Likert scale whereas the PANAS presented its Likert scale once only with participants writing a number against each item rather than selecting from along Likert scale options associated with each individual item. As such, the potential confounding effect of motion within both scales was avoided to a greater degree than in other emotion measures. The aim here was to control rather than eliminate motion from this study.

It could be argued that using the same assessment tools pre- and post-emotion induction may result in participants merely echoing their initial responses when answering the questions for a second time. However, the time taken to read the text passage between the two presentations of the two emotion scales made it unlikely that participants would remember their initial responses when answering the questions again particularly in the case of the multiple-item PANAS. The present study was the first to examine whether a single-item assessment of emotion would differ in outcome from the multiple-item PANAS.

Trait test anxiety scale. Participants' test anxiety was assessed using the Westside Test Anxiety Scale (WTAS: Driscoll, 2004; see Appendix N). The WTAS uses two subscales: one subscale, consisting of six items, assesses perceived performance impairment (e.g., memory loss); the other subscale, consisting of four items, assesses cognitions which interfere with concentration (e.g., worry, fear of failure). In this experiment participants rated the extent to which each item in the scale was true of them. Items were rated on a 5-point Likert scale with scores ranging from 1 (*not at all or never true*) to 5 (*extremely or always true*). The WTAS has a possible score range of 1 to 5 (i.e., cumulative score divided by total number of scale items), with higher scores indicating greater test anxiety.

Research has identified correlations between anxiety-reduction as measured by the WTAS and improvements in academic test scores across different population samples, for example, college students (Bowman & Driscoll, 2013; Driscoll, Holt, & Hunter, 2005) and primary school students (Miller, Morton, Driscoll, & Davis, 2006). Such findings suggest that the WTAS is an objective measure of test anxiety in as much as higher test anxiety impairs test results. In the present experiment and across all participants, the WTAS had good internal consistency with the Cronbach alpha coefficient being .881.

Social anxiety scale. Participants' social anxiety was assessed using the self-report version of the Liebowitz Social Anxiety Scale (LSAS-SR: Cox, Ross, Swinson, & Direnfeld, 1998; Fresco et al., 2001; Kobak et al., 1998; Rytwinski et al., 2009; see Appendix O). The LSAS-SR contains 24 items to assess fear and avoidance of either social (11 items; e.g., *being the centre of attention*) or performance (13 items; e.g., *speaking up at a meeting*) situations over the past week. Participants rate each situation as to anxiety intensity (fear) and frequency of avoidance on a 4-point Likert-type scale. The social fear ratings are 0 (*no fear*), 1 (*mild fear*), 2 (*moderate fear*), and 3 (*severe fear*). The social avoidance ratings are 0 (*never*), 1 (*occasionally, 1-33% of the time*), 2 (*often, 34-67% of the time*), and 3 (*usually, 67-100% of the time*). The LSAS-SR generates an overall score and six subscale scores: fear of performance situations, fear of social interaction, total fear, avoidance of performance situations, avoidance of social interaction, and total avoidance. The possible range of scores are 0 to 39 for the performance subscales, 0 to 33 for the social interaction subscales, 0 to 72 for the total fear subscale and for the total avoidance subscale, and 0 to 144 for the overall scale. Higher scores indicate greater social anxiety.

The LSAS has demonstrated good psychometric properties in self-report (Baker, Heinrichs, Kim, & Hofmann, 2002; Fresco et al., 2001; Rytwinski et al., 2009) and clinician-administered (Baker et al., 2002; Fresco et al., 201; Heimberg et al., 1999) formats. The LSAS-SR exhibits good internal consistency across all subscales with reported alphas higher than .73 (Baker et al., 2002; Fresco et al., 2001). In the present experiment, the internal consistency of the LSAS-SR Scales in the entire sample was good with Cronbach's alphas as follows: full scale .945, total fear .917, fear of social interaction .864, fear of performance situations .841, total avoidance .887, avoidance of social interaction .803, and avoidance of performance situations .810.

The LSAS-SR has demonstrated strong correlations with other measures of social anxiety including the Social Interaction Anxiety Scale (SIAS) and Social Phobia Scale (SPS) (Fresco et al., 2001), the negative self-statements of the Self statements during Public Speaking Scale (SPSS) (Baker et al., 2002), and with the Emotion Regulation Interview (ERI) (Werner, Goldin, Ball, Heimberg, & Gross, 2011). In addition, the LSAS-SR displays good discriminant validity, with low to moderate correlation of the fear and avoidance factors with unrelated constructs such as depression (Baker et al., 2002; Fresco et al., 2001). Overall, the LSAS-SR is easy to administer, widely used, and demonstrates good psychometric properties regarding the fear and avoidance behaviours associated with social phobia.

In discussions of the LSAS (self-report or clinician-administered), one issue has been that the two-factor model (fear and avoidance) as conceived by Liebowitz (1987) is inadequate. On the one hand, there is considerable overlap between these factors (Baker et al., 2002; Heimberg et al., 1999; Oakman, Van Ameringen, Mancini, & Farvolden, 2003). On the other hand, there is no consensus yet as to the ideal factor structure for the LSAS. For instance, Safren et al. (1999) and Slavkin, Holt, Heimberg, Jaccard, and Liebowitz (1990) both recommend four factors, although not the same four factors, whereas Baker et al., (2002) found that a five-factor model was a better fit for their results. Despite this, most researchers support the LSAS, in both self-report and clinician-administered versions, as a valid and reliable tool for assessing social phobia (Baker et al., 2002; Fresco et al., 2001; Heimberg et al., 1999; Rytwinski et al., 2009). For present purposes, the LSAS-SR provided the data necessary to investigate whether social phobia influenced temporal perspective.

General negativity scale. Participants' negative emotional state was assessed using the Depression, Anxiety, and Stress Scales short form (DASS-21: Lovibond & Lovibond, 1995; see Appendix P). The 21-item instrument contains three 7-item subscales: Depression (e.g., *I felt that I had nothing to look forward to*), Anxiety (e.g., *I felt scared without any good reason*), and Stress (e.g., *I found it hard to wind down*). Participants indicate how much each statement applies to them *over the past week* on a scale of 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). The DASS-21 generates three subscale scores (depression, anxiety, stress) each with a possible range of scores of 0 to 21 and an overall score of negative emotional state with a possible range of scores of 0 to 63. Higher scores indicate higher levels of emotional distress. In the present study the DASS-21 full scale and subscales raw scores were doubled (possible range of scores for the three subscales was 0 to 42 and for the overall scale was 0 to 112), as recommended in the DASS manual (Lovibond & Lovibond, 1995), to facilitate comparison of these scores with the full-length 42-item DASS in future research.

The DASS-21 exhibits good internal consistency across all subscales with reported alphas higher than .80 across clinical and non-clinical samples (Antony, Bieling, Cox, Enns, & Swinson, 1998; Clara, Cox, & Enns, 2001; Daza, Novy, Stanley, & Averill, 2002; Henry & Crawford, 2005; Sinclair et al., 2012). In the present experiment, the internal consistency of the DASS-21 in the entire sample was good with Cronbach's alphas for the DASS-21 full scale and for the DASS-21 Depression, Anxiety, Stress subscales being .925, .870, .813, and .829, respectively.

The DASS-21 demonstrates good convergent validity with other measures of depression and anxiety, including the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) and the Personal Disturbance Scale (Bedford & Foulds, 1978) as found by Henry and Crawford (2005), the PANAS (Watson et al., 1988) as found by Crawford and Henry (2004), and the Mental Component Summary score of the SF-8 Health Survey (Ware, Kosinski, Dewey, & Gandek, 2001) as found by Sinclair et al. (2012). In addition, the DASS-21 has been found to be negatively correlated with the Satisfaction with Life Scale (Diener et al., 1995) with higher levels of depression, anxiety, and stress associated with lower levels of life satisfaction (Tonsing, 2014).

The DASS-21 has two advantages over the full-length (42 item) version. First, the DASS-21 takes less time to complete (advantageous in an experiment such as this where participants had a number of questionnaires to answer). Second, it has a cleaner factor structure owing to problematic items from the full-length version being omitted from the shortenedversion (Antony et al., 1998; Brown, Chorpita, Korotitsch, & Barlow, 1997; Clara et al., 2001; Crawford & Henry, 2003). Overall, the DASS-21 is easy to administer and demonstrates good psychometric properties regarding negative emotional states consisting of depression, anxiety, and stress.

Procedure

Participants were tested individually or in groups of up to ten. The study title presented to participants was "Individual differences in perceptions and feelings about events." Each participant sat at a separate desk well-removed from other individuals. After reading the information sheet (see Appendix Q), having any questions answered, and signing the consent form (see Appendix R), participants were randomly assigned to one of the nine experimental conditions.

Each participant received a booklet and followed the instructions contained therein (see Appendix S). Figure 9 presents the sequence of tasks contained in the booklet. Each task was presented on a separate page. The text passages were titled and contained instructions identical to those used in Experiment 1 (see Chapter 6). The TAQ and the AQ contained one of three possible events (i.e., friend's party [positive], meeting [neutral], or exam [negative]) depending on the event valence condition to which the participant was assigned. The order of the AQ responses, "I am approaching the *event*" and "The *event* is approaching me" was counterbalanced, with the third AQ response "Neither" always appearing as the last option. The final page of the booklet instructed participants to remain seated quietly until everyone present had completed their tasks (see Appendix T). When all participants had completed their tasks, they were debriefed, thanked for their time, and asked not to discuss the study with their peers, to avoid any possible contamination of results should those peers be participating in the study at a future date.

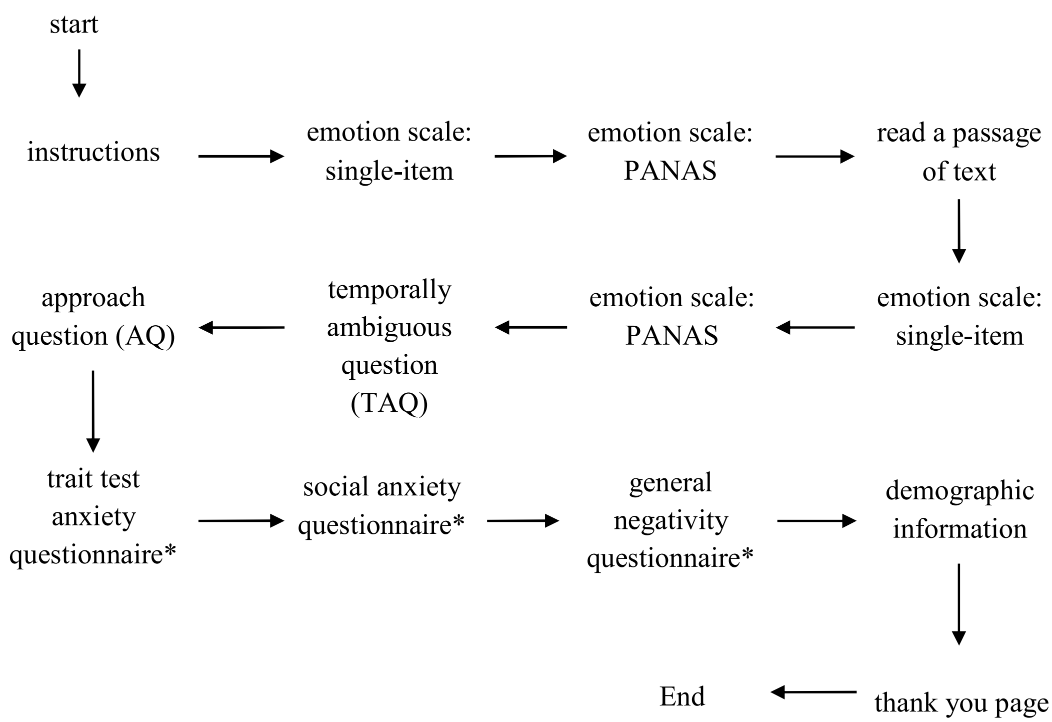

Figure 9. Sequence of tasks presented to participants in Experiment 2.
* The presentation order of these questionnaires was counterbalanced.

Results

Data Screening: Checking for Accuracy, Missing Data, and Outliers

Responses of 15 participants were excluded from all analyses for two reasons. First, answers to the TAQ were neither Monday nor Friday (6 Saturday, 4 Sunday, 1 blank, 1 with two dates). Second, too many answers were missing (i.e., 50% or more) from at least one of the pre- or post-manipulation PANAS subscales questionnaires, preventing assessment of the efficacy of the emotion induction technique. In cases where the initial response to a TAQ or an AQ was crossed out (18 cases and 3 cases, respectively), it is this crossed out response that was included in further analysis, as the interest lay with a participant's first response to each question.[34]

For 10 items (3 on DASS-21, 7 on LSAS-SR) across three participants, mean substitution was used as two neighbouring rating values were selected, indicating that participants intended their response for those items to be between the two ratings rather than one rating or the other. In three cases, participants' responses on the LSAS-SR Avoidance subscale were written in percentage values rather than number values. Such confusion may arise from the inclusion of percentages in the ratings descriptions for the Avoidance subscale but not the Anxiety subscale of the LSAS. The percentage values were converted into their corresponding number values when those participants' data were entered into the statistical software package SPSS. Table U1 presents greater detail regarding these, and other, data exclusions or amendments.

Data from the original paper questionnaires were keyed into SPSS. A random sampling of 15% of the SPSS entered participant data (n = 489) were compared to the original paper questionnaires. No discrepancies were identified.

Each SPSS data cell was checked to ensure that it was within its prescribed item range (i.e., 128 data cells x 489 participants). Four data cells were outside of the prescribed range (e.g., a PANAS item keyed in mistakenly as 12 rather than 2). The original data for the four items were checked and the correct values entered (see Table U2).

Missing data were identified. Minimal data were missing across all variables (0.3% total, 189 data cells). No discernible pattern existed within the missing data as indicated by a

[34] Being able to determine the initial response was an advantage of employing a pen-and-paper based experiment.

nonsignificant Little's MCAR ('missing completely at random': Little, 1988) test, $\chi^2 = 5201.23$, $df = 5109$, $p = .180$. An expectation maximisation algorithm in SPSS was employed to impute the missing data (see Scheffer, 2002). This algorithm computes the maximum likelihood estimates for parameters in the presence of missing data (Tabachnick & Fidell, 2013). The data used in the expectation maximisation algorithm must be meaningful. One example is that the data fill for missing items from the negative affect subscale of the PANAS should be informed by the existing data for that subscale only and not by the full PANAS which includes a positive affect subscale, as subscale items correlate with each other and not with items from other subscales. Table 13 presents information about what data for each instrument informed the data fill for missing items; for example, whether it was data from all participants, data from participants within the same emotion induction (EI) procedure only, or data from participants who experienced the same EI procedure and the same event. Missing demographics data (age, gender, first language) were not imputed. Table U3 presents greater detail regarding missing data, including exclusions from certain analyses and items filled via the expectation maximisation algorithm.

Table 13

Data Informing the Expectation Maximisation Algorithm for Individual Instruments

	Participants' Data		
Scale	All	Same emotion induction procedure (EIP)	Same experimental condition (EIP + event valence)
FEELINGS (pre-manipulation)	*		
PANAS (pre-manipulation)			
Positive affect	*		
Negative affect	*		
FEELINGS (post-manipulation)		*	
PANAS (post-manipulation)			
Positive affect		*	
Negative affect		*	
WTAS			*
DASS-21			
Depression			*
Anxiety			*
Stress			*
LSAS-SR			
Fear or anxiety - Performance			*
Fear or anxiety – Social			*
Avoidance - Performance			*
Avoidance - Social			*

Each individual scale and subscale was checked for univariate outliers, that is, standardised scores greater than ±3.29 (Tabachnick & Fidell, 2013). Univariate outliers were detected in the pre- and post-induction NA subscales only, with the raw score on those variables changed to one unit larger than the next highest score in the distribution to lessen their impact (Tabachnick & Fidell). The raw scores for the pre- and post-induction NA subscales were reduced until no univariate outliers were detected (see Appendix V).

Emotion: Single-Item Scale

A one-way between-groups ANCOVA was conducted to assess the effect of the three emotion induction manipulations (text passages: positive, neutral, negative) on the single item emotion scale. Table 14 provides descriptive statistics for pre- and post-induction emotion scores across each emotion condition.

Table 14

Pre- and Post-induction Descriptive Data of Feelings Scale Scores Across Emotion Conditions

Emotion	*n*	Min.	Max.	*M*	*SD*	Skewness	Kurtosis
				Pre-induction Feelings Scale Scores			
Positive	161	2	7	4.90	1.19	-0.26	-0.51
Neutral	167	1	7	4.75	1.17	-0.19	-0.12
Negative	161	1	7	4.79	1.15	-0.08	0.27
				Post-induction Feelings Scale Scores			
Positive	161	2	7	5.30	1.11	-0.13	-0.45
Neutral	167	2	7	4.37	0.95	0.46	0.43
Negative	161	1	7	3.57	1.00	0.47	1.24

Note. The possible range of scores was 1–7.

The data were not normally distributed, but the ANCOVA was considered robust to non-normality with skew and kurtosis less than |2.0| and |9.0|, respectively (Schmider, Ziegler, Danay, Beyer, & Bühner, 2010) and with more than 30 observations in each cell (Field, 2013; Pallant, 2013). The assumption of homogeneity of variances was violated, Levene's F test, $F(2, 486) = 7.59$, $p = .001$; however, this is tolerable due to the large group sizes and the differences in group sizes not exceeding 1:1.5 (smallest to largest) (Hills, 2008). The assumptions of linearity and homogeneity of regression slopes ($p = .21$) were met. After adjusting for pre-induction scores, there was a significant difference between the three emotion induction procedures on post-induction scores of the single item emotion scale, $F(2, 485) = 154.31$, $p <$

.001, $\eta^2 = .39$. That is, the valence of the induced emotion had an effect on scores on the single item Feelings scale.

The positive emotion induction condition achieved higher scores (i.e., greater positivity ratings) than either the neutral emotion ($M_{Diff} = 0.87$, $p < .001$) or the negative emotion ($M_{Diff} = 1.69$, $p < .001$) conditions. The neutral emotion condition achieved higher scores (i.e., higher positivity ratings) than the negative emotion condition ($M_{Diff} = 0.82$, $p < .001$). These statistically significant results confirm that the neutral emotion condition had an effect as expected, between the positive emotion and negative emotion conditions.

Emotion: PANAS-Positive Emotion

A one-way between-groups analysis of covariance (ANCOVA) was conducted to assess the effect of the three emotion induction manipulations (text passages: positive, neutral, negative) on positive affect (PA). Table 15 provides descriptive statistics for pre- and post-induction positive affect scores across each emotion condition.

Table 15

Pre- and Post-induction Descriptive Data of Positive Affect Scores Across Emotion Conditions

Emotion	*n*	Min.	Max.	*M*	*SD*	Skewness	Kurtosis
			Pre-induction Positive Affect Scores				
Positive	161	12	48	28.40	7.75	0.15	-0.38
Neutral	167	13	47	29.12	7.73	0.09	-0.47
Negative	161	12	46	28.42	6.90	0.17	-0.23
			Post-induction Positive Affect Scores				
Positive	161	10	49	28.60	9.14	0.11	-0.74
Neutral	167	10	48	25.37	9.01	0.41	-0.56
Negative	161	10	45	24.39	7.71	0.41	-0.22

Note. The possible range of scores was 10–50.

Post-induction PA data were not normally distributed, but the ANCOVA was considered robust to non-normality with skew and kurtosis less than |2.0| and |9.0|, respectively (Schmider et al., 2010) and with more than 30 observations in each cell (Field, 2013; Pallant, 2013). The assumption of homogeneity of variances was violated, Levene's *F* test, $F(2, 486) = 3.56$, $p = .029$; however, this is tolerable due to the large group sizes and the differences in group sizes not exceeding 1:1.5 (smallest to largest) (Hills, 2008). The assumptions of linearity, homogeneity of regression slopes ($p = .673$), and reliable measurement of the covariate (Cronbach's alpha of .860) were met. After adjusting for pre-induction scores, there was a significant difference between the three emotion induction procedures on post-induction scores of positive affect, $F(2, 485) = 30.39$, $p < .001$, $\eta^2 = .11$. That is, the valence of the induced emotion had an effect on PA scores.

The positive emotion induction condition achieved higher PA scores than either the neutral emotion ($M_{Diff} = 3.88$, $p < .001$) or the negative emotion ($M_{Diff} = 4.23$, $p < .001$) condition. These results confirm that, for each emotion induction condition, the positive emotion condition produced (or, at least, maintained) greater PA then did either of the two other emotion conditions. In addition, the neutral emotion condition achieved higher PA scores than the negative emotion condition ($M_{Diff} = 0.35$, $p = .565$). Although this difference was not statistically significant, it does suggest that the neutral emotion condition had an effect as expected, between the positive emotion and negative emotion conditions.

Emotion: PANAS-Negative Emotion

A one-way between-groups ANCOVA was conducted to assess the effect of the three emotion induction manipulations (text passages: positive, neutral, negative) on negative affect

(NA). Table 16 provides descriptive statistics for pre- and post-induction negative affect scores across each emotion condition.

Table 16

Pre- and Post-induction Descriptive Data of Negative Affect Scores Across Emotion Conditions

Emotion	*n*	Min.	Max.	*M*	*SD*	Skewness	Kurtosis
			Pre-induction Negative Affect Scores				
Positive	161	10	27	14.46	4.29	0.94	-0.08
Neutral	167	10	36	15.88	5.77	1.42	1.66
Negative	161	10	31	14.52	4.61	1.49	1.97
			Post-induction Negative Affect Scores				
Positive	161	10	24	12.30	3.17	1.64	2.30
Neutral	167	10	32	13.89	4.88	1.81	3.13
Negative	161	10	43	17.13	7.44	1.46	1.78

Note. The possible range of scores was 10–50.

The data were not normally distributed. However, the ANCOVA was considered robust to non-normality with skew and kurtosis less than |2.0| and |9.0|, respectively (Schmider et al., 2010) and with more than 30 observations in each cell (Field, 2013; Pallant, 2013). The assumption of homogeneity of variances was violated, Levene's F test, $F(2, 486) = 43.53$, $p < .001$. However, this is tolerable due to the large group sizes and the differences in group sizes not exceeding 1:1.5 (smallest to largest) (Hills, 2008). The assumptions of linearity, homogeneity of regression slopes ($p = .058$), and reliable measurement of the covariate (Cronbach alpha of .810) were met. After adjusting for pre-induction scores, there was a significant difference between the three emotion induction procedures on post-induction scores of negative affect, $F(2, 485) = 59.48$, $p < .001$, $\eta^2 = .20$. That is, the valence of the induced emotion had an effect on NA scores.

The negative emotion induction condition achieved higher NA scores than either the positive emotion ($M_{Diff} = 4.78$, $p < .001$) or the neutral emotion ($M_{Diff} = 4.17$, $p < .001$) condition. These results confirm that, for each emotion induction condition, the negative emotion condition produced (or, at least, maintained) greater NA then did either of the two other emotion conditions. In addition, the neutral emotion condition achieved higher NA scores than the positive emotion condition ($M_{Diff} = 0.62$, $p = .194$). Although this difference was not statistically significant, it does confirm that the neutral emotion condition had an effect as expected, between the negative emotion and positive emotion conditions.

Relationship between Emotion, Event Valence, and TAQ Responses

Testing the emotion- and event valence-related TAQ research questions involved conducting chi-square analyses, either goodness-of-fit or test for independence. For each chi-square analysis performed assumptions were met with each participant contributing one TAQ response only and the expected frequency of Monday responses and Friday responses both being greater than five (Field, 2013; Hills, 2008). Alpha was set to .05. The reported chi-square value for a test for independence is Pearson chi-square.

Table 17 presents an analysis of the breakdown of TAQ responses across experimental conditions.

Table 17
Analysis of Participants' TAQ Responses Across Experimental Conditions

Condition (text/event)	Monday	Friday	*p* value
Neutral/Neutral (i.e., control)	27 (48.2%)	29 (51.8%)	.789^
Positive/Positive	24 (44.4%)	30 (55.6%)	.692
Positive/Neutral	24 (42.9%)	32 (57.1%)	.569
Neutral/Positive	27 (48.2%)	29 (51.8%)	N/A
Neutral/Negative	33 (60.0%)	22 (40.0%)	.213
Negative/Neutral	35 (63.6%)	20 (36.4%)	.102
Negative/Negative	34 (61.8%)	21 (38.2%)	.150
Positive/Negative	32 (62.7%)	19 (37.3%)	.131
Negative/Positive	33 (64.7%)	18 (35.3%)	.086

Note: Analysis performed was a two-way chi-square (against neutral/neutral condition) unless stated otherwise. ^ Analysis performed was a one-way chi-square (against 50%/50%). N/A - no analysis needed because experimental condition figures were identical to control condition figures.

To test the hypothesis that in a control condition there will be no difference between the frequency of MT and ME responses a chi-square goodness-of-fit analysis was conducted on the neutral emotion/neutral event valence (i.e., control) condition. The hypothesised data were evenly split (i.e., 50%/50%) because testing for no difference in the proportion of TAQ responses in each category. Of the 56 participants in the control condition, 48.2% (27) responded Monday, whereas 51.8% (29) responded Friday. There was no statistically significant difference between the frequency of MT (i.e., Monday) and ME (i.e., Friday) responses, $\chi^2(1, N = 56) = 0.07$, $p = .789$. Thus, the hypothesis was supported.

To test whether the embodiment of positive emotion as approach-related behaviour would manifest itself as an observer seeking to decrease the temporal distance between himself or herself and the event (MT perspective) or would manifest as the observer thinking in terms of moving toward the event, and so projecting his or her typical direction of forward movement (futureward) onto the event (ME perspective), a series of chi-square test for independence analyses were performed comparing the control condition with three separate conditions: the neutral emotion/positive event valence condition, the positive emotion/neutral event valence condition, and the positive emotion/positive event condition. The neutral emotion/positive event valence condition produced the same breakdown in TAQ responses as the control condition, $n = 56$, 48.2% (27) Monday, 51.8% (29) Friday, for both conditions. The proportion of Monday and Friday answers in the control group was not significantly different from the other two groups: the positive emotion/neutral event valence condition (42.9% [24] Monday, 57.1% [32] Friday), $\chi^2(1, N = 112) = 0.32$, $p = .569$ and the positive emotion/positive event valence condition (44.4% [24] Monday, 55.6% [30] Friday), $\chi^2(1, N = 110) = 0.16$, $p = .692$. There was no effect of positive emotion or positive event valence, nor of both positives combined, on participants' responses to a TAQ. However, the trend in all three positive-type conditions was a preference for ME responses over MT responses.

To test whether those negative emotions embodied as avoidance-related behaviour would manifest as an observer pushing away the event (ME perspective) or as "freezing" in the hope that the event moves away (ME perspective) or as "freezing" in the belief that the event is coming at him or her (MT perspective), a series of chi-square test for independence analyses were performed comparing the control condition with three separate conditions: the neutral emotion/negative event valence condition, the negative emotion/neutral event valence condition, and the negative emotion/negative event condition. The proportion of Monday and Friday answers in the control group was not significantly different from all three other groups: neutral emotion/negative event valence condition (n = 55, 60.0% [33] Monday, 40.0% [22] Friday), $\chi^2(1, N = 111) = 1.55$, $p = .213$; negative emotion/neutral event valence condition (63.6% [35] Monday, 36.4% [20] Friday), $\chi^2(1, N = 111) = 2.68$, $p = .102$; negative emotion/negative event valence condition (61.8% [34] Monday, 38.2% [21] Friday), $\chi^2(1, N = 111) = 2.07$, $p = .150$. These results indicate that there was no effect of negative emotion or negative event valence, nor of both negatives combined, on participants' responses to a TAQ. However, in all three negative-type conditions, the trend was a preference for MT responses over ME responses, the opposite of the trend for positive-type conditions.

To test whether there is any difference in effects between an incidentally-induced emotional state and an emotion felt toward a relevant external event, a series of chi-square test for independence analyses were performed comparing the control condition with two separate and conflicting (i.e., induced emotion versus event valence) conditions: the positive emotion/negative event valence condition and the negative emotion/positive event valence condition. The proportion of Monday and Friday answers in the control group was not significantly different from the two other groups: positive emotion/negative event valence condition (62.7% [32] Monday, 37.3% [19] Friday), $\chi^2(1, N = 107) = 2.28$, $p = .131$; negative emotion/positive event valence condition (64.7% [33] Monday, 35.3% [18] Friday), $\chi^2(1, N = 107) = 2.95$, $p = .086$. These results indicate that there was no effect of conflicting factors regarding participants' responses to the TAQ. In terms of trend, however, each of the two experimental conditions containing conflicting factors favoured MT responses over ME responses. Such a response pattern is consistent with the pattern of responses found among other conditions that included at least one negative factor, emotion or event.

Relationship between Emotion, Event Valence, and AQ Responses

Of the 489 participants, one participant was excluded from all analyses involving AQ responses because that response was missing. Testing the emotion- and event valence-related AQ research questions involved conducting chi-square analyses, either goodness-of-fit or test for independence. For each chi-square analysis performed assumptions were met with each participant contributing one AQ response only and the expected frequency of “I am approaching the *event*”, “The *event* is approaching me”, and “Neither” responses all being greater than five (Field, 2013; Hills, 2008). Alpha was set to .05. The reported chi-square value for a test for independence is Pearson chi-square. Two sets of tests were conducted: one set of tests assumed an AQ response indicated positivity or negativity via temporal agency and was free from an influence of a prior TAQ response and the other set of tests assumed an AQ response was influenced by a prior TAQ response.

Assuming AQ responses are not influenced by TAQ. Table 18 presents an analysis of the breakdown of TAQ responses and AQ responses across experimental conditions.

Table 18

Analysis of Participants' Responses (TAQ, AQ) Across Experimental Conditions

	TAQ response			AQ response			
Condition (text/event)	Monday	Friday	*p* value	I am approaching	Event is approaching	Neither	*p* value
Neutral/Neutral (i.e., control)	27 (48.2%)	29 (51.8%)	.789^	20 (35.7%)	21 (37.5%)	15 (26.8%)	.575^^
Positive/Positive	24 (44.4%)	30 (55.6%)	.692	20 (37.2%)	18 (33.3%)	16 (29.6%)	.893
Positive/Neutral	24 (42.9%)	32 (57.1%)	.569	15 (26.8%)	27 (48.2%)	14 (25.0%)	.473
Neutral/Positive	27 (48.2%)	29 (51.8%)	N/A	12 (21.4%)	23 (41.1%)	21 (37.5%)	.213
Neutral/Negative	33 (60.0%)	22 (40.0%)	.213	23 (41.8%)	23 (41.8%)	9 (16.4%)	.408
Negative/Neutral	35 (63.6%)	20 (36.4%)	.102	20 (36.4%)	26 (47.3%)	9 (16.4%)	.364
Negative/Negative	34 (61.8%)	21 (38.2%)	.150	18 (33.3 %)	26 (48.1%)	10 (18.5%)	.449
Positive/Negative	32 (62.7%)	19 (37.3%)	.131	14 (27.5%)	28 (54.9%)	9 (17.6%)	.189
Negative/Positive	33 (64.7%)	18 (35.3%)	.086	14 (27.5%)	21 (41.2%)	16 (31.4%)	.651

Note: Analysis performed was a two-way chi-square (against neutral/neutral condition) unless stated otherwise.
^ Analysis performed was a one-way chi-square (against 50%/50%). ^^ Analysis was a one-way chi-square (against 33.3%/33.3%/33.3%). N/A - no analysis needed because experimental condition figures were identical to control condition figures.

To test the hypotheses that in a control condition there will be no significant difference between the frequency of TA, EA, and "neither" responses, a chi-square goodness-of-fit analysis was conducted on the neutral emotion/neutral event valence (i.e., control) condition. The hypothesised data were evenly split three-ways (i.e., 100%/3) because testing for no difference in the proportion of AQ responses in each category. Of the 56 participants in the control condition, 35.7% (20) responded "I am approaching the meeting", 37.5% (21) responded "The meeting is approaching me", and 26.8% (15) responded "Neither". There was no statistically significant difference between the frequency of TA, EA and neither-agency responses, $\chi^2(2, N = 56) = 1.11$, $p = .575$. Thus, the hypothesis was supported.

To test whether positivity will produce more EA than either TA or neither-agency responses, a series of chi-square test for independence analyses were performed comparing the control condition with three separate conditions: the neutral emotion/positive event valence condition, the positive emotion/neutral event valence condition, and the positive emotion/positive event condition. The proportion of AQ responses in the control group was not significantly different from any of the three other groups: the neutral emotion/positive event valence condition (21.4% [12] "I am approaching", 41.1% [23] "The event is approaching", 37.5% [21] "neither"), $\chi^2(2, N = 112) = 3.09$, $p = .213$; the positive emotion/neutral event valence condition (26.8% [15] "I am approaching", 48.2% [27] "The event is approaching", 25.0% [14] "neither"), $\chi^2(2, N = 112) = 1.50$, $p = .473$; the positive emotion/positive event valence condition (37.2% [20] "I am approaching", 33.3% [18] "The event is approaching", 29.6% [16] "neither"), $\chi^2(2, N = 110) = 0.23$, $p = .893$. There was no effect of positive emotion or positive event valence, nor of both positives combined, on participants' responses to an AQ.

To test whether negativity will produce more TA than either EA or neither-agency responses, a series of chi-square test for independence analyses were performed comparing the control condition with three separate conditions: the neutral emotion/negative event valence condition, the negative emotion/neutral event valence condition, and the negative emotion/negative event condition. The proportion of AQ responses in the control group was not significantly different from any of the three other groups: the neutral emotion/negative event valence condition (41.8% [23] "I am approaching", 41.8% [23] "The event is approaching", 16.4% [9] “neither”), $\chi^2(2, N = 111) = 1.79$, $p = .408$; the negative emotion/neutral event valence condition (36.4% [20] “I am approaching”, 47.3% [26] “The event is approaching”, 16.4% [9] “neither”), $\chi^2(2, N = 111) = 2.02$, $p = .364$; the negative emotion/negative event valence condition (33.3% [18] “I am approaching”, 48.1% [26] “The event is approaching”, 18.5% [10] “neither”), $\chi^2(2, N = 110) = 1.60$, $p = .449$. There was no effect of negative emotion or negative event valence, nor of both negatives combined, on participants’ responses to an AQ. It is worth noting that TA responses were the most frequent responses in all three negative type conditions albeit equal frequency with EA responses in the neutral emotion/negative event valence condition.

To test whether there is any difference in effects between an incidentally-induced emotional state and an emotion felt toward a relevant external event, a series of chi-square test for independence analyses were performed comparing the control condition with two separate and conflicting (i.e., induced emotion versus event valence) conditions: the positive emotion/negative event valence condition and the negative emotion/positive event valence condition. The proportion of AQ responses in the control group was not significantly different from either of the two conflicting factors groups: the positive emotion/negative event valence condition (27.5% [14] “I am approaching”, 54.9% [28] “The event is approaching”, 17.6% [9] “neither”), $\chi^2(2, N = 107) = 3.33$, $p = .189$, and, the negative emotion/positive event valence condition (27.5% [14] “I am approaching”, 41.2% [21] “The event is approaching”, 31.4% [16] “neither”), $\chi^2(2, N = 107) = 0.86$, $p = .651$. These results indicate that there was no effect of conflicting factors regarding participants’ responses to an AQ. Each of the two experimental conditions containing conflicting factors favoured TA responses over either EA responses or "neither" responses. Such a response pattern is consistent with negativity being associated with event agency (McGlone & Pfiester, 2009).

Assuming AQ responses are influenced by TAQ. To test whether there will be a difference in AQ responses between individuals who responded Monday to a TAQ compared with individuals who responded Friday to a TAQ, a chi-square test for independence analysis was performed comparing the two groups. The proportion of AQ responses in the group who responded Monday to a TAQ (24.2% [65] "I am approaching", 55.8% [150] "The event is approaching", 20% [54] "neither") was significantly different from the group who responded Friday to a TAQ (41.5% [91] "I am approaching", 28.8% [63] "The event is approaching", 29.7% [65] "neither"), $\chi^2(2, N = 488) = 36.14$, $p < .000$. Thus, regardless of the condition to which participants were assigned, individuals who responded Monday to a TAQ favoured an "event is approaching me" AQ option, whereas individuals who responded Friday to a TAQ favoured an "I am approaching the event" AQ option.

To test whether more "Neither" AQ responses are produced from a Friday TAQ response than from a Monday TAQ response, a chi-square test goodness-of-fit analysis was conducted. The hypothesised data were evenly split (i.e., 50%/50%) because testing for no difference in the proportion of TAQ responses in each category. Of the 119 participants who responded "Neither" to the AQ, 45.4% (54) had responded Monday, whereas 54.6% (65) had responded Friday. There was no statistically significant difference between the frequency of MT (i.e., Monday) and ME (i.e., Friday) responses, $\chi^2(1, N = 119) = 1.02$, $p = .313$. However, the trend was for the "Neither" AQ response to be selected more often by individuals whose TAQ response had indicated an ME perspective than by individuals whose TAQ response had indicated an MT perspective.

Trait Test Anxiety for a Negatively Valenced Event

Of the 161 participants who answered questions regarding an exam event, one participant was excluded from all analyses involving trait test anxiety because too many responses were missing on the WTAS and another participant was excluded from analyses concerning trait test anxiety and AQ responses because the AQ response was left blank. Scores ranged from 1.3 to 5 (M = 3.34, SD =0.92) for overall trait test anxiety.

To test if there is an influence of trait test anxiety on an individual's choice of TAQ response when the event specified is an exam (negatively valenced), a binomial logistic regression analysis comparing the constant-only model with a model including WTAS scores was conducted. The standardised residuals had values of less than ±2 indicating that the model fit the data well (Field, 2013). There was no statistically significant difference between the full model and the constant-only model, $\chi^2(1) = 0.85$, $p = .356$. That is, trait test anxiety did not significantly improve prediction of TAQ responses for participants who were asked about an exam event.

To test if there is an influence of trait test anxiety on an individual's choice of AQ response when the event specified is an exam (negatively valenced), a multinomial logistic regression analysis comparing the constant-only model with a model including WTAS scores was conducted. The referent was "The exam is approaching me" AQ response, because negativity (in the absence of an influence of a prior TAQ response) is reflected in event agency assignments (McGlone & Pfiester, 2009) and most people would regard exams as negatively valenced events. There were contrasting results regarding how well the model fit the data with the nonsignificant Pearson chi-square value suggesting a good fit, $\chi^2(68) = 81.08$, $p = .133$, whereas the significant Deviance chi-square value suggested otherwise, $\chi^2(68) = 92.64$, $p = .025$.

When there are differences in the findings between these two statistics, Field (2013) recommends checking for the possibility of overdispersion. In this case, both dispersion parameters,[35] $ø_{Pearson}$ = 1.19 and $ø_{Deviance}$ = 1.36, were not particularly high and were close to the ideal value of 1 indicating that overdispersion was not an issue. Table 19 presents a summary of the multinomial logistic regression analysis. Trait test anxiety scores did significantly improve prediction of AQ responses between "I am approaching the exam" and "The exam is approaching me" but not for AQ responses between "Neither" and "The exam is approaching me". As WTAS scores increase by one unit, the relative risk for responding "I am approaching the exam" rather than "The exam is approaching me" would be expected to decrease by a factor of 0.59. In other words, as a participant's trait test anxiety increases, we would expect him/her to be more likely to respond "The exam is approaching me" than "I am approaching the exam" to an AQ. Results indicate a positive correlation between trait test anxiety and TA perspective responses for a negatively valenced AQ event (i.e., "The exam is approaching me").

Table 19
Summary of Multinomial Logistic Regression Analysis for Trait Test Anxiety Predicting AQ Responses when Event was an Exam

		Wald's		95% *CI* for Odds Ratio		
	b (SE)	χ^2 (*df*=1)	*p*	Lower	Odds Ratio	Upper
"I am approaching the exam" vs. "The exam is approaching me"						
Intercept	1.43 (0.71)	4.10	.043			
Trait test anxiety	-0.52 (0.21)	6.49	.011	0.40	0.59	0.89
"Neither" vs. "The exam is approaching me"						
Intercept	0.64 (0.86)	0.56	.454			
Trait test anxiety	-0.49 (0.25)	3.75	.053	0.38	0.62	1.01

Note: R^2 = .05 (Cox & Snell), .06 (Nagelkerke). Model $\chi^2(2)$ = 8.03, *p* = .018.

[35] Dispersion parameters, in this and subsequent analyses, were calculated as χ^2Pearson/*df* and χ^2Deviance/*df*.

Social Anxiety for a Positively Valenced Event

Of the 161 participants who answered questions regarding a friend's party event, one participant was excluded from all analyses involving social anxiety as too many items were missing from the LSAS-SR questionnaire. Scores ranged from 0 to 34 (M = 17.62, SD = 6.93) for fear of performance situations, 0 to 31 (M = 14.54, SD = 6.82) for fear of social interaction, 0 to 63 (M = 32.16, SD = 12.98) for total fear, 0 to 33 (M = 15.05, SD = 7.30) for avoidance of performance situations, 3 to 31 (M = 14.40, SD = 6.45) for avoidance of social interactions, 3 to 62 (M = 29.45, SD = 12.86) for total avoidance, and 11 to 123 (M = 61.61, SD = 24.44) for overall social anxiety.

To test if there is an influence of social anxiety on an individual's choice of TAQ response when the event specified is a friend's party (positively valenced), a binomial logistic regression analysis comparing the constant-only model with a model including LSAS-SR scores was conducted. The standardised residuals had values of less than ±2 indicating that the data fit the model well (Field, 2013). There was no statistically significant difference between the full model and the constant-only model, $\chi^2(1) = 2.10$, $p = .148$. That is, social anxiety did not significantly improve prediction of TAQ responses for participants who experienced a friend's party event.

To test if there is an influence of social anxiety on an individual's choice of AQ response when the event specified is a friend's party (positively valenced), a multinomial logistic regression analysis comparing the constant-only model with a model including WTAS scores was conducted. The referent was "The party is approaching me" AQ response, because negativity (in the absence of an influence of a prior TAQ response) is reflected in event agency assignments (McGlone & Pfiester, 2009) and an individual with social phobia may regard a friend's party as a negatively valenced event. There were contrasting results regarding how well the model fit the data with the nonsignificant Pearson chi-square value suggesting a good fit, $\chi^2(152) = 162.57$, $p = .264$, whereas the significant Deviance chi-square value suggested otherwise, $\chi^2(152) = 187.08$, $p = .028$. When there are differences in the findings between these two statistics, Field (2013) recommends checking for the possibility of overdispersion. In this case, both dispersion parameters, $ø_{Pearson} = 1.07$ and $ø_{Deviance} = 1.23$, were not particularly high and were close to the ideal value of 1 indicating that overdispersion was not an issue. Table 20 presents a summary of the multinomial logistic regression analysis. Social anxiety scores did significantly improve prediction of AQ responses between "Neither" and "The party is approaching me" but not for the prediction of AQ responses between "I am approaching the party" and "The party is approaching me". As LSAS-SR scores increase by one unit, the relative risk for responding "Neither" rather than "The party is approaching me" would be expected to decrease by a factor of 0.62. In other words, as a participant's social anxiety increases, we would expect him/her to be more likely to respond "The party is approaching me" than "Neither" to the AQ. Results indicate a positive correlation between social anxiety and TA perspective responses for a positively valenced AQ event (i.e., "The party is approaching me").

Table 20

Summary of Multinomial Logistic Regression Analysis for Social Anxiety Predicting AQ Responses when Event was a Party

		Wald's		95% *CI* for Odds Ratio		
	b (SE)	χ^2 (*df*=1)	*p*	Lower	Odds Ratio	Upper
"I am approaching the party" vs. "The party is approaching me"						
Intercept	0.72 (0.55)	1.66	.197			
Social anxiety	-0.02 (0.01)	3.64	.057	0.97	0.98	1.00
"Neither" vs. "The party is approaching me"						
Intercept	0.90 (0.54)	2.84	.092			
Social anxiety	-0.02 (0.01)	4.30	.038	0.99	0.62	1.00

Note: R^2 = .04 (Cox & Snell), .04 (Nagelkerke). Model $\chi^2(2) = 5.70$, $p = .058$.

General Negativity Across All Events

Of the 489 participants, one participant was excluded from all analyses involving general negativity states as too many DASS-21 responses were missing. As recommended in the DASS manual (Lovibond & Lovibond, 1995), the DASS-21 full scale and subscales raw scores were doubled to facilitate comparison of these scores with the full-length 42-item DASS in future research. Scores ranged from 0 to 42 (*M* = 12.54, *SD* = 9.87) for depression, 0 to 40 (*M* = 11.67, *SD* = 9.41) for anxiety, 0 to 42 (*M* = 16.82, *SD* = 9.50) for stress, and 0 to 114 (*M* = 41.02, *SD* = 25.53) for overall general negativity.

To test if there is an influence of a general negative emotional state, namely, depression, anxiety, and stress on an individual's choice of TAQ response across all event valences (positive, neutral, negative), a binomial logistic regression analysis comparing the constant-only model with a model including DASS-21 scores was conducted. The standardised residuals had values of less than ±2 indicating that the data fit the model well (Field, 2013). There was no statistically significant difference between the full model and the constant-only model, $\chi^2(1) = .24$, $p = .627$. That is, DASS-21 scores did not significantly improve prediction of participants' TAQ responses.

To test if there is an influence of a general negative emotional state, namely, depression, anxiety, and stress on an individual's choice of AQ response across all event valences (positive, neutral, negative), a multinomial logistic regression analysis comparing the constant-only model with a model including DASS-21 scores was conducted. The referent was "The *event* is approaching me" AQ response, because negativity (in the absence of an influence of a prior TAQ response) is reflected in event agency assignments (McGlone & Pfiester, 2009). The model fit the data well, with Pearson and Deviance chi-square values both nonsignificant, $\chi^2(126) = 111.79$, $p = .813$ and $\chi^2(126) = 125.38$, $p = .499$, respectively. Table 21 presents a summary of the multinomial logistic regression analysis. DASS-21 scores did significantly improve prediction of AQ responses between "I am approaching the *event*" and "The *event* is approaching me" but not for the prediction of AQ responses between "Neither" and "The *event* is approaching me". As DASS-21 scores increase by one unit, the relative risk for responding "I am approaching the *event*" rather than "The *event* is approaching me" would be expected to decrease by a factor of 0.98. In other words, as a participant's negative emotional state increases, we would expect him/her to be more likely to respond "The *event* is approaching me" than "I am approaching the *event*" to the AQ. Results indicate a positive correlation between negative emotional states and TA perspective responses for all AQ events (i.e., "The *event* is approaching me").

Table 21

Summary of Multinomial Logistic Regression Analysis for Negative Emotional States Predicting AQ Responses

		Wald's		95% *CI* for Odds Ratio		
	b (SE)	χ^2 (*df*=1)	*p*	Lower	Odds Ratio	Upper
"I am approaching the *event*" vs. "The *event* is approaching me"						
Intercept	0.36 (0.20)	3.19	.074			
Negative emotional states	-0.02 (0.004)	14.28	.000	0.98	0.98	0.99
"Neither" vs. "The *event* is approaching me"						
Intercept	-0.29 (0.22)	1.63	.201			
Negative emotional states	-0.01 (0.005)	2.47	.116	0.98	0.99	1.00

Note: R^2 = .03 (Cox & Snell), .04 (Nagelkerke). Model $\chi^2(2) = 15.28$, $p < .001$. Depending on the assigned experimental condition *event* is either a friend's party, a meeting, or an exam.

Discussion

Findings

The results from the two instruments (single-item, multiple-item PANAS) assessing the effectiveness of the induction demonstrated that the positive and negative emotion-induction passages induced (or maintained) their target emotional states. That is, the positive emotion and negative emotion conditions were the most effective inducers (or maintainers) of positive and negative emotion, respectively. A difference in results between the two instruments related to the neutral emotion condition. Specifically, as expected, the scores for the neutral emotion condition were between the scores for both the positive emotion and the negative emotion conditions. However, the difference in scores between the neutral emotion and positive emotion conditions and between the neutral emotion and negative emotion conditions were statistically significant for the single-item measure but statistically nonsignificant for the multiple-item PANAS.

As predicted, the control condition (i.e., neutral emotion/neutral event valence) showed no significant difference in choice of temporal perspective. Positivity, whether emotion or event valence or both together, had no effect on TAQ responses. Negativity, whether emotion or event valence or both together, had no effect on TAQ responses. There was also no effect on TAQ responses when an incidentally-induced emotional state and event valence were inconsistent (i.e., one positive other negative).

In considering an AQ response as indicating only positivity or negativity the findings were as follows. As predicted, the control condition (i.e., neutral emotion/neutral event valence) showed no significant difference between the frequency of TA, EA, and "neither" responses. Positivity, whether emotion or event valence or both together, had no effect on AQ responses. Negativity, whether emotion or event valence or both together, had no effect on AQ responses. There was also no effect on AQ responses when an incidentally-induced emotional state and event valence were inconsistent (i.e., one positive other negative). In contrast, considering an AQ response as being influenced by a prior TAQ response revealed that Monday TAQ responses prompted more "The *event* is approaching me" AQ responses, whereas Friday responses prompted more "I am approaching the *event*" AQ responses.

When the event was an exam (negatively valenced), findings relating to TAQ and AQ responses were as follows. There was no influence of trait test anxiety on an individual's choice of TAQ response as shown by trait test anxiety not being a significant predictor of TAQ responses. In contrast, there was a positive correlation between trait test anxiety and TA perspective responses to an AQ, in that, higher trait test anxiety was a significant predictor of an AQ response more likely being “the exam is approaching me” rather than “I am approaching the exam”, but not a significant predictor of any difference in responses between “the exam is approaching me” and “neither”.

When the event was a friend’s party (positively valenced), findings relating to TAQ and AQ responses were as follows. There was no influence of social anxiety on an individual’s choice of TAQ response as shown by social anxiety not being a significant predictor of TAQ responses. In contrast, there was a positive correlation between social anxiety and TA perspective responses to an AQ, in that, higher social anxiety was a significant predictor of an AQ response more likely being “neither” rather than “the party is approaching me”, but not a significant predictor of any difference in responses between “the party is approaching me” and “I am approaching the party”.

Across all events, findings relating to TAQ and AQ responses were as follows. There was no influence of general negativity on an individual’s choice of TAQ response as shown by general negativity not being a significant predictor of TAQ responses. In contrast, there was a positive correlation between general negativity and TA perspective responses to an AQ, in that, higher general negativity was a significant predictor of an AQ response more likely being “The *event* is approaching me” rather than “I am approaching the *event*”, but not a significant predictor of any difference in responses between “The *event* is approaching me” and “neither”.

The Ten Critical Questions: Interpreting the Findings

The present findings are interpreted and discussed further via consideration of the ten critical questions (including solutions and strategies) raised in this thesis. These ten questions are addressed in an order that better suits the flow of this discussion rather than in the number sequence assigned to them in Chapters 4 and 5. Each question is clearly labelled. The results section has already addressed the two critical questions involving statistical analyses. That is, for TAQ or AQ responses a chi-square test for independence was conducted when comparing TAQ or AQ responses, respectively, from two experimental conditions (Critical Question 10) and sufficient information regarding participant numbers (including exclusions from any specific data analysis) and statistical analysis performed was provided to facilitate any future statistical analysis replication attempts (Critical Question 9). The next critical question to address is whether the emotion induction procedure was effective.

In the present study, did the emotion induction procedure change or maintain the participant's initial emotional state (Critical Question 5)? This question is primary because there would have been no point considering further the results of the present research if the emotion induction procedure was ineffective. So, was the induction procedure employed in this study effective? The answer is yes. That is, participants' emotion (positive, neutral, negative) was as expected after completing the emotion induction procedure. To my knowledge, this is the first study investigating the influence of emotion on the metaphorical understanding of time via TAQ responses to assess the efficacy of an emotion induction procedure using pre- and post-emotion manipulation checks. Such checks allowed confidence that the present emotion induction procedure was effective (i.e., changed or maintained emotion) and that participants were experiencing, or, at least, reporting themselves to be experiencing, the emotional state congruent with their assigned experimental condition. Earlier studies allowed confidence in the latter but not the former by using a single-item post-manipulation check only (i.e., Lee & Ji, 2014, Exp. 4; Margolies & Crawford, 2008, Exp. 2; Richmond et al., 2012, Exp. 3 & 4). Regarding participants experiencing the emotional state congruent with their assigned experimental condition there are two points worth considering. First, there is the possibility that some participants may have determined the purpose of the text passages and structured their responses on the emotion measures accordingly or that some participants may have deliberately given false information. There was no evidence to suggest these possibilities occurred, but these possibilities exist in any study involving emotion induction including the other TAQ studies investigating the role of emotion on choice of temporal perspective that included a post-manipulation check (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). The second point was raised and answered in Chapter 6. Although it may be established via a post-manipulation check alone that participants are in the desired emotion state, regardless of how they got into that state, only pre- and post-manipulation checks together allow a researcher to claim, as I do in this study, or to suggest implicitly,[36] that an emotion induction method was responsible for a desired emotional state.

The present research contributes evidence for the reliability of the PANAS, with consistent results obtained across this experiment and Experiment 1 (Chapter 6) for the same emotion-induction stimuli (i.e., text passages). In addition, consistent results were obtained between two different types of emotion manipulation assessments: the widely used multiple-item PANAS[37] and a single-item instrument similar to those used in earlier studies (i.e., Lee & Ji, 2014, Exp. 4; Margolies & Crawford, 2008, Exp. 2; Richmond et al., 2012, Exp. 3 & 4). Both instruments were easy to administer and, in the present work, there is no evidence to suggest that either instrument primed participants with regard to motion (actual or implied). The latter is an

[36] That an emotion induction method was responsible for a desired state is suggested implicitly when employing an emotion induction method and a post-manipulation check only.

[37] A search for the number of citations against the original PANAS study by Watson et al. (1988) conducted on February 8th 2016 revealed 8,975 citations on psycINFO, 20,478 citations on GoogleScholar, and 11,746 citations on SCOPUS.

important consideration as studies have shown that participants answer a future day TAQ in a motion prime-consistent manner, that is, an MT perspective (i.e., Monday) or an ME perspective (i.e., Friday), for toward/backward/pastward or away/forward/futureward ego-reference point motion primes, respectively (Boroditsky, 2000; Boroditsky & Ramscar, 2002; Duffy et al., 2014; Matlock et al., 2011; Ramscar et al., 2010; Sullivan & Barth, 2012). In the present experiment, the findings suggest that no such priming was inadvertently involved, and that either instrument alone would have sufficed when examining the effects of general emotional states (positive, neutral, negative) on temporal perspective. What to consider when choosing the type of emotion assessment to employ in this research area is discussed further in Chapter 8.

In the present research, findings were based on comparing the outcome of an experimental manipulation (i.e., emotion induction, event valence, or both) with the outcome when there was no such manipulation(s) (i.e., a control condition) (Critical Question 6). However, of the five published experiments also investigating the influence of an emotion manipulation(s) on responses to a future day TAQ (see Table 3 in Chapter 4), only one experiment made such a comparison (i.e., Hauser et al., 2009, Exp. 2), with the remaining experiments comparing two experimental conditions of which neither was a control condition. This latter type of comparison is the most popular type concerning TAQ responses generally in the current empirical literature (see Chapter 5), but this popularity is based on what Lakatos has rather harshly called “mob psychology” (1970, p. 178), for logic entails that the *full* effect of experimental manipulations may be known only when these manipulations are compared to what would happen in the absence of any such manipulation. Another popular comparison is examining the outcome of an experimental condition against a fifty-fifty split, but comparing against a fifty-fifty split is neither logically nor empirically supported (see Chapter 5). So would the TAQ and AQ outcomes have been different had the present research followed the “mob” or compared results against a fifty-fifty split (TAQ only) or compared results against an even three-way split (AQ only)? In other words, would there be more results of statistical significance? The answer is yes. Table 22 presents those results that were statistically significant (see Appendix W and Appendix X for a full listing of these alternative TAQ and AQ results, respectively). The important point is that the research waters regarding the cause-effect relationship between independent (emotion, event valence) and dependent (TAQ response, AQ response) variables may have been muddied further had the results of TAQ responses and of AQ responses from the present experiment been assessed in a manner commonly employed throughout the available empirical literature rather than in the logical manner argued for in Chapter 5.

Table 22

TAQ Responses and AQ Responses: Statistically Significant Results when Comparing Experimental Conditions Against Each Other Or Against a Fifty-Fifty Split (TAQ only) Or Against an Even Three-Way Split (AQ only)

Comparison	Result
TAQ responses	
Positive/Neutral vs. Negative/Negative	$\chi^2(1, N = 111) = 3.998, p = .046$[a]
Positive/Neutral vs. Negative/Neutral	$\chi^2(1, N = 111) = 4.811, p = .028$[a]
Positive/Neutral vs. Negative/Positive	$\chi^2(1, N = 107) = 5.119, p = .024$[a]
Positive/Neutral vs. Positive/Negative	$\chi^2(1, N = 107) = 4.232, p = .040$[a]
Positive/Positive vs. Negative/Neutral	$\chi^2(1, N = 109) = 4.042, p = .044$[a]
Positive/Positive vs. Negative/Positive	$\chi^2(1, N = 105) = 4.339, p = .037$[a]
Negative/Positive vs. fifty-fifty split	$\chi^2(1, N = 51) = 4.412, p = .036$[b]
Negative/Neutral vs. fifty-fifty split	$\chi^2(1, N = 55) = 4.091, p = .043$[b]
AQ responses	
Neutral/Positive vs. Negative/Neutral	$\chi^2(2, N = 111) = 6.975, p = .031$[a]
Neutral/Positive vs. Neutral/Negative	$\chi^2(2, N = 111) = 8.249, p = .016$[a]
Positive/Negative vs. third-third-third split	$\chi^2(2, N = 51) = 11.412, p = .003$[c]
Neutral/Negative vs. third-third-third split	$\chi^2(2, N = 55) = 7.127, p = .028$[c]
Negative/Neutral vs. third-third-third split	$\chi^2(2, N = 55) = 8.109, p = .017$[c]
Negative/Negative vs. third-third-third split	$\chi^2(2, N = 54) = 7.111, p = .029$[c]

Note: [a]Analysis is a chi-square test for independence and result is Pearson chi-square.
[b]Analysis is a chi-square goodness-of-fit against a hypothesised 50%/50% data split.
[c]Analysis is a chi-square goodness-of-fit against a hypothesised third/third/third data split.

With an effective emotion induction procedure and having compared the outcome of experimental manipulation(s) against the outcome in the absence of such manipulation(s) the other findings may now be interpreted. The present research did not find evidence that an incidentally-induced emotion and/or the valence associated with an event, either positive or negative, influenced either temporal perspective or temporal agency assignment. This may be interpreted as there being no relation between emotion and either temporal perspective or temporal agency assignment, but, this seems unlikely considering it is generally accepted that positivity and negativity are associated with approach- and avoidance-related motivation respectively (cf. Cacioppo et al., 1993; Chen & Bargh, 1999; Rinck & Becker, 2007). What seems more likely is that given the complexity of ways in which the influence of these factors may manifest via TAQ responses and via AQ responses as argued in this thesis (see Figure 6 in Chapter 4), it is perhaps unsurprising that no clear empirical picture has emerged. On this view, how should the data be interpreted? The answer is to consider these findings in light of the critical questions not yet addressed in this section. Also, the importance of null findings will be discussed further in the next chapter.

To begin with, in answer to Critical Question 1, it was argued earlier via conceptual analysis (see Chapter 4) that a TAQ and an AQ do not measure the same thing, namely, temporal perspective. The present study's results provide empirical support for that conclusion. Before discussing the breakdown of TAQ responses and AQ responses in this study and in earlier studies, it is worth noting that for AQ responses direct comparisons with earlier studies are not possible because the present work introduced a third AQ option (i.e., "Neither"). This option was included to cater for individuals who, having answered a TAQ and moved an event *forward* indicating either an MT or ME spatio-temporal perspective, then view both entities (i.e., observer and event) as stationary. A "Neither" option would also cater for individuals, who having answered Friday to a TAQ and who thereby feel that the distance between themselves and the event has now increased are puzzled by the two AQ options which mention “approaching”, that is, “to draw near”. A sizeable proportion of participants selected “Neither”, providing empirical evidence that such an option is warranted. In turn, this suggests that previous research obtained from the dichotomous alternatives of “The event is approaching me” and “I am approaching the event” may have forced some participants into selecting an option that did not reflect their thinking. Thus, future studies employing an AQ should consider providing three rather than two response options.

Although not statistically significant there was a greater proportion of “Neither” AQ responses when Friday TAQ responses exceeded Monday TAQ responses than vice versa, with such a pattern suggesting that a “Neither” AQ response following a Friday TAQ response may be due to some participants who view the two entities as stationary *and* to other participants who are puzzled by “approaching” after the event has been moved farther into the future, whereas, a “Neither” AQ response following a Monday TAQ response is more likely due only to the participants who view the two entities as stationary. In turn, this suggests that the AQ is influenced by TAQ responses, so that an AQ response cannot be considered as reflecting the conceptions in the same way as a previously answered TAQ.

Is an ME perspective always mappable onto an approach-related behaviour (Critical Question 2)? While the current literature claims that the answer is yes (Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012), nevertheless, the findings in these studies were inconsistent or problematic (see Chapter 4). The present study provides no empirical evidence to support such a claim. It argues instead for a more complex mapping of approach-related behaviour onto the ego-referenced spatio-temporal conceptual metaphors (see Figure 6 in Chapter 4). On this view, and coupled with an effective emotion-induction procedure, the present findings suggest that for some participants approach-related motivation involved reducing the temporal distance between observer and event (bringing the event closer to the observer) which manifests as a TAQ response of Monday, whereas for other participants approach-related motivation involved an observer moving toward an event and seeing the event as moving in the same *forward* direction as an observer which manifests as a TAQ response of Friday. This more complex view helps explain the seeming inconsistencies of past results (e.g., Hauser et al., 2009; Margolies & Crawford, 2008). Regarding this complex view the question becomes how researchers can tease apart which approach-related motivational pathway an individual adopts—this is discussed further in the next chapter.

In the case of a TAQ response, is it always appropriate to map "avoidance" onto an MT perspective (Critical Question 3)? The current literature claims that the answer is yes (Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012), but again the findings in these studies were inconsistent or problematic (see Chapter 4). The present study provides no empirical evidence to support such a claim. It argues instead for a more complex mapping of avoidance-related behaviour onto the ego-referenced spatio-temporal conceptual metaphors (see Figure 6 in Chapter 4). On this view, and coupled with an effective emotion-induction procedure, the present findings suggest that for some participants avoidance-related motivation involves "freezing" in the belief that the event is coming at them which manifests as a TAQ response of Monday, whereas for other participants avoidance-related motivation involves avoiding either by pushing away the event or by "freezing" in the hope that the event moves away, with both manifesting as a TAQ response of Friday. This more complex view helps explain the seeming inconsistencies of past results (e.g., Hauser et al., 2009; Margolies & Crawford, 2008). Regarding this complex view the question becomes how researchers can tease apart which avoidance-related motivational pathway an individual adopts—this also is discussed further in the next chapter.

It is worth noting that in the present study, the greater proportion of Monday TAQ responses compared with Friday TAQ responses across all conditions containing a negative manipulation (i.e., emotion and/or event valence) hints at negativity being associated with passivity or "freezing" (*it's coming at me*). That is, negativity coupled with a Monday TAQ response indicates that the observer is stationary and that the event is *moving forward* in its typical direction of forward motion. Also, the greater proportion of Friday TAQ responses compared with Monday TAQ responses across all conditions not containing a negative manipulation (i.e., emotion or event valence) hints at negativity being the stronger emotion because Monday TAQ responses are more common when incidentally-induced emotion and event valence are conflicting (positive emotion/negative event valence, negative emotion/positive event valence).

The present study was the first to ask whether, if emotion does have an effect on choice of time perspective (via TAQ response), there is any difference in effects between an incidentally-induced emotional state and an emotion felt toward a relevant external event, which is the one that is being moved (Critical Question 4). The present study did not find any effect of incidentally-induced emotional state, of an emotion elicited by an event, or, of incidentally-induced emotional state and an emotion elicited by an event whether summative or interactive on choice of time perspective. This failure to find differences in effects between an incidentally-induced emotional state and an emotion elicited by an event referred to in the TAQ could be taken as support for this study's claim, similar to Lewin (1935), that valence is not intrinsic to an event, but is a relation between person and event based on the person's own motivational orientations of approach and avoidance. On that basis, the failure to find differences in effects between an incidentally-induced emotional state and an emotion elicited by an event may be attributed to the complex mapping of approach- and avoidance-related behaviour onto the ego-referenced spatio-temporal conceptual metaphors as discussed above.

This was the first study to ask whether there are individual differences in the effects of emotion on TAQ and AQ responses (Critical Question 7). Specifically, it examined individual differences in spatio-temporal understanding and in temporal agency assignment across personality traits and more relatively stable negative emotional states, such as, trait test anxiety, social anxiety, and general negativity (i.e., depression, stress, anxiety). Based on TAQ responses, the present study provides no evidence to suggest that these factors influenced an individual's choice of temporal perspective. In contrast, based on AQ responses the evidence suggests that these factors influenced temporal agency assignment: temporal agency was more likely to be assigned to the event (TA perspective) than to the person (EA perspective) or to neither event nor person. Thus, for AQ responses, participants with higher levels of relatively stable negative emotional traits were more likely to assign temporal agency to an event rather than to themselves. That is, the person is passive. This supports the claim that temporal agency is more likely to be assigned to events when describing unpleasant events (McGlone & Pfiester, 2009). These differences in findings across personality-related factors and more general stable emotional states for TAQ responses and for AQ responses suggest that the two questions do not assess the same thing. They also highlight the importance of considering individual differences in metaphoric thinking of time (Hauser et al., 2009) and metaphoric thinking generally (Fetterman et al., 2016). Individual differences in metaphoric thinking will be discussed further in the next chapter.

It is possible that the emotion-induction procedures, positive and negative, may have influenced participants' responses on the three questionnaires assessing trait test anxiety, social anxiety, and, general negativity (i.e., depression, stress, anxiety). That is, participants experiencing a positive emotion may have responded less negatively than they would have otherwise whereas participants experiencing a negative emotion may have responded more negatively than they would have otherwise. The reason that the questionnaires were not administered at the beginning of the experimental procedure was to avoid the general negativity associated with the items in those questionnaires influencing the efficacy of the emotion-induction procedure. To avoid any potential influence of the emotion-induction procedure on subsequent responses to the three questionnaires, or vice versa, it would be advisable for future researchers to administer such questionnaires a few hours or a day before or after the TAQ portion of a study; traits are expected to remain relatively consistent across longer time-spans.

The present study investigated the influence of emotion on TAQ responses and on AQ responses, but for an AQ response one more influencing factor was also considered, one not previously considered in the literature: Is an AQ response influenced by a prior TAQ response? In other words, is an AQ response influenced by the response given to a prior TAQ rather than the emotion-induced approach- and avoidance-related motivations that may have influenced that TAQ response? The present study found that, regardless of assigned experimental condition, individuals who responded Monday to a TAQ were more likely to respond "The event is approaching me" to an AQ, whereas individuals who responded Friday to a TAQ were more likely to respond "I am approaching the event" to an AQ. This occurred even though a sizeable proportion of participants chose the "Neither" AQ option. This finding suggests that a TAQ response, rather than an experimental manipulation(s), influences a subsequent AQ response. As such, an AQ cannot be viewed as an independent measure when used in conjunction with a preceding TAQ as has been claimed in other studies (Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). Whether or not to employ an AQ in future studies involving the investigation of the metaphorical understanding of time will be discussed further in the next chapter.

Conclusion

As Popper asserts, null findings are criteria that "may allow us to recognize error and falsity….help[ing] us in groping our way out of the darkness of our cave" (1960/1985, p. 55). This chapter has argued that the mostly null findings of Experiment 2 not only show that the simplistic mappings of approach motivations onto an ME perspective and avoidance motivations onto an MT perspective in the current literature are inadequate, but also help to explain the inconsistencies of past results (e.g., Hauser et al., 2009; Margolies & Crawford, 2008). The ramifications of adopting a more complex theoretical approach regarding how the influence of emotion may manifest via TAQ responses and via AQ responses, and how a TAQ and an AQ each assess different things, are discussed further in the final chapter, and will be related to attempts to bring research into the metaphorical understanding of time out of "the darkness of…[its] cave".

CHAPTER 8

General Discussion

The overall aim of this project was to investigate the role of emotion on the metaphoric understanding of time, specifically, on the ego-reference point conceptual metaphors of MT and ME. The limited number of studies in this research area (Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) have produced anomalous results. From adopting the broader conception of scientific method as suggested by Machado and Silva (2007), a conception that included interrogating these four recent studies, the wider literature, and the methodological and statistical issues, ten critical questions were developed. The solutions, strategies, and predictions based on the ten critical questions formed a basis for the two experiments conducted in the present study. The first experiment provided evidence for the efficacy of an emotion-induction method (film, text) being dependent on the valence of the induced emotion. The second experiment failed to find any effect of emotion or event valence on metaphoric understanding of time. It will be argued that the empirical and theoretical implications of the present study point to an enriched understanding of the relation between emotion and temporal perspective.

Embodied Cognition and Conceptual Metaphor: An Embodied and Non-Representationist View

This enriched understanding begins with positioning Conceptual Metaphor Theory (CMT) within a coherent theoretical framework. This requires that CMT sits within an area of embodied cognition (EC) which requires *both* embodiment and a direct realist rejection of representationism. A rejection of representationism is consistent with the position adopted by *some* cognitive researchers (e.g., Beer, 1995, 2014; Chemero, 2009, 2013; Gallagher, 2005, 2008; Hutto & Myin, 2013, 2014; Gibson, 1966, 1979; Thelen & Smith, 1994; van Gelder, 1995, 1998), but contrary to *other* cognitive researchers who accept representationism (e.g., Barsalou, 1999, 2008, 2009, 2010; Clark, 1997, 2011; Glenberg, 1997, 1999; Keijzer, 2002; Markman & Dietrich, 2000a, 2000b; Pecher et al., 2004; Sutton et al., 2010; Wilson, 2002). As argued here the logical problems of representationism (Anderson, 1927/1962; Maze, 1983, 1991; McMullen, 2011) mean that it does not provide an adequate framework for explaining empirical findings. Moreover, as argued earlier in Chapter 2, criticisms of EC or CMT typically relate to either a representationist view or a misunderstanding of claims made (e.g., EC: Adams, 2010; Laakso, 2011; Goldinger et al., 2016; Mahon & Caramazza, 2008; CMT: Kertész & Rákosi, 2009; McGlone, 2007, 2011; Murphy, 1996). A direct realist EC position avoids the former and further employment of conceptual analysis helps to avoid the latter.

Emotion

When studying the effect of emotion it is important that participants be in the required emotional state. However, as argued here, a more critical approach concerning how individuals come to be in that desired emotional state is required to provide clarity to the emotion-induction process. In taking a critical approach, the present study highlights the importance of considering four specific factors: the source of the emotion, whether a desired emotion has been experimentally induced, the choice of emotion-induction assessment instrument, and the choice of emotion-induction stimulus.

The Source of Emotion Must Be Considered

This was the first study to consider the question whether the source of the emotional state matters. It investigated both separately and jointly the effects of incidentally-induced emotion (positive, neutral, negative) and event-valence emotion (positive, neutral, negative) on choice of temporal perspective. As will be discussed later, in the present study the failure to find an effect of emotion or event valence (Experiment 2) may be attributed to the complex mapping of approach- and avoidance-related behaviour onto the two ego-reference-point spatio-temporal conceptual metaphors ME and MT. Therefore, although the present study found no effect of emotion on choice of temporal perspective via TAQ responses, it remains a relevant question for future research whether – if emotion does have an influence - being in an incidentally-induced emotional state and being in an emotional state vis-à-vis some event referred to in a TAQ, have different effects on choice of temporal perspective. Furthermore, if an incidentally-induced emotional state is the variable of interest, then it may be important for researchers to avoid a possible influence of event valence by employing a neutrally valenced TAQ event (e.g., meeting, event).

Has the Required Emotion Been Experimentally Induced?

The present study employed pre- and post-manipulation checks to determine whether the required emotion had been experimentally induced (Exp. 1 and Exp. 2). This allows for the claim, made in both experiments, that the emotion induction procedure (EIP) was responsible for a desired emotional state. Such a claim is suggested implicitly in earlier studies employing a post-manipulation check only (i.e., Lee & Ji, 2014, Exp. 4; Margolies & Crawford, 2008, Exp. 2; Richmond et al., 2012, Exp. 3 & 4). However, a post-manipulation check alone may only establish that participants are in a desired state, not that an EIP was responsible for them being so. Therefore, to justify any claim that an EIP is responsible for a desired emotional state, pre- and post-manipulation checks are important. In addition, pre- and post-manipulation checks will help assess the efficacy of an emotion-induction procedure relative to other EIPs, and prevent any one EIP being unjustifiably (and perhaps incorrectly) claimed to be superior to another EIP.

Choice of Emotion Assessment Instrument

The reliability of the PANAS across Experiments 1 and 2 suggests that the positive emotion and the negative emotion induced by the text-based EIP was well captured by this instrument. This is despite the positive emotion induced by the text, a mixture of happiness, calmness, and cheerfulness, not appearing *prima facie* to correlate with some of the positive affect items of the PANAS (e.g., *active, alert, determined, proud, strong*), and the negative emotion induced by the text, a mixture of sadness, depression, gloominess, and apprehension, not appearing *prima facie* to correlate with some of the negative affect items of the PANAS (e.g., *ashamed, guilty, hostile, irritable*). The present findings support Watson & Clark's (1997) claim that happy and sad emotions overlap with the PANAS subscale items.

Even so, it would be methodologically sound to safeguard any comparison of different EIPs by considering the specific content of the inducing medium, together with its relationship to the specific items on the measuring instrument. To illustrate, in Experiment 1, there was a superior effect of film (i.e., *Misery*) compared with text as a negative EIP perhaps due to the specific type of negative emotion induced by the film which, in comparison to the negative emotion induced by the text, seemed to better correlate with the negative affect items of the PANAS (*afraid, ashamed*, *distress*, *guilty*, *hostile*, *irritable*, *jittery*, *nervous*, *scared*, *upset*).

Choice of Emotion-Induction Stimulus

The present study found support for text (Exp. 1 and Exp. 2) and film (Exp. 1) as being effective EIPs. Text was chosen as the EIP for Experiment 2 because in Experiment 1 it performed as expected across all three emotion conditions (positive, neutral, negative), whereas the neutral film condition did not perform as expected, between the positive and negative film. Another reason for employing text rather than film in Experiment 2 was the ability to control a character's movements to prevent motion being a confounding element. Thus, while efficacy is a primary factor when selecting an EIP, it is worth considering other possible factors in an EIP that may influence experimental investigations.

The Relationship Between Approach- and Avoidance-Motivations and Temporal Perspectives

The focus of this project was the role of emotion on the metaphoric understanding of time, specifically, the ego-reference point conceptual metaphors of MT and ME. The link between how a perceiver thinks of an event's movement through time and the emotional state of that perceiver was conceived in terms of approach and avoidance motivations.

In the present project, conceptual analysis revealed that the simple mapping of *all* approach-related behaviour onto an ME perspective and *all* avoidance-related behaviour onto an MT perspective, as assumed in the literature, (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) does not sufficiently reflect the complexity of the situation. That is, the embodiment of positive emotion as approach-related behaviour or the embodiment of those types of negative emotion (e.g., anger) that manifest as approach-related behaviour (i.e., attack) gives rise to two possible outcomes for a TAQ: an observer may either wish to decrease the temporal distance between himself or herself and the event (MT perspective) or think in terms of moving toward the event, thus, projecting his or her typical direction of forward movement (futureward) onto the event (ME perspective). For those negative emotions that are embodied as avoidance-related behaviour there are two possible outcomes for a TAQ: an observer may "avoid" by pushing away the event (ME perspective) or by "freezing" either in the hope that the event moves away (ME perspective) or believing that the event is coming at him or her (MT perspective).

Experiment 2 failed to find any effect of emotion on metaphoric understanding of time despite employing an effective emotion induction procedure and having sufficient power regarding the analysis of the effect. This finding is consistent with the finding from Hauser et al. (2009).[38] The other three published studies investigating the role of emotion on temporal perspective (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) did not include a control condition, so it is not possible to assess accurately the effects of those experimental manipulations. The present study's results should not necessarily be taken as confirming that such an effect does not exist (although they are consistent with it), but, rather, as being consistent with the complexity of ways in which approach- and avoidance-related motivations may manifest via TAQ responses. For instance, for avoidance-related motivations, one participant may have answered Friday to the TAQ, "freezing" in the hope that the event moves away, whereas another participant may have answered Monday to the TAQ, "freezing" in the belief that the event is coming at him or her. So, both participants are "avoiding" but this avoidance is not clearly indicated via TAQ responses. In future research it may be worth assessing what type of approach- and avoidance-related motivation pathway is more likely for each participant. For instance, participants could be presented with images of unpleasant situations and asked to indicate whether they want to push the image away, move away from the image, or neither. In addition, they could be presented with images of pleasant situations and asked to indicate whether they want to move toward the image or to bring the image toward

[38] As noted earlier in Chapter 4, in Hauser et al. (2009) it is possible that presenting the AQ on the same page as the TAQ may have primed participants to think in terms of approach, of *reducing* the distance, when answering the TAQ. Thus, it is possible that those results may have been confounded. The present study presented the TAQ and the AQ on separate pages.

them. A behavioural assessment might involve having participants hold images of unpleasant situations and monitoring whether they are more likely to move their head or body away from the image, move the hand holding the image away from their body, or no movement. In addition, participants asked to hold images of pleasant situations could be monitored for whether they are more likely to move their head or body toward the image, or move the hand holding the image toward their body. These types of *a priori* assessments would provide additional information to aid in the interpretation of each participant's TAQ response.

Choice of Temporal Perspective: Are the Standard Measures Appropriate?

Earlier researchers (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) investigating the role of emotion on the metaphoric understanding of time have employed a TAQ and an AQ as indicators of temporal perspective. However, the complexity involved in discerning how the influence of emotion on temporal perspective manifests via TAQ responses, as discussed above, raises the question: Is a TAQ an appropriate measure of temporal perspective? The answer is yes, albeit with consideration of potential confounding factors that may influence TAQ responses. Regarding an AQ, the present study has demonstrated that this question does not assess temporal perspective in the same manner as a TAQ;[39] hence, it is problematic to use an AQ as an alternative measure of temporal perspective to a TAQ. What to consider regarding the use of a TAQ or an AQ for future research will now be addressed in more detail.

TAQ: Keep as a dependent variable but consider potential confounds. With nothing to indicate an event's direction of motion, a TAQ appears to be a suitable assessor of metaphoric

[39] In a recent study, Duffy and Evans (2016) noted that the inconsistency between TAQ and AQ responses may be due to the "different nature of the two questions" (p. 5); that is, that a TAQ portrays a temporal scene whereas an AQ portrays a spatial scene. Despite this, they nevertheless go on to claim of their empirical findings that MT and ME perspectives were reflected via both TAQ and AQ responses.

understanding of time with respect to whether temporal perspective is MT or ME. A TAQ allows for temporal understanding via either a distance-change view or temporal agency assignment. However, it is worth considering at least three factors when employing a TAQ to investigate the role of emotion on metaphoric understanding of time. These three factors are the influence of motion (actual or imagined), the influence of event valence, and the influence of TAQ formulations that contain personal pronouns.

The first factor is the influence of motion on choice of temporal perspective. This influence has been demonstrated empirically (Boroditsky, 2000; Boroditsky & Ramscar, 2002; Duffy et al., 2014; Matlock et al., 2011; Ramscar et al., 2010; Sullivan & Barth, 2012). In Experiment 2 of the present study three steps were taken to prevent motion (actual or imagined) influencing an individual's metaphoric understanding of time. Two steps were related to the emotion induction procedure: in the positive emotion and negative emotion induction text passages the character portrayed was sitting, and the two emotion assessment instruments used allowed for greater control of any potential confounding effect of motion than other instruments (e.g., affect rating dial measure [Gottman & Levenson, 1985; Levenson & Gottman, 1983], Affect Grid measure [Russell et al., 1989]). The other step was that participants were seated for a period of time before answering the TAQ. Eliminating all motion may not be possible, but the more it can be controlled the less likely it can intrude as a potential confounding factor.

The second factor is the influence of event valence on TAQ responses. The present study and other studies (e.g., Hauser et al., 2009; Margolies & Crawford, 2008) have presented logical, albeit somewhat different, arguments as to why event valence is expected to influence choice of temporal perspective. These arguments are rooted in the understanding of conceptual metaphor as being embodied. However, if interest is focused specifically on the effect of an incidentally-induced emotion on temporal perspective, then it would make sense to employ a neutrally valenced TAQ event (e.g., meeting, event) to control for a potential confound of event valence. Conversely, if interest is focused specifically on the effect of event valence, then it would be worth considering that there may be individual differences regarding valence because, as argued in this thesis, valence is a relation between organism and object.

The third factor is that, unless interest is focused specifically on the influence of personal pronouns on TAQ responses (see Feist & Duffy, 2015) or on the influence of *who* is doing the moving of the temporal event, it is best to avoid a TAQ that specifies a person (e.g., I, you, she/he) as moving the event forward. Recognising how the wording of a TAQ influences metaphoric understanding of time will help researchers control for potential confounds and better interpret results, thus, bringing greater clarity to this research area. Indeed, without a study-specific reason to vary the form of the TAQ, it might be worth researchers agreeing to employ a single version of the TAQ (i.e., single event, no personal pronouns). In this way, a standardised TAQ used across studies would help control the influence of the potential confounding factors of event valence and personal pronouns as discussed here.

AQ: Discard as a dependent variable. The present study demonstrated that an AQ is not an alternative measure of temporal perspective to a TAQ despite the AQ being used in this manner in the literature (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). That is, regarding approach and avoidance motivations, positivity or negativity regarding an event may be indicated via temporal distance change (in the TAQ response) or via temporal agency assignment (in the TAQ response, in the AQ response). With respect to the ego-referenced direction of movement of an event *moved forward* it appears that TAQ responses provide information on how individuals think about time via metaphor: an ME perspective moves the event forward in the ego's typical forward direction, the event moves futureward, whereas, an MT perspective moves the event forward in the event's typical forward direction, the event moves pastward. For either TAQ response the event's movement results in temporal distance change between the observer and the event: an ME perspective increases the distance whereas an MT perspective decreases the distance. In contrast, an AQ asks for information solely regarding agency assignment with *both* AQ response alternatives in the literature ("I am approaching the event"; "The event is approaching me") indicating a *reduction* in temporal distance between observer and event. An AQ response requires a categorisation that reflects the identified moving agent (i.e., an ego-agency or time-agency) rather than reflects a temporal perspective. It seems clear, therefore, that an AQ should not be employed as an alternative measure to a TAQ. For the same reason, the statistically significant AQ results of previous studies (Hauser et al., 2009; Margolies & Crawford, 2008; Richmond et al., 2012) may not be indicative of an individual's temporal perspective.

Indeed, it is difficult to interpret AQ results from previous studies (Hauser et al., 2009; Margolies & Crawford, 2008; Lee & Ji, 2014; Richmond et al., 2012) for three reasons. First, as demonstrated conceptually and empirically in the present study, there is a requirement for a third AQ option of "Neither". That is, a "Neither" AQ option would be applicable for participants who, having answered a TAQ that moves an event *forward* indicating either an MT or ME spatio-temporal perspective, then view both entities (i.e., observer and event) as stationary, or who, having answered Friday to a TAQ and who thereby feel that the distance between themselves and the event has now increased, are puzzled by the two AQ options which mention "approaching" (i.e., "to draw near"). In Experiment 2, a sizeable proportion of participants selected a "Neither" option. Without a "Neither" option, this suggests that previous research obtained from the dichotomous alternatives of “The event is approaching me” and “I am approaching the event” may have forced some participants into selecting an option that did not reflect their thinking. The second reason is that as argued in the present study it is possible that an AQ response is influenced more by a preceding TAQ response than by an experimental manipulation. After all, an AQ is asking a question about a TAQ so it is reasonable to assume that how an individual responds to a TAQ will influence their response to the subsequently asked AQ. That is, if only asked how they felt about a positive future event, a participant may respond with “I am approaching the event”, but, if the “approaching” question were asked after a TAQ and that same participant had responded Monday to the TAQ because they wanted the positive event to be temporally closer, then that TAQ response *rather than* solely the view of the event as positive may influence the participant to respond “The event is approaching me” to an AQ. In the present study, regardless of assigned experimental condition, individuals who responded Monday to a TAQ were more likely to respond “The event is approaching me” to an AQ, whereas individuals who responded Friday to a TAQ were more likely to respond “I am approaching the event” to an AQ. The third reason is that, with the exception of Hauser et al. (2009), the previous research in this area did not include a control condition and, as argued earlier in Chapter 5, the *full* effect of experimental manipulations may be known only when these manipulations are compared to what would happen in the absence of any such manipulation.

Assessing the Full Effect of an Experimental Manipulation Requires a Control Condition

Similar to Hauser et al. (2009), the present study found a lack of effect of emotion on choice of temporal perspective via TAQ responses. The present study’s finding may only be compared with that of Hauser et al. (2009) because the other three published studies in this research area (Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012) did not include a control condition. The statistically significant results from Lee and Ji (2014) and Richmond et al. (2012) are not considered here for empirical comparison because those results were obtained by comparing two experimental conditions, of which neither was a control condition. As demonstrated in Experiment 2, the present study would have found some statistically significant findings had two experimental conditions (neither a control condition) been compared or had an experimental condition been compared with a hypothesised fifty-fifty split (see Table 22 in Chapter 7)—both of these comparison options are found in the current TAQ literature—but, as argued earlier in Chapter 5, the former is not logically appropriate if wishing to assess the *full* effect of an experimental manipulation and the latter is logically and empirically unwarranted. Therefore, of the four published studies and the present study, it is only the present findings based on an inclusion of a control condition and the presentation of a TAQ and an AQ on separate pages that, in the absence of any confounding factor, allow for assessment of the influence of emotion on choice of temporal perspective.

As discussed in Chapter 5 there is a paucity of control conditions across the current TAQ research literature. The present control condition findings indicate a slight preference for Friday TAQ responses (51.8%, Exp. 2). Boroditsky (2000), Núñez (2007), and Sullivan and Barth (2012) report a preference for answering Friday with figures of 54.3%, 61%, and 77%, respectively, whereas, McGlone and Harding (1998), Hauser et al., (2009), and Ramscar et al. (2010) report a preference for answering Monday with figures of 57.1%, 71%, and 51%, respectively. Therefore, a clear picture regarding default preferences has yet to emerge empirically. According to Duffy and Feist “lifestyle and personality factors influence people’s temporal perspective, precluding a universal ‘neutral’ context” (2014, p. 45). These researchers found that individuals who respond Friday tended to have higher scores on procrastination and rate higher in extroversion than individuals who respond Monday, suggesting that these personality factors may influence temporal perspectives. In the present study, the personality factors of trait test anxiety, social anxiety, or general emotional negativity did not influence TAQ responses.

Individual Differences

To date, individual differences in metaphoric thinking have received very little attention (Fetterman et al., 2016; Hauser et al., 2009). Within the published research examining the metaphoric understanding of time only two studies included an investigation of personality factors (cf. Hauser et al., 2009, Exp. 1, trait anger; Richmond et al., 2012, Exp. 2 & 3, personal agency, trait anxiety). The present project (Exp. 2) empirically investigated the relation between negative traits (i.e., trait test anxiety, social anxiety, general negativity [i.e., depression, stress, anxiety]) and TAQ and AQ responses. The traits were found to be related to AQ responses but not to TAQ responses. Specifically, for AQ responses, temporal agency was more likely to be assigned to the event (TA perspective) than to the person (EA perspective) or to "Neither" option. However, these findings must be interpreted with caution because of a potential confound due to a TAQ response influencing a subsequent AQ response, as discussed above. Regardless of any potential confound in the present project, assessment of individual differences appears to be a promising direction to take in future research, so that any such difference(s) may be revealed and used to better inform the experimental outcomes.

A recent study by Fetterman et al. (2016) has drawn attention to another important individual difference regarding the investigation of conceptual metaphor: high versus low metaphor usage preferences. These authors argue that individuals accustomed to thinking and using metaphors are more susceptible to conceptual metaphor effects than individuals who tend to think in more literal terms. The Metaphor Usage Measure (MUM: Fetterman et al., 2016) was developed to identify whether an individual is a high or low metaphor user. In one experiment, Fetterman et al. failed to find an expected metaphor transfer effect (i.e., dark-negative, light-positive) of neutral words being evaluated with greater negativity when presented in a darker, as opposed to a lighter, font colour (see Meier et al., 2004, 2015). However, an effect of metaphor usage was found with high (but not low) metaphor users rating neutral words more negatively when they were presented in black (versus white) font. These results suggest that metaphor use influences the black negativity effect, something that would have remained hidden had the MUM not been employed. Therefore, including the MUM in future research would help reveal whether an effect (or a lack of effect) was due to the conceptual metaphor effect under investigation alone or whether metaphor use had an influence. However, it is not clear what, if any, benefit would have accrued from employing the MUM in the present study because it was not an investigation of conceptual metaphor effects.

Identifying Errors in the Literature: Aiding Empirical Clarity

The present study sought to add to the increasing groundswell of critical scrutiny of experimental research programs in psychology that questions the appropriateness of the statistical analyses employed and the accuracy of the values reported (e.g., Bakker & Wicherts, 2011, 2014; Nuijten et al., 2015; Wicherts et al., 2011). This project's research synthesis and meta-analysis across TAQ studies identified a number of errors within the literature (e.g., misreporting of participant numbers, of degrees of freedom, and of p values, and problems concerning the type of statistical analysis conducted). Granted, most researchers do not have the time to undertake a review of the empirical research in their area as comprehensive as the review undertaken in the present study. Nevertheless, where there is time to review, any identified flaws or problems in the empirical research deserve attention. In a survey of 3,247 researchers, Martinson et al. found that 12.5% of respondents overlooked "others' use of flawed data or questionable interpretation of data" (2005, p. 737). This situation may have been one factor that allowed articles by Diederik Stapel to be published (Stapel Investigation, 2012), articles subsequently found to contain fraudulent data.

Questioning the appropriateness of the statistical analyses employed and the accuracy of the values reported in the literature is part of a current shift of perspective within psychology. Included in this shift of perspective is a renewed acceptance of the value of null findings and of experimental replications.

The Current Research *Zeitgeist*: A Welcome Shift in Perspective

Null Findings

In the preceding chapter I noted Popper's assertion that null findings are criteria that "may allow us to recognize error and falsity….help[ing] us in groping our way out of the darkness of our cave" (1960/1985, p. 55). Despite this assertion, until recently, the standard view concerning null findings within psychology was to ignore them. This aversion to null findings is "arguably one of the most pernicious and unscientific aspects of modern social science" (Ferguson & Heene, 2012, p. 558). The discounting of such findings is shown by researchers being more likely to submit articles for publication that report statistically significant results rather than report statistically nonsignificant results (Coursol & Wagner, 1986; Greenwald, 1975) and by publishers being more likely to publish studies with statistically significant results (Dwan et al., 2008; Ferguson & Brannick, 2012; Gerber & Malhotra, 2008b). Such publication bias is not a new phenomenon (e.g., McNemar, 1960; Smart, 1964; Sterling, 1959). Irrespective of whether the imperative for statistically significant results comes from researchers, reviewers, or editors, there is evidence to suggest that researchers feel under pressure to produce "publishable" results and pressure may manifest in unscientific ways. For instance, a meta-analysis of surveys asking scientists if they had committed or if they knew of a colleague that had committed research misconduct found responses in the affirmative at approximately 2% for the former and approximately 14% for the latter (Fanelli, 2009). These figures should be considered as being deceptively low with individuals less likely to admit their own wrongdoing and the scientists being fuzzy on the difference between modifying research and falsifying research (Fanelli, 2009). Whether null findings are ignored or "modified" such "genuflecting at the altar of $p < 0.05$" (Osborne, 2010, p. 3) produces biases in the available literature misrepresenting the real situation and thus impeding genuine scientific progress.

A publication bias toward statistically significant results ignores that "*the* criterion of the scientific status of a theory is its falsifiability, or refutability, or testability" (Popper, 1963, p. 37). Failure to disseminate null findings contributes to conceptual unclarity. Conceptual unclarity may render later research futile, misleading, or limit understanding of experimental results and their theoretical implications (Bennett & Hacker, 2003). A recent change of attitude toward null findings attempts to combat these negative implications.

One example of this attitudinal change is the pre-registration process implemented in some journals (e.g., *Cognition and Emotion, Experimental Psychology, Perspectives on Psychological Science, Psychological Science*). Preregistration involves detailing aspects of a study for peer review in advance of conducting the study (e.g., research rationale, hypotheses, design, participants, materials, and analytic strategies). Pre-registering shifts the focus away from results and helps researchers to remember that the goal "is not to publish as many articles as we can, but to discover and disseminate truth" (Simmons, Nelson, & Simonsohn, 2011, p. 1365). A successful pre-registration of a study means that researchers may complete the study with the knowledge that statistically nonsignificant results will not be a criterion for nonpublication of the study's findings. However, a successful pre-registration does not guarantee publication, because a study may be rejected on other grounds (e.g., failing to employ pre-registered manipulation checks). Pre-registration increases the likelihood that more studies with null findings will be published.

Within the current, and more scientific, research perspective that shifts the value of research away from a focus on statistically significant results the question remains how should the present project's mostly null findings be evaluated? The answer lies in the information provided via the clarification of theoretical assumptions and the strength of the study's design. The present project sought to provide clarification of theoretical assumptions and a more accurate picture of what has, and what has not, been empirically supported in the literature regarding the metaphoric understanding of time in general and how such metaphoric thinking relates to emotion in particular. The present study's design provided an effective emotion induction procedure, adequate measuring techniques, and controlled for a possible confound of motion. The individual and joint effects of emotion and event valence (valence as a relation) were investigated and the implications of teasing apart these effects were discussed. The importance of utilising a control condition and appropriate statistical analyses to assess the full effect of experimental manipulations was demonstrated. Theoretical analysis revealed a previously unacknowledged level of complexity regarding how TAQ responses indicate approach and avoidance motivations. Theoretical analysis in conjunction with empirical findings relating to the effect of traits and more general stable emotional states have demonstrated that the TAQ and the AQ should not be considered as measuring the same thing, namely, temporal perspective. Overall, this study has provided a thoroughgoing assessment of existing assumptions and existing empirical findings, and highlighted numerous points whose consideration would make a positive contribution to future research.

Reproducibility

As discussed in Chapter 7, Experiment 2 served as a conceptual replication of other studies (i.e., Hauser et al., 2009; Lee & Ji, 2014; Margolies & Crawford, 2008; Richmond et al., 2012). Replications are important in all scientific research endeavours but perhaps more so in relatively young theoretical areas such as conceptual metaphor where a clear picture has yet to emerge. However, within psychology in general and similar to the case with null findings as discussed above, experimental replications have been out of favour; novelty has been privileged over reproducibility. This aversion to replication is somewhat surprising given that replication is considered "a cornerstone of science" (Association for Psychological Science, n.d.) and that the reproducibility of findings is a better indicator of a "good" experiment than statistical significance (Lykken, 1968). Yet again, however, the current *zeitgeist* suggests a shift in attitude with researchers starting to agree with Tukey that "[c]onfirmation comes from repetition" (1969, p. 84).[40] For instance, there are now widespread replication collaborations between researchers, including Open Science Collaboration (2015), where from 100 selected studies 39% of replications were successful, and Open Science Center: Many Labs 3 (2015), where from 10 selected studies 7 could not be replicated. Also, the journal *Perspectives on Psychological Science* has introduced registered replication reports where a pre-registered direct replication of

[40] As may be seen by the references to Lykken (1968) and Tukey (1969) the current *zeitgeist* is not a new phenomenon, but, rather, a return to an earlier position.

an original study is made publically available in the hope that other researchers will conduct such a replication and the results from those series of independently conducted studies are published as one report. A 2016 registered replication report by Eerland, Sherrill, Magliano, and Zwaan did not replicate the effects found in the original Hart and Albarracín (2011) study. In a similar but somewhat different vein, Schweinsberg et al. (2016) have attempted, with the help of crowdsourcing, to replicate experiments prior to publication. Before the advent of the internet, Lykken (1968) had deemed such pre-publication reproducibility an ideal but impractical goal. In commenting on the fraud case involving Diederik Stapel of Tilburg University in the Netherlands, the former APS president Henry Roediger (2012) noted that "if others had tried to replicate his [i.e., Stapel's] work soon after its publication, his misdeeds might have been uncovered much more quickly". Therefore, replications are to be valued and rather than view the low rate of successful replications as a "crisis" (Pashler & Harris, 2012), an alternative view would be to see them as a "healthy corrective" (Bohannon, 2014) which can only benefit psychology.

Experiment 2 in the present study is but a single experiment investigating the role of emotion on the metaphoric understanding of time. A single experiment, whether with statistically significant or nonsignificant results, cannot be decisive. Although every attempt was made to design the study with a strong theoretical foundation and hypotheses which were logically derived from the theory, nevertheless, it remains just a single study and, as such, in need of replication.

Conclusion

The influence of emotion on our metaphoric understanding of time is more theoretically complex, and is less empirically clear, than researchers have so far assumed. The present project offers us, as researchers in conceptual metaphor, an opportunity to reassess the current norms, and, in turn, to establish a more robust theoretical and empirical approach, from a rigorously developed scientific perspective. By continuing to favour a broader approach to science that includes conceptual analysis, null results, and replications, we can redirect along more fruitful lines empirical inquiry into the effect of emotion on temporal perspective.

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APPENDICES

Appendix A
Definitions of Affective Phenomena

Affective phenomena	Definition
Emotion	A relatively brief episode of coordinated brain, autonomic, and behavioural changes that facilitate a response to an external or internal event of significance for the organism.
Feelings	The subjective representation of emotions.
Mood	A diffuse affective state that is often of lower intensity than emotion, but considerably longer in duration.
Attitudes	Relatively enduring, affectively coloured beliefs, preferences, and predispositions toward objects or persons.
Affective style	Relatively stable dispositions that bias an individual toward perceiving and responding to people and objects with a particular emotional quality, emotional dimension, or mood.
Temperament	Particular affective styles that are apparent early in life, and thus may be determined by genetic factors.

Note: This table is based on definitions outlined by Davidson et al. (2003, p. xiii)

Appendix B

Database Search Results—Journal Articles that Cite One or More of the Seven Base Articles

Study	Databases			Studies cited						
	psycINFO	Scopus	Google Scholar	1998 McGlone and Harding	2000 Boroditsky	2004 Motz and Núñez	2006 Núñez et al.	2007 Ballinger et al.	2009 Hauser et al.	2010 Kranjec at al.
Aaltola, M. (2011). Agile small state agency: Heuristic plays and flexible national identity markers in Finnish foreign policy. *Nationalities Papers, 39*(2), 257-276.		*	*		*					
Ahrens, K., & Huang, C. R. (2002). Time passing is motion. *Language & Linguistics*, *3*(3), 491-519.			*	*						
Alibali, M. W., & Nathan, M. J. (2012). Embodiment in mathematics teaching and learning: Evidence from learners' and teachers' gestures. *Journal Of The Learning Sciences*, *21*(2), 247-286. doi:10.1080/10508406.2011.611446	*	*	*		*					
Alloway, T., Corley, M., & Ramscar, M. (2006). Seeing ahead: Experience and language in spatial perspective. *Memory & Cognition*, *34*(2), 380-386.	*		*	*	*					
Amin, T. G. (2009). Conceptual metaphor meets conceptual change. *Human Development*, *52*(3), 165-197. doi:10.1159/000213891	*		*		*					
Amorim, M., Isableu, B., & Jarraya, M. (2006). Embodied spatial transformations: 'Body analogy' for the mental rotation of objects. *Journal Of Experimental Psychology: General*, *135*(3), 327-347. doi:10.1037/0096-3445.135.3.327	*		*		*					
Arcimavičienė, L. (2011). The Complex Metaphor of Political Animals in Media Political Discourse: a Cross-Linguistic Perspective. *Kalbų Studijos*, (19), 95-100.			*		*					
Arik, E. (2012). Space, time, and iconicity in Turkish sign language (TID). *Trames*, 16(4), 345-358. doi: 10.3176/tr.2012.4.03			*	*			*			
Athanasiadou, A. (2007). Before and after: Relations of anteriority and posteriority along paths of conceptual structure. *Annual Review of Cognitive Linguistics*, *5*(1), 1-26. [a]			*	*	*					
Ballinger, A., Sacerio, L., Carrasco, A., Elgart, S., Jacobson, R., Tsai, J., & Zoromsk, A. (2007). Imagined Spatial Motion and Spatiotemporal Metaphors. *The Wesleyan Journal of Psychology*, *2*, 7-18. ^			*	*	*					
Bar-Anan, Y., Liberman, N., & Trope, Y. (2006). The association between psychological distance and	*		*		*					

Study	Databases			Studies cited						
	psycINFO	Scopus	Google Scholar	1998 McGlone and Harding	2000 Boroditsky	2004 Motz and Núñez	2006 Núñez et al.	2007 Ballinger et al.	2009 Hauser et al.	2010 Kranjec at al.
construal level: Evidence from an implicit association test. *Journal Of Experimental Psychology: General*, *135*(4), 609-622. doi:10.1037/0096-3445.135.4.609										
Bargh, J. A. (2006). Agenda 2006: What have we been priming all these years? On the development, mechanisms, and ecology of nonconscious social behavior. *European Journal Of Social Psychology*, *36*(2), 147-168. doi:10.1002/ejsp.336	*		*		*					
Barrett, L., Henzi, P., & Dunbar, R. (2003). Primate cogntion: From 'what now?' to 'what if?'. *Trends In Cognitive Sciences*, *7*(11), 494-497. doi:10.1016/j.tics.2003.09.005	*		*		*					
Barsalou, L. W. (2008). Grounded cognition. *Annual Review Of Psychology*, *59,*617-645. doi:10.1146/annurev.psych.59.103006.093639	*		*		*					
Bartczak, M. (2009). A notional level of cognitive distortions in depression: Does it exist? A voice for interdisciplinarity in studying cognitive functioning of individuals with depressive disorders. *Polish Psychological Bulletin*, *40*(4), 58-71. doi:10.2478/s10059-009-0016-0	*		*		*					
Behrendt, R. (2010). Contribution of hippocampal region CA3 to consciousness and schizophrenic hallucinations. *Neuroscience And Biobehavioral Reviews*, *34*(8), 1121-1136. doi:10.1016/j.neubiorev.2009.12.009	*	*	*		*					
Behrendt, R. (2013). Conscious experience and episodic memory: Hippocampus at the crossroads. *Frontiers In Psychology*, *4*.	*	*	*		*					
Behrendt, R. (2013). Hippocampus and consciousness. *Reviews In The Neurosciences*, *24*(3), 239-266. doi:10.1515/revneuro-2012-0088 [a]	*	*	*		*					
Bell, R. A., McGlone, M. S., & Dragojevic, M. (2013). Bacteria as Bullies: Effects of Linguistic Agency Assignment in Health Message. *Journal of health communication*, (ahead-of-print), 1-19.			*	*						
Bell, R. A., McGlone, M. S., & Dragojevic, M. (2013). Vicious viruses and vigilant vaccines: Effects of linguistic agency assignment in health policy advocacy. *Journal of health communication*, (ahead-of-print), 1-18. 10.1080/10810730.2013.811330			*	*						
Bender, A., Beller, S., & Bennardo, G. (2010). Temporal frames of reference: Conceptual analysis and empirical evidence from German, English, Mandarin Chinese and Tongan. *Journal Of Cognition And Culture*, *10*(3-4), 283-307. doi:10.1163/156853710X531195 ^^	*	*		*	*					
Bender, A., Rothe-Wulf, A., Hüther, L., & Beller, S. (2012). Moving forward in space and time: how strong is the conceptual link between spatial and temporal frames of reference?. *Frontiers in psychology*, *3*. ^^			*	*	*		*			
Bennardo, G. (2008). Metaphors, Source Domains, and Key Words in Tongan Speech about Social			*		*					

	Databases			Studies cited						
Study	psycINFO	Scopus	Google Scholar	1998 McGlone and Harding	2000 Boroditsky	2004 Motz and Núñez	2006 Núñez et al.	2007 Ballinger et al.	2009 Hauser et al.	2010 Kranjec at al.
Relationships:'Ofa'Love'Is Giving. *Anthropological Linguistics*, 174-204.										
Bergen, B. K., & Lau, T. (2012). Writing direction affects how people map space onto time. *Frontiers In Psychology*, *3*.	*	*	*		*					
Bergen, B. K., Lindsay, S., Matlock, T., & Narayanan, S. (2007). Spatial and linguistic aspects of visual imagery in sentence comprehension. *Cognitive Science*, *31*(5), 733-764. doi:10.1080/03640210701530748	*		*		*					
Bergen, B., & Feldman, J. (2006). It's the body, stupid! concept learning according to cognitive science. *It's the body, stupid: Concept of learning according to cognitive science*. Academia.edu - Share research site			*		*					
Bergen, B., Medeiros-Ward, N., Wheeler, K., Drews, F., & Strayer, D. (2013). The crosstalk hypothesis: Why language interferes with driving. *Journal of Experimental Psychology: General, 142*(1), 119-130.		*	*		*					
Bernárdez, E. (2013). On the cultural character of metaphor. *Review of Cognitive Linguistics, 11*(1), 1-35. [a]		*			*					
Bin, W. (2009). Translating Figure Through Blending. *Perspectives: Studies in Translatology*, *16*(3-4), 155-167. doi: 10.1080/09076760902795656			*		*					
Blom, S. H., & Semin, G. R. (2013). Moving events in time: Time-referent hand–arm movements influence perceived temporal distance to past events. *Journal Of Experimental Psychology: General*, *142*(2), 319-322. doi:10.1037/a0029026	*	*	*		*					
Bochaver, A., & Fenko, A. (2010). Metaphors in happy and unhappy life stories of Russian adults. *Metaphor And Symbol*, *25*(4), 243-262. doi:10.1080/10926488.2010.510928	*	*	*		*					
Boltz, M. G., & Yum, Y. (2010). Temporal concepts and predicted duration judgments. *Journal Of Experimental Social Psychology*, *46*(6), 895-904. doi:10.1016/j.jesp.2010.07.002 ^^	*	*	*	*	*					
Bonato, M., Zorzi, M., & Umiltà, C. (2012). When time is space: Evidence for a mental time line. *Neuroscience And Biobehavioral Reviews*, *36*(10), 2257-2273. doi:10.1016/j.neubiorev.2012.08.007	*	*	*		*					*
Bonn, C. D., & Cantlon, J. F. (2012). The origins and structure of quantitative concepts. *Cognitive Neuropsychology*, *29*(1-2), 149-173. doi:10.1080/02643294.2012.707122	*	*	*		*					
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Study	Databases			Studies cited						
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Study	Databases			Studies cited						
	psycINFO	Scopus	Google Scholar	1998 McGlone and Harding	2000 Boroditsky	2004 Motz and Núñez	2006 Núñez et al.	2007 Ballinger et al.	2009 Hauser et al.	2010 Kranjec at al.
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Study	Databases			Studies cited						
	psycINFO	Scopus	Google Scholar	1998 McGlone and Harding	2000 Boroditsky	2004 Motz and Núñez	2006 Núñez et al.	2007 Ballinger et al.	2009 Hauser et al.	2010 Kranjec at al.
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Note: ^ This is one of the seven base studies. ^^ This is a TAQ study. [a] Unable to access article

Appendix C
TAQ Experiments: Results – Originally Reported and Replication Attempts

Table D1
TAQ Experiments: Original Results or Claims and Issues with Replication Attempts

TAQ Study		Replication		
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
1998 – McGlone and Harding				
2 - Moving Ego versus Mixed Context versus Moving Time (3 Future Day TAQs)	$\chi^2(2, N = 85) = 6.60, p < .05$	2	Yes (Likelihood Ratio)	
2 – Moving Ego versus Moving Time (3 Future Day TAQs)	$\chi^2(1, N = 57) = 6.22, p < .01$	2	No	
2 - Moving Ego versus Mixed Context (3 Future Day TAQs)	$\chi^2(1, N = 56) = 2.58, p > .20$	2	No	
2 - Mixed Context versus Moving Time (3 Future Day TAQs)	$\chi^2(1, N = 57) = 1.10$	2	No	
2000 - Boroditsky				
1 – Prime consistent versus Prime not consistent (Ego-Moving and Object-Moving)	$\chi^2(1, N = 56) = 5.2, P < 0.05$	2	No - I/D	
2 – Time-to-Time	$\chi^2(1, N = 66) = 9.07, P < 0.01$	2	No - I/D	
2 – Space-to-Time	$\chi^2(1, N = 72) = 5.71, P < 0.05$	2	No - I/D	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
2002 – Boroditsky and Ramscar				
1 – Ego-Moving versus Object-Moving	$\chi^2(1, N = 239) = 13.3, p < 0.001$	2[a]	No - I/D	
2 – Moving along a lunch line	when the effect of…perceived waiting time was controlled for, spatial position was still predictive of people's answers, $r = .20, p = .05$	3[a]	No - I/D	
3 – Airport: Just flown in versus waiting to depart	$\chi^2(1, N = 220) = 11.8, p < 0.01$	2[a]	No - I/D	
3 – Airport: Waiting to depart versus waiting to pick someone up	$\chi^2(1, N = 217) = 4.3, p < 0.05$	2[a]	No - I/D	
4 – Train journey	The closer…to the end point of their trip, the more likely they were to…say…Friday, $r = .23$, $p < .01$.	3[a]	No - I/D	
2004 Motz and Núñez				
1 – Future Day TAQ and Future Hour TAQ (answered both)	Significantly different from…chance…$p < 0.005$	1	Yes	
2005 – Matlock, Ramscar, and Boroditsky				
1 – FM sentences versus nonFM sentences	$\chi^2(1) = 6.05, p < 0.01$	2[a]	No	
2 – Scan points: 4 versus 8 versus 20 versus over 80	$\chi^2(3) = 7.14, p = .008$	2[a]	No	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
3 – Ego-Moving versus Object-Moving	$\chi^2(1) = 4.27$, $p = .038$	2[a]	No	
2006 - Núñez, Motz, and Teuscher				
1 – ‘Next Wednesday’ and ‘Last Wednesday’(Future Day TAQ and Past Day TAQ) versus Boroditsky (2000) proportions	$\chi^2(1, N = 66) = 8.56$, $p = 0.0034$	1[a]	No	U
1 –Leftward versus Rightward	$\chi^2(1, N = 66) = 0.26$, $p = 0.61$	2[a]	Yes (Pearson chi-sq.)	
1 – ‘Next Wednesday’ versus ‘Last Wednesday’ (Future Day TAQ versus Past Day TAQ)	$\chi^2(1, N = 66) = 0.49$, $p = 0.49$	2[a]	Yes (Pearson chi-sq.)	
2 – Response consistency across Day TAQ and Hour TAQ (Future and Past)	$\chi^2(1, N = 103) = 72.2$, $p = 1.19 \times 10^{-17}$	2[a]	No - I/D	
2 – Primed versus Control (Future Day TAQ, Future Hour TAQ, Past Day TAQ, Past Hour TAQ)	$\chi^2(1, N = 45) = 6.58$, $p = 0.01$	1[a]	Yes	D
2 – Primed condition: Past TAQs (Day TAQ and Hour TAQ)	$\chi^2(1, N = 45) = 0.002$, $p = 0.96$	1[a]	No - I/D	
2 – Future TAQs (Day TAQ and Hour TAQ)	$\chi^2(1, N = 44) = 4.23$, $p = 0.04$	1[a]	No - I/D	
2007 – Ballinger et al.				
1 – Day TAQ: Baseline	$\chi^2(1) = 8.45$, $p < 0.05$	1[a]	No	
1 – Hour TAQ: Baseline	no significant difference	1[a]	Yes[d]	
1 – TAQ Baselines: Day versus Hour	no significant difference	2[a]	Yes (Pearson chi-sq.)	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
1 – Rightward versus Leftward	no significant effect	2[a]	No - I/D	
1 – Ego-Moving versus Time-Moving	no significant effect	2[a]	Yes (Pearson chi-sq.)	
1 – Ego-Moving-Left	$\chi^2(1) = 4.5$, $p < 0.05$	1[a]	No	
1 – Ego-Moving-Right	Difference did not quite reach statistical significance	1[a]	No	E
1 – Ego-Moving	$\chi^2(1) = 3.9$, $p < 0.05$	1[a]	No	
1 – Time-Moving	no bias towards Monday or Friday	1[a]	Yes[d]	
1 – Day TAQ: Time-Moving versus Baseline	$\chi^2(1) = 3.9$, $p < 0.05$	2[a]	Yes (Continuity Correction)	
2 – Day TAQ Baseline	$\chi^2(1) = 11.52$, $p < 0.001$	1[a]	No	
2 – Hour TAQ Baseline	no significant difference	1[a]	Yes	
2 – TAQ Baselines: Day versus Hour	$\chi^2(1) = 6.58$, $p < 0.02$	2[a]	Yes (Continuity Correction)	
2 – Up versus Down	no significant differences	2[a]	No - I/D	

(continued)

TAQ Study		Replication		
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
2 – Day TAQ: Ego-Moving-Down	$\chi^2(1) = 4.06$, $p < 0.05$	1[a]	No	
2 – Hour TAQ: Ego-Moving-Down	not more likely	1[a]	Yes[d]	
2 – Day TAQ: Ego-Moving-Up	difference did not reach statistical significance	1[a]	Yes[d]	
2 – Hour TAQ: Ego-Moving-Up	$\chi^2(1) = 6.06$, $p < 0.02$	1[a]	No	
2 – Day TAQ: Ego-Moving-Up versus Baseline	$p < 0.05$	2[a]	No	
2 – Day TAQ: Time-Moving	no bias	1[a]	Yes[d]	
2 – Day TAQ: Time-Moving versus Baseline	$\chi^2(1) = 7.169$, $p < 0.01$	2[a]	No	
2 – Hour TAQ: Time-Moving	equally likely to provide 10:00 a.m. and 2:00 p.m. answers (21 10:00 a.m., 18 2:00 p.m.)	1[a]	No	E
2007 - Núñez				
1 – Moving cubes versus control	χ^2 =16.09….with a .01% level of significance	1	Yes	D

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
2008 – Margolies and Crawford				
1 – Enthusiasm versus Dread (own event)	$\chi^2(1, 150) = 2.23$, $p = .14$	2[a]	No - I/D	
2 – Enthusiasm versus Dread (prescribed event)	$\chi^2(1, 182) = 0.23$, $p = .63$	2[a]	No - I/D	
2009 – Hauser, Carter, and Meier				
1 – Relationship between trait anger and time representation	...higher trait anger scores were associated with a Friday rather than a Monday response…	4	No - I/D	
2 – Anger-inducing versus Neutral	$\chi^2(1, 60) = 1.00$, $p = .316$	2	Yes (Pearson chi-sq.)	
2010 – Bender, Beller, and Bennardo				
1 – All cultures (German, US, Chinese, Tongan)	χ^2=205.6, df=9, P< 0.001	2 ?	No	
1 – Tongan non-students versus Tongan students	χ^2=26.6; df=3; N=120; P< 0.001	2[a]	No - I/D	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
2010 Boltz and Yum				
Pretest – Ego-motion/video, Ego-motion linguistic, Time-motion video, Time-motion linguistic	The ego motion video and linguistic primes produced a higher frequency of "Friday" responses (M = 75% and M = 83%, respectively) while the time motion video and linguistic primes yielded a higher frequency of "Monday" responses (M = 75% and M = 75%, respectively).	6	Yes	
2010 – Kranjec et al.				
1 – NoPrep/Hour	$\chi^2(1, N = 60) = 0.53, p = 0.47$	1[a]	Yes	B
1 – NoPrep/Day	$\chi^2(1, N = 60) = 2.13, p = 0.14$	1[a]	Yes	B
1 – NoPrep/Month	$\chi^2(1, N = 60) = 0.00, p = 1.00$	1[a]	Yes	B
1 – NoPrep/Hour versus NoPrep/Day versus NoPrep/Month	nor were they significantly different from one another	2[a]	Yes	
1 – Prep/Hour	$\chi^2(1, N = 60) = 3.33, p = 0.07$	1[a]	Yes	B
1 – Prep/Day	$\chi^2(1, N = 60) = 6.53, p = 0.01$	1[a]	Yes	B
1 – Prep/Month	$\chi^2(1, N = 60) = 6.53, p = 0.01$	1[a]	Yes	B

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
1 – Prep/Hour versus NoPrep/Hour	$\chi^2(1, N = 60) = 6.65, p = 0.01$	1[a]	Yes	D
1 – Prep/Day versus NoPrep/Day	not significant	?[a]	Yes	D
1 – Prep/Month versus NoPrep/Month	$\chi^2(1, N = 60) = 6.53, p = 0.01$	1[a]	Yes	D
2010 – Ramscar et al.				
1 – Line length: Short versus Medium versus Long	$\chi^2(1) = 6.99, p = .008$	2	Yes (Linear-by-Linear Association)	
2 – Number of trees: 4, 8, 20, and over 80	$\chi^2(1) = 8.58, p < .05$ (linear-by-linear association)	2	No (Linear-by-Linear Association)	
2 – Number of trees: 10, 11, 12, 19, and 100	$\chi^2(1) = 10.585, p < .03$	2	Yes (Pearson chi-sq.)	A, C
2 – Number of trees: all conditions plus figures from Matlock et al. (2005) experiment 2 (4 trees, 8 trees, 20 trees, and over 80 trees)	$\chi^2(1) = 19.89, p < .03$	2	No	No point attempting replication as could not replicate 2005 results
3 – FM sentences versus nonFM sentences	$\chi^2(3) = 4.75, p < .05$	2[a]	Yes (Pearson chi-sq.)	A
4 – FM 'goes' versus FM 'comes'	$\chi^2(1) = 5.57, p = .025$	2[a]	No	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
2011 - Elvevåg, Helsen, De Hert, Sweers, and Storms				
3– Patients versus Controls	"…'moved forward'…responses were at chance level…" "…'moved forward'…most responses are at (or close to) chance level…"	6	No - I/D	E
2011 – Matlock et al.				
1 – Counting: Forward versus Backward	$\chi^2(1) = 9.19$, $p < .002$	2	Yes (Continuity Correction)	
1 – Counting: Forward	$\chi^2(1) = 11.00$, $p < .001$	1	Yes	
1 – Counting: Backward	$\chi^2(1) = 1.68$, $p > .19$	1	Yes	
2 – Alphabet: Forward versus Backward	$\chi^2(1) = 6.34$, $p < .012$	2	Yes (Continuity Correction)	
2 – Alphabet: Forward	$\chi^2(1) = 11.52$, $p < .0001$	1	Yes	C
2 – Alphabet: Backward	$\chi^2(1) = .20$, $p > .6$	1	Yes	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
3 – Countdown: Forward versus Backward	$\chi^2(1) = 17.34$, $p < .0001$	2	Yes (Continuity Correction)	
3 – Countdown: Forward	$\chi^2(1) = 28.17$, $p < .0001$	1	Yes	
3 – Countdown: Backward	$\chi^2(1) = .18$, $p > .6$	1	Yes	
2012 – Bender et al.				
1 - USA participants only – Future Day TAQ and Past Hour TAQ or Past Day TAQ and Future Hour TAQ			No - I/D, N/A	
2012 – Richmond et al.				
1 – Future Day TAQ response versus Spatial a response	$\chi^2 = 21.66$, $p < .001$	2[a]	No - I/D	
1 – Future Day TAQ response versus Spatial b response	$\chi^2 = 16.06$, $p < .001$	2[a]	No - I/D	
1 – Future Day TAQ response versus Spatial c response	$\chi^2 = 28.57$, $p < .001$	2[a]	No - I/D	
1 – Future Day TAQ response versus Spatial d response	$\chi^2 = 24.59$, $p < .001$	2[a]	No - I/D	
1 – Future Day TAQ response versus Clock a response	$\chi^2 = 40.90$, $p < .001$	2[a]	No - I/D	
1 – Future Day TAQ response versus Clock b response	$\chi^2 = 13.53$, $p < .005$	2[a]	No - I/D	
1 – Future Day TAQ response versus Calendar a response	$\chi^2 = 46.04$, $p < .001$	2[a]	No - I/D	
1 – Future Day TAQ response versus Calendar b response	$\chi^2 = 38.74$, $p < .001$	2[a]	No - I/D	

(continued)

TAQ Study			Replication		
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?	
1 – Future Day TAQ response versus Calendar c response	$\chi^2 = 39.41$, $p < .001$	2[a]	No - I/D		
2 – Perceived personal agency and time perspective			No - I/D, N/A		
3 – Happiness versus anxiety and depression			No - I/D, N/A		
4 – Happiness-induced versus Anxiety –induced versus Sadness-induced			No - I/D, N/A		
4 – Happiness-induced versus Happiness-non-induced	χ^2 1 ($N = 77$) = 11.44, $p = .001$	2	No - I/D		
4 – Anxiety-induced versus Anxiety-non-induced	χ^2 1 ($N = 78$) = 48.27, $p < .001$	2	No - I/D		
4 – Sadness-induced versus Sadness-non-induced	χ^2 1 ($N = 77$) = 19.76, $p < .001$	2	No - I/D		
2012 – Sullivan and Barth					
1 – Baseline versus Passive ego-moving	$p = .55$	5	No - I/D		
1 – Baseline versus Low-effort ego-moving	$p = .76$	5	No - I/D		
1 – Baseline versus High-effort ego-moving	$p = .37$	5	No - I/D		
1 – Baseline versus Low-effort object-moving	$p = .009$	5	No - I/D		
1 – Baseline versus High-effort object-moving	$p = .007$	5	No - I/D		
1 – Baseline versus Passive object-moving	$p = 1.000$	5	No - I/D		
1 – Passive object-moving versus Passive ego-moving	$p = .547$	5	No - I/D	(continued)	

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
1 – Passive object-moving versus Low-effort object-moving	p = .045	5	No - I/D	
1 – Passive object-moving versus High-effort object-moving	p = .006	5	No - I/D	
1 – Low-effort object-moving versus High-effort object-moving	p = .573	5	No - I/D	
2013 – Lai and Boroditsky				
1 – English monolinguals versus Mandarin/English bilinguals – Day TAQ	$\chi^2(1, N = 121) = 9.7, p < 0.005$	2[a]	Yes (Continuity Correction)	
1 – English monolinguals versus Mandarin monolinguals – Day TAQ	$\chi^2(1, N = 117) = 53.7, p <$ 0.0001, Yates-corrected	2	Yes (Continuity Correction)	
1 – Mandarin/English bilinguals versus Mandarin monolinguals – Day TAQ	$\chi^2(1, N = 106) = 22.0, p <$ 0.0001, Yates-corrected	2	Yes (Continuity Correction)	
1 – English monolinguals versus Mandarin/English bilinguals – Hour TAQ	$\chi^2(1, N = 67) = 22.6, p <$ 0.0001, Yates-corrected	2	Yes (Continuity Correction)	
1 – English monolinguals versus Mandarin monolinguals – Hour TAQ	$\chi^2(1, N = 52) = 37.5, p <$ 0.0001, Yates-corrected	2	Yes (Continuity Correction)	
1 – Mandarin/English bilinguals versus Mandarin monolinguals – Hour TAQ	$\chi^2(1, N = 63) = 4.465, p < 0.05$, Yates-corrected	2	Yes (Continuity Correction)	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
2014 – Duffy and Feist				
1 – Administrators versus Students	$\chi^2_{1,123} = 10.375$; $p < 0.001$	2	Yes (Pearson chi-sq.)	C
2 – Procrastination and temporal judgements, conscientiousness and temporal judgements			No - I/D, N/A	
3 – Temporal judgements: Extroverts versus introverts			No - I/D, N/A	
2014 – Duffy et al.				
1 – People at a bus stop: On schedule or early versus late	$\chi^2_{1,\ 104} = 17.262$, , $p < .0001$	2	No - I/D	
2 – Students submitting an assignment			No - I/D, NA	
3 – Arriving for an appointment: Early versus late (Hour TAQ)	$\chi^2_{1,\ 45} = 4.132$, , $p = .042$	2	No	
3 – Arriving for an appointment: Early versus late (Month TAQ)	$\chi^2_{1,\ 45} = 4.500$, , $p = .034$	2	Yes (Pearson chi-sq.)	
3 – Arriving for an appointment: Early versus late (Consistency across Hour TAQ responses and Month TAQ responses)	$\chi^2_{1,\ 45} = 30.633$, $p < .0001$	2[a]	No	
2014 – Lee and Ji				
1 – Embraced by friends versus Rejected by friends	$\chi^2(1, N = 49) = 6.61$, $p = .01$	2[a]	No - I/D	

(continued)

TAQ Study			Replication	
Study Exp. – Condition(s)	Reported result or claim (direct quotation)	Analysis performed [ab]	Able to replicate or agree with author(s) claim [c]	Issue(s)?
3 – Recall past event: Proud versus Ashamed	$\chi^2(1, N = 60) = 4.69, p = .03$	2[a]	No - I/D	
4 – Imagine future event: Cheerful versus Sad	$\chi^2(1, N = 100) = 5.15, p < .03$	2[a]	No - I/D	

Note: Unless otherwise stated, the reported result or claim is for responses to a future Day TAQ and the hypothesised distribution in a chi-square goodness-of-fit is assumed to be at chance level.

[a] Type of analysis performed is assumed, based on wording and/or report syntax used and/or a successful result replication, rather than explicitly stated by the author(s) of the experiment.

[b] 1 = Chi-square (goodness-of-fit), 2 = Chi-square (test-for-independence), 3 = Pearson's product-moment correlation, 4 = Logistic regression; 5 = Fisher's exact test, 6 = No statistical analysis other than comparing frequencies.

[c] No - I/D – insufficient data in article (e.g., participant numbers per condition) to allow an attempt at replication of result; N/A – not applicable as author(s) does not investigate breakdown in TAQ responses directly.

[d] Claim replicated successfully but cannot be certain that hypothesised distribution at chance level used in replication is the same hypothesised distribution used in the original experiment.

A = degrees of freedom, B = sample size, C = *p* value, D = why not perform a chi-square test for independence, E = poor word choice(s), U = unsure

Appendix D

Statements concerning the Statistical Analyses Performed on TAQ Responses

Study Exp. - Condition(s)	Analysis performed
1998 - McGlone and Harding	
2 - Moving Ego versus Mixed Context versus Moving Time (3 Future Day TAQs)	"…a 3 X 2 chi-square analysis…" (p. 1219)
2 - Moving Ego versus Moving Time (3 Future Day TAQs)	"Planned comparisons…" (p. 1219)
2 - Moving Ego versus Mixed Context (3 Future Day TAQs)	"Planned comparisons…" (p. 1219)
2 - Mixed Context versus Moving Time (3 Future Day TAQs)	"Planned comparisons…" (p. 1219)
2000 - Boroditsky	
1 - Prime consistent versus Prime not consistent (Ego-Moving and Object-Moving)	"A χ^2 statistic…" (p. 9)
2 - Time-to-Time	"…in a 2 X 2 χ^2 analysis…" (p. 15)
2 - Space-to-Time	"…in a 2 X 2 χ^2 analysis…" (p. 15)
2004 - Motz and Núñez	
1 - Future Day TAQ and Future Hour TAQ (answered both)	"Chi-square analyses…from those expected by chance…"
2006 - Núñez et al.	
1 - 'Next Wednesday' and 'Last Wednesday'(Future Day TAQ and Past Day TAQ) versus Boroditsky (2000) proportions	"When compared against these proportions…" (p. 140)
2 - Primed versus Control (Future Day TAQ, Future Hour TAQ, Past Day TAQ, Past Hour TAQ)	"The proportion of…" (p. 143)
2 - Primed condition: Past TAQs (Day TAQ and Hour TAQ)	"…in the proportions of…" (p. 143)
2007 - Núñez	
1 - Moving cubes versus control	"χ^2 (Chi-Square)…" (p. 111)
2009 - Hauser et al.	
1 - Relationship between trait anger and time representation	"A logistic regression analysis…" (p. 1171)
2 - Anger-inducing versus Neutral	"…a chi-square test for independence…" (p. 1173)
2010 - Bender et al.	
1 - All cultures (German, US, Chinese, Tongan)	"…main effect culture…" (p. 299)
	(continued)

Study Exp. - Condition(s)	Analysis performed
2010 - Kranjec et al.	
1 - NoPrep/Hour	"Proportions of….than the 50/50 model predicted by chance…" (p. 114)
1 - NoPrep/Day	"Proportions of….than the 50/50 model predicted by chance…" (p. 114)
1 - NoPrep/Month	"Proportions of….than the 50/50 model predicted by chance…" (p. 114)
1 - NoPrep/Hour versus NoPrep/Day versus NoPrep/Month	"Proportions of…" (p. 114)
1 - Prep/Hour	"Proportions of….from the 50/50 model predicted by chance…" (p. 114)
1 - Prep/Day	"Proportions of….from the 50/50 model predicted by chance…" (p. 114)
1 - Prep/Month	"Proportions of….from the 50/50 model predicted by chance…" (p. 114)
1 - Prep/Hour versus NoPrep/Hour	"Proportions of…" (p. 114)
1 - Prep/Day versus NoPrep/Day	"Proportions of…" (p. 114)
1 - Prep/Month versus NoPrep/Month	"Proportions of…" (p. 114)
2010 - Ramscar et al.	
1 - Line length: Short versus Medium versus Long	"A Chi-square analysis…" (p. 597)
2 - Number of trees: 4, 8, 20, and over 80	"A Chi-square test (linear-by-linear association)…" (p. 603)
2 - Number of trees: 10, 11, 12, 19, and 100	"A Chi-square test…" (p. 603)
2 - Number of trees: all conditions plus figures from Matlock et al. (2005, Exp. 2; 4, 8, 20, and over 80)	"A Chi-square test…" (p. 603)
2011 - Elvevåg et al.	
3 - Patients versus Controls	"Percentages of…(ME)…and (MT) answers for the three spatiotemporal verbs in three different contexts." (p. 210)
2011 - Matlock et al.	
1 - Counting: Forward versus Backward	"A chi-square test of independence…" (p. 264)
1 - Counting: Forward	"Chi-square goodness-of-fit tests…" (p. 265)
1 - Counting: Backward	"Chi-square goodness-of-fit tests…" (p. 265)
2 - Alphabet: Forward versus Backward	"A chi-square test of independence…" (p. 266)
2 - Alphabet: Forward	"…chi-square goodness-of-fit tests…" (p. 266)

(continued)

Study Exp. - Condition(s)	Analysis performed
2 - Alphabet: Backward	"…chi-square goodness-of-fit tests…" (p. 266)
3 - Countdown: Forward versus Backward	"A chi-square test of independence…" (p. 267)
3 - Countdown: Forward	"Chi-square goodness-of-fit tests…" (p. 267)
3 - Countdown: Backward	"Chi-square goodness-of-fit tests…" (p. 267)
2012 - Richmond et al.	
1 - Future Day TAQ response versus Spatial a response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Spatial b response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Spatial c response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Spatial d response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Clock a response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Clock b response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Calendar a response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Calendar b response	"Chi-square analysis…" (p. 815)
1 - Future Day TAQ response versus Calendar c response	"Chi-square analysis…" (p. 815)
2 - Perceived personal agency and time perspective	"*t*-Test analyses…" (p. 816)
3 - Happiness versus anxiety and depression	"*t*-Test analyses…" (p. 818)
4 - Happiness-induced versus Anxiety –induced versus Sadness-induced	"*t*-Test analyses…" (p. 819)
4 - Happiness-induced versus Happiness-non-induced	"…chi-squared analyses…" (p. 819)
4 - Anxiety-induced versus Anxiety-non-induced	"…chi-squared analyses…" (p. 819)
4 - Sadness-induced versus Sadness-non-induced	"…chi-squared analyses…" (p. 819)
2012 - Sullivan and Barth	
1 - Baseline versus Passive ego-moving	"…Fisher's exact test…" (p. 1105)
1 - Baseline versus Low-effort ego-moving	"…Fisher's exact test…" (p. 1105)
1 - Baseline versus High-effort ego-moving	"…Fisher's exact test…" (p. 1105)
1 - Baseline versus Low-effort object-moving	"…Fisher's exact test…" (p. 1105)
1 - Baseline versus High-effort object-moving	"…Fisher's exact test…" (p. 1105)
1 - Baseline versus Passive object-moving	"…Fisher's exact test…" (p. 1105)

(continued)

Study Exp. - Condition(s)	Analysis performed
1 - Passive object-moving versus Passive ego-moving	"…Fisher's exact test…" (p. 1105)
1 - Passive object-moving versus Low-effort object-moving	"…Fisher's exact test…" (p. 1105)
1 - Passive object-moving versus High-effort object-moving	"…Fisher's exact test…" (p. 1105)
1 - Low-effort object-moving versus High-effort object-moving	"…Fisher's exact test…" (p. 1105)
2013 - Lai and Boroditsky	
1 - English monolinguals versus Mandarin monolinguals – Day TAQ	"Yates-corrected" (p. 6)
1 - Mandarin/English bilinguals versus Mandarin monolinguals – Day TAQ	"Yates-corrected" (p. 6)
1 - English monolinguals versus Mandarin/English bilinguals – Hour TAQ	"Yates-corrected" (p. 6)
1 - English monolinguals versus Mandarin monolinguals – Hour TAQ	"Yates-corrected" (p. 6)
1 - Mandarin/English bilinguals versus Mandarin monolinguals – Hour TAQ	"Yates-corrected" (p. 6)
2014 - Duffy and Feist	
1 - Administrators versus Students	"…chi-square test…" (p. 38)
2014 - Duffy et al.	
1 -People at a bus stop: On schedule or early versus late	"…chi-square test…" (p. 5)
2 - Students submitting an assignment	
3 - Arriving for an appointment: Early versus late (Hour TAQ)	"…chi-square test…" (p. 8)
3 - Arriving for an appointment: Early versus late (Month TAQ)	"…chi-square test…" (p. 8)

Appendix E

TAQ Experiments: Breakdown of Discrepancies in Participant Numbers

<table>
<tr><th>Study</th><th>Exp.</th><th>Quote(s)</th><th>Problem(s)</th></tr>
<tr><td>Motz and Núñez (2004)</td><td>Poster</td><td>Table 1
Number of responses by order of target questions.
<table>
<tr><th></th><th colspan="2">TAQ sequence</th></tr>
<tr><th>TAQ response</th><th>Day then Hour</th><th>Hour then Day</th></tr>
<tr><td>Monday</td><td>8</td><td>17</td></tr>
<tr><td>Friday</td><td>24</td><td>16</td></tr>
<tr><td>10:00am</td><td>7</td><td>16</td></tr>
<tr><td>2:00pm</td><td>25</td><td>18</td></tr>
</table></td><td>The ‘Hour then Day’ condition has 34 participants answering the Hour TAQ but 33 participants answering the Day TAQ. As participants answered both TAQs, this discrepancy between 34 Hour TAQ responses and 33 Day TAQ responses highlights that data from one participant was excluded, however, the poster gives no information concerning excluded data</td></tr>
<tr><td>Matlock et al. (2005)</td><td>2</td><td>“A total of 127 Stanford undergraduates participated…” (p. 660)
“Of 124 responses …”
“One incorrect response was discarded…” (p. 660)</td><td>127 - 1 = 126. This does not agree with the number of responses (i.e., 124) the authors’ claim after exclusions.</td></tr>
<tr><td>Matlock et al. (2005)</td><td>3</td><td>“Seventy-four Stanford undergraduates participated.” (p. 662)
“Of the 37 participants with ego-moving sentences,…and of the 34 participants with object-moving sentences…” (p. 662)
“One response was discarded…” (p. 662)</td><td>37 + 34 = 71. This does not agree with the authors’ claim of 74 participants.</td></tr>
<tr><td>Ballinger et al. (2007)</td><td>1</td><td>“Questionnaires were distributed to 275 willing students and affiliates…” (p. 10)
“Each student participated in only one condition.” (p. 10).
“Most questionnaires were filled out on a Wednesday (231 questionnaires), but a number of them were filled out on a Thursday (42 questionnaires).” (p. 11)</td><td>Number of questionnaires (231 + 42 = 273) does not agree with the authors’ claim of 275 participants.</td></tr>
</table>

(continued)

Study	Exp.	Quote(s)	Problem(s)
Ballinger et al. (2007)	2	"Questionnaires were distributed to a new set of 197 students and affiliates…" (p. 13) "Each student participated in only one condition." (p. 13) "A total of 9 participants were disqualified…" (p. 13) "…baselines…(1 Monday, 16 Friday)…(10 10:a.m., 10 2:00 p.m.)." (p. 14) "Participants in the Ego-Moving Down condition…(5 Monday, 15 Friday)…(9 10:a.m., 11 2:00 p.m.)." (p. 14) "Participants in the Ego-Moving Up condition…(5 Monday, 12 Friday)…(6 10:a.m., 16 2:00 p.m.)." (p. 14) "In the Wednesday time-moving conditions…(20 Monday, 18 Friday)…" (p. 14) "Participants in the noon time-moving conditions…(21 10:a.m., 18 2:00 p.m.)." (p. 14)	(1 + 16) + (10 + 10) + (5 + 15) + (9 + 11) + (5 + 12) + (6 + 16) + (20 + 18) + (21 + 18) = 193. This does not agree with the authors' claim of 188 participants (i.e., 197 participants less nine participants).
Margolies and Crawford (2008)	1	"One-hundred fifty-seven University of Richmond undergraduates participated…" (p. 1404) "Five participants answered the first question with responses other than Monday or Friday and thus were excluded from the analysis." (p. 1404) "Emotion condition did not have a significant effect on responses to the day question, χ^2 (1, 150) = 2.23, *p* = .14." (p. 1405) "For the question asking whether participants thought of themselves as approaching the event or the event as approaching them, there was a significant effect of valence, χ^2 (1, 154) = 9.8, *p* < .01." (p. 1405) "…there was a significant effect of valence on the filler question, χ^2 (1, 154) = 11.97, *p* < .001." (p. 1405)	157 – 5 = 152. This does not agree with the sample sizes used in the chi-square results for either the TAQ (150) or the AQ (154).

(continued)

Study	Exp.	Quote(s)	Problem(s)
Margolies and Crawford (2008)	2	"One-hundred eighty-four undergraduates at the University of Richmond and Virginia Commonwealth University were recruited…" (p 1407) "For the question about the day of the rescheduled event, one person gave a response other than Monday or Friday and was excluded from further analysis." (p. 1407) "As in Experiment 1, there was no effect of event valence on participants' responses to the day question, χ^2 (1, 182) = 023, p = .63." (p. 1408) "For the question about whether the participant or the event was approaching, there was a significant effect of valence, χ^2 (1, 183) = 5.3, p < .05." (p. 1408) "As for the filler question, one participant failed to respond. Among those who responded, there was a significant effect of valence on the filler question, χ^2 (1, 182) = 8.3, p < .01." (p. 1408)	184 – 1 = 183. This does not agree with the sample size (182) used in the TAQ chi-square result. However, it does agree with the sample size (183) used in the AQ chi-square result. Filler question: 184 -1 -1 = 182. This agrees with the sample size used in the filler question chi-square result.
Kranjec et al. (2010)	1	"We thus included data from 180 participants with 30 unique participants responding to each sentence." (p. 114)	Six experimental conditions, each with 30 participants, but when the chi-square goodness-of-fit results are reported for each condition the sample size is stated as 60. For example, "AT + hour, χ^2(1, N = 60) = 3.33, p = 0.07" (p. 114).
Ramscar et al. (2010)	2	"A total of 399 participants read fictive motion sentences that varied only on the number of trees specified by the subject noun phrase." (p. 602) "Prior to the analysis, responses from seven participants were discarded…" (p. 603) "With regard to…*four, eight, twenty* and *over eighty trees*….Percentages were based on 29, 25, 28, and 29 participants…" (p. 603) Regarding…*ten, eleven, twelve,* and *nineteen trees*….percentages were based on 53, 53, 42, and 44 participants….'*a hundred trees'*…based on 96 responses…" (p. 603)	The number of participants across on all conditions on which percentage figures are calculated is: 29 + 25 + 28 + 29 + 53 + 53 + 42 + 44 + 96 = 399. This figure matches the authors' initial number of participants and does not take into account the seven participants who were discarded from all analyses.

(continued)

Study	Exp.	Quote(s)	Problem(s)
Richmond et al. (2012)	2	"Fifteen male and 113 female undergraduate students…" (p. 816) "Those who perceived the event as approaching them adopted a more time-moving representation (66.7%, n = 38) rather than an ego-moving representation (50.7%, n = 38), whereas those envisaging that they were approaching the event were more likely to adopt an ego-moving perspective (49.3%, n = 37) than a time-moving perspective (33.3%, n = 17); however, this was only marginally significant (χ^2 1 (N = 77) = 3.71, p = .054)." (p. 817)	38 + 38 + 37 + 17 = 130. This does not agree with the sample size used in the chi-square result.
Sullivan and Barth. (2012)	1	p. 1407 "One-hundred and ninety-eight members of the Wesleyan University community participated…" "Participants were randomly assigned to one of six test conditions or to the baseline condition (n = 28 per condition)…" "Four participants were excluded from analysis for failure to follow directions, and four were excluded for answering the test question…with a day other than Friday or Monday."	28 X 7 = 196. This does not agree with the initial number of participants as being 198. 196 – 8 = 188.

Appendix F

Studies Using Film Clips as Emotion-Inducing Stimuli

			Target Emotional States										
Year	Author(s)	Number of Recommended Clips (# of films used)*	Amusement	Anger	Disgust	Fear	Happiness/Joy	Interest	Neutral	Sadness	Surprise	Tenderness	Earlier Studies that Used the Same Clip(s)** (# of clips)
1993	Philippot	12 (10)		✓	✓	✓	✓		✓	✓			None
1990	Tomarken, Davidson, and Henriques	13 (12)	✓	✓	✓	✓	✓	✓	✓				None
1995	Gross and Levenson	16 (16)	✓	✓	✓	✓			✓	✓			None
1999	Hagemann et al.	13 (12)		✓	✓		✓		✓	✓			Tomarken et al. (1990) (8); Gross and Levenson (1995) (4)
2005	Hewig et al.	20 (19)	✓	✓	✓	✓			✓	✓			Tomarken et al. (1990) (8); Gross and Levenson (1995) (6)
2007	Rottenberg et al.	14 (14)	✓	✓	✓	✓			✓	✓	✓		Gross and Levenson (1995) (6); Hewig et al. (2005) (1)
2010	Schaefer et al.	70 (48)	✓	✓	✓	✓			✓	✓		✓	Gross and Levenson (1995) (1)
2012	Jenkins and Andrewes	18 (17)	✓	✓	✓	✓	✓		✓	✓			Gross and Levenson (1995) (1); Hewig et al. (2005) (1)

*A single film may yield numerous recommended individual clips.
**When same clip was used in multiple studies, only the earliest study is mentioned here.

Appendix G
Film Clips Used in Pilot Study

				Earlier Studies Using Same Clip	
Film Title (director, year)	Clip Length (min:sec)	Film Clip (target affect)	Clip Description	Author(s)	Clip Length (min:sec)
Africa: The Serengeti (Novros & Casey, 2005)	3'00"	AFRICA (neutral)	African omnivores in their natural habitat.	New to this study	
All the President's Men (Coblenz & Pakula, 1976)	3'01"	PRESIDENT (neutral)	Two men conversing in a courtroom followed by a man waiting to see a county court official.	Hewig et al. (2005); Jenkins and Andrewes (2012)	1'05"
Dead Poets Society (Haft, Junger Witt, Thomas, & Weir, 1989)	2'40"	POETS (positive)	All the students climb on their desks to express solidarity with their teacher, who has just been fired.	Schaefer et al. (2010)	2'40"
Forrest Gump (Finerman, Tisch, Starkey, & Zemeckis, 1994)	2'37"	GUMP (positive)	Father and son meet for the first time.	Schaefer et al. (2010)	2'02"
Maire Antoinette (Katz, Coppola, & Coppola, 2006)	2'44"	MARIE (positive)	French Queen Maire Antoinette spends time at her country house with her young daughter, friends, and farm animals.	Jenkins and Andrewes (2012)	2'14"
Misery (Scheinman, Reiner, & Reiner, 1990)	3'10"	MISERY (negative)	Annie breaks Paul's legs.	Schaefer et al. (2010)	3'39"
Road Kill (Abrams, Moore, & Dahl, 2001)	3'01"	ROAD (negative)	A killer lures two boys to a hotel room where the door handle is connected to a shotgun aimed at their friend.	Jenkins and Andrewes (2012)	5'01"
The Shining (Kubrick & Kubrick, 1980)	2'56"	SHINING (negative)	Boy and man talking followed by boy playing in hallway.	Gross and Levenson (1995); Rottenberg et al. (2007)	1'21"
The Silence of the Lambs (Utt, Saxon, Bozman, & Demme, 1991)	2'58"	LAMBS (negative)	Basement chase scene.	Gross and Levenson (1995); Hewig et al. (2005); Rottenberg et al. (2007)	3'26"
When Harry Met Sally (Reiner, Scheinman, & Reiner, 1989)	2'52"	HARRY (positive)	Sally and Harry sitting in a restaurant talking about faking orgasms.	Gross and Levenson (1995); Hagemann et al. (1999); Hewig et al. (2005); Rottenberg et al. (2007); Schaefer et al. (2010)	2'45"

Note: The pilot study altered the duration of film clips from those used in other studies so that viewing times for each clip would be similar. Ensuring participants were seated for similar durations would be one means of controlling for participant motion (a potential confound) in the later experiment investigating temporal understanding.

Appendix H

Editing Instructions for Creating Film Clips as Used in Pilot Study

<table>
<tr><td rowspan="2">Film</td><td colspan="2" rowspan="2">Africa</td><td>Clip Length</td><td>3'00"</td></tr>
<tr><td>Target affect</td><td>Neutral</td></tr>
<tr><td colspan="2">Scene description</td><td colspan="3">Animals of The Serengeti.</td></tr>
<tr><td colspan="3" rowspan="3">Clip – Part 1</td><td>Start (h:mm:ss)</td><td>0:02:38</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:04:34</td></tr>
<tr><td>Clip Length</td><td>1'56"</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Wildebeest grazing.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">Single bird.</td></tr>
<tr><td colspan="3" rowspan="3">Clip – Part 2</td><td>Start (h:mm:ss)</td><td>0:12:27</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:12:51</td></tr>
<tr><td>Clip Length</td><td>0'24”</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Herd of giraffes feeding on plants.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">Single giraffe walking.</td></tr>
<tr><td colspan="3" rowspan="3">Clip – Part 3</td><td>Start (h:mm:ss)</td><td>0:19:49</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:20:06</td></tr>
<tr><td>Clip Length</td><td>0'17"</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Herds of wildebeest and zebras.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">Single bird with fluffy white neck feathers.</td></tr>
<tr><td colspan="3" rowspan="3">Clip – Part 4</td><td>Start (h:mm:ss)</td><td>0:20:19</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:20:42</td></tr>
<tr><td>Clip Length</td><td>0'23”</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Herd of zebras.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">Single zebra.</td></tr>
<tr><td colspan="5">Additional Notes:
This film clip was created for the pilot study and has not been used in earlier research. It was designed as a pleasant neutral clip because, according to Rottenberg et al. (2007), such pleasant neutral films fully engage participants’ attention.</td></tr>
</table>

<table>
<tr><td rowspan="2">Film</td><td rowspan="2" colspan="2">All the President’s Men</td><td>Clip Length</td><td>3'02"</td></tr>
<tr><td>Target affect</td><td>Neutral</td></tr>
<tr><td rowspan="3" colspan="3">Clip – Part 1</td><td>Start (h:mm:ss)</td><td>0:08:04</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:09:10</td></tr>
<tr><td>Clip Length</td><td>1'06"</td></tr>
<tr><td colspan="2">Scene description</td><td colspan="3">Reporter Rob Woodward (Robert Redford) tries to get some information from people in a courtroom.</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Bob is talking with a group of men outside the courtroom.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">Bob is writing in his notebook. The other man has just left.</td></tr>
<tr><td rowspan="3" colspan="3">Clip – Part 2</td><td>Start (h:mm:ss)</td><td>0:40:28</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:42:24</td></tr>
<tr><td>Clip Length</td><td>1'56"</td></tr>
<tr><td colspan="2">Scene description</td><td colspan="3">Reporter Carl Bernstein (Dustan Hoffman) waits to see a county court official.</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Carl exits a lift.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">A dark-haired woman answers the telephone saying “Mr Dardus’ office”.</td></tr>
<tr><td colspan="5">Additional Notes:
Clip 1 used in: Hewig et al. (2005) – 1’05”, Jenkins and Andrewes (2012) – 1’06”. The current study added an additional scene to increase overall clip length.</td></tr>
</table>

<table>
<tr><td rowspan="4">Film</td><td rowspan="4" colspan="2">Dead Poets Society</td><td>Start (h:mm:ss)</td><td>1:57:30</td></tr>
<tr><td>End (h:mm:ss)</td><td>2:00:10</td></tr>
<tr><td>Clip Length</td><td>2'40"</td></tr>
<tr><td>Target affect</td><td>Positive</td></tr>
<tr><td colspan="2">Scene description</td><td colspan="3">The students climb on their desks to manifest their solidarity with Mr. Keating (Robin Williams), who has just been fired.</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">The face of one of the students (a red-haired boy) is looking into the camera. Then we see Mr Keating entering the classroom.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">A dark-haired student is standing on his desk and we see his face and upper body as he looks into the camera.</td></tr>
<tr><td colspan="5">Additional Notes:
Same clip used in Schaefer et al. (2010, target emotion was tenderness.</td></tr>
</table>

Film	**Forrest Gump**	Start (h:mm:ss)	1:56:05
		End (h:mm:ss)	1:58:42
		Clip Length	2'37”
		Target affect	Positive
Scene description	Father and son meet for the first time.		
First scene	Jenny (Robin Wright) apologies to Forrest (Tom Hanks).		
Last scene	Forrest and his son are watching television. They have their heads tilted.		
Additional Notes: Schaefer et al. (2010) used 2’02” of the same clip. The current study extended the beginning of the clip.			

Film	**Marie Antoinette**	Clip Length	2'44"
		Target affect	Positive
Scene description	French Queen Marie Antoinette spends time at her picturesque country house with her young daughter, farm animals and friends.		
Clip – Part 1		Start (h:mm:ss)	1:19:23
		End (h:mm:ss)	1:21:40
		Clip Length	2'17"
First scene	Foliage in foreground, slightly obscuring a stone vase resting on a stone pedestal.		
Last scene	Marie Antoinette and her friends are drinking milk from cups.		
Clip – Part 2		Start (h:mm:ss)	1:22:03
		End (h:mm:ss)	1:22:30
		Clip Length	0'27"
First scene	The queen and her friends are sitting in a field.		
Last scene	The queen and her daughter picking flowers in a garden.		
Additional Notes: Jenkins and Andrewes (2012) used 2’14” of the same clip, target emotion was happiness. The current study extended the end of the clip.			

Film	**Misery**	Clip Length	3'10"
		Target affect	Negative
Scene description	Annie (Kathy Bates) breaks Paul's (James Caan) legs.		
Clip – Part 1		Start (h:mm:ss)	1:19:17
		End (h:mm:ss)	1:19:39
		Clip Length	0'22"
First scene	Close-up of Paul's face as he is licking his lips.		
Last scene	Paul says "See you in the morning" and his eyes move from side to side.		
Clip – Part 2		Start (h:mm:ss)	1:19:57
		End (h:mm:ss)	1:20:24
		Clip Length	0'27"
First scene	Paul is asleep, then wakes to find Annie hovering over him.		
Last scene	A door bangs closed as Annie leaves the room.		
Clip – Part 3		Start (h:mm:ss)	1:20:31
		End (h:mm:ss)	1:22:52
		Clip Length	2'21"
First scene	Close-up of Paul's face as he lies in bed.		
Last scene	Close-up of Annie's face after she has broken Paul's legs.		
Additional Notes: Schaefer et al. (2010) used the same clip, target emotion was fear. The current study removed some frames within that original 3'39" clip.			

Film	**Road Kill**	Clip Length	3'01"
		Target affect	Negative
Scene description	A killer lures two men to a hotel room where the door handle is connected to a shotgun aimed at their friend.		
Clip – Part 1		Start (h:mm:ss)	1:16:55
		End (h:mm:ss)	1:17:15
		Clip Length	0'20"
First scene	Woman sitting down with cellophane wrapped around her mouth.		
Last scene	Click switches over from 12:00 to 12:01.		
Clip – Part 2		Start (h:mm:ss)	1:18:33
		End (h:mm:ss)	1:20:06
		Clip Length	1'33"
First scene	Two men standing and facing each other in a motel room.		
Last scene	One man exits the room.		
Clip – Part 3		Start (h:mm:ss)	1:20:42
		End (h:mm:ss)	1:21:02
		Clip Length	0'20"
First scene	A man (Steve Zahn) is walking.		
Last scene	Man on phone says "We sure as hell won't tell the cops" and we see another man (Steve Zahn) walking outside.		
Clip – Part 4		Start (h:mm:ss)	1:21:05
		End (h:mm:ss)	1:21:53
		Clip Length	0'48"
First scene	A man (Steve Zahn) is climbing to look through a window.		
Last scene	A hand pulls back from a door handle.		
Additional Notes: Jenkins and Andrewes (2012) used the same clip, target emotion was fear. The current study removed some frames within that original 5'01" clip.			

Film	**The Silence of the Lambs**	Clip Length	2'58"
		Target affect	Negative
Scene description	FBI investigator (Jodie Foster) speaks with a murder suspect then chases him into a basement.		
Clip – Part 1		Start (h:mm:ss)	1:37:10
		End (h:mm:ss)	1:39:17
		Clip Length	2'07"
First scene	A house with a blue car in the foreground.		
Last scene	A brown shoe is on a step leading down into the basement.		
Clip – Part 2		Start (h:mm:ss)	1:39:29
		End (h:mm:ss)	1:40:13
		Clip Length	0'44"
First scene	The back of a dark haired woman (Jodie Foster) is visible. There is a door to her left and bric-a-brac, including a red cloth, on a cabinet in front of her.		
Last scene	The profile of the dark-haired woman (Jodie Foster) is visible. There is a metal wire/cord hanging from the ceiling just behind the woman and she is about to open a door.		
Clip – Part 3		Start (h:mm:ss)	1:42:58
		End (h:mm:ss)	1:43:05
		Clip Length	0'07"
First scene	Hands holding a gun are moving rapidly into the scene from the right of the screen. In the background, there is dirty yellow wallpaper.		
Last scene	The dark-haired woman (Jodie Foster) has her back to the yellow wallpaper and has pointed her gun between the upper middle and the upper right-hand portions of the screen. We hear her exclaim as the lights go out.		
Additional Notes: Same clip (albeit slightly different duration) used in: Gross and Levenson (1995) – 3’29”, Hewig et al. (2005) – 3’22”, Rottenberg et al. (2007) – 3’29”, target emotion was fear. The current study removed some frames to reduce clip length. Schaefer et al. (2010) used this film but selected a different clip (i.e., forensic examination of a dead body – 3’29”), target emotion was disgust.			

Film	**The Shining**	Clip Length	2'56"
		Target affect	Negative
Scene description – Clips Part 1, 2, 3	A man (Scatman Crothers) and a boy (Danny Lloyd) are having a conversation while seated at a table.		
Clip – Part 1		Start (h:mm:ss)	0:20:51
		End (h:mm:ss)	0:20:56
		Clip Length	0'05"
First scene	Boy says "Is there something bad here?"		
Last scene	Close-up of man's face as his head is tilted and looking down at the boy.		
Clip – Part 2		Start (h:mm:ss)	0:21:43
		End (h:mm:ss)	0:21:59
		Clip Length	0'16"
First scene	Man says "I think a lot of things happened..."		
Last scene	Boy says "What about room 237?"		
Clip – Part 3		Start (h:mm:ss)	0:22:20
		End (h:mm:ss)	0:22:29
		Clip Length	0'09"
First scene	Man says "There ain't nothing in room 237...."		
Last scene	Man says "So stay out."		
Scene description – Clips Part 4, 5, 6, 7	A boy (Danny Lloyd) sees two girls in a corridor and is scared.		
Clip – Part 4		Start (h:mm:ss)	0:35:06
		End (h:mm:ss)	0:35:35
		Clip Length	0'29"
First scene	Boy cycling on a tricycle in a corridor with blue carpet (just before the boys makes a left turn)		
Last scene	Two girls say "Come and play with us Danny."		
Clip – Part 5		Start (h:mm:ss)	0:35:37
		End (h:mm:ss)	0:35:39
		Clip Length	0'02"
One scene	Two girls say "Forever"		
Clip – Part 6		Start (h:mm:ss)	0:35:43
		End (h:mm:ss)	0:35:45
		Clip Length	0'02"
One scene	Two girls say "and ever"		
Clip – Part 7		Start (h:mm:ss)	0:35:48
		End (h:mm:ss)	0:36:21
		Clip Length	0'33"
First scene	Close up of a boy with both hands over his face.		
Last scene	Two seconds after the boy says "Tony, I'm scared."		

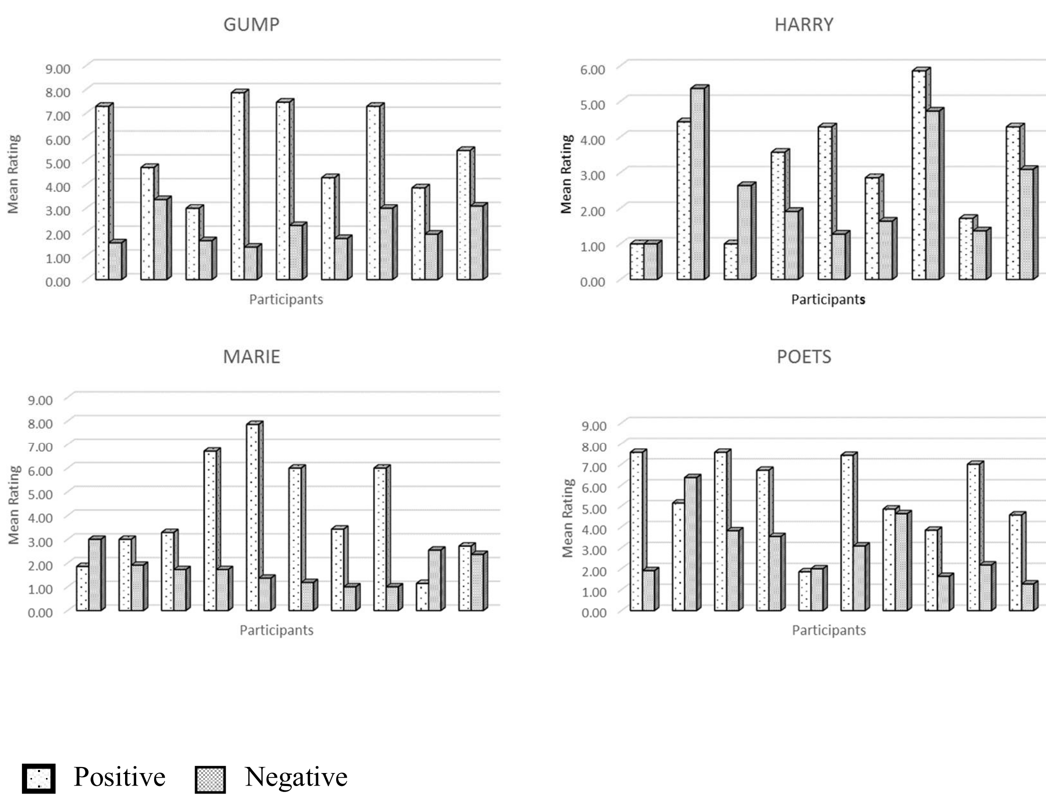
<table>
<tr><td rowspan="2">Film</td><td rowspan="2" colspan="2">The Shining (cont’d)</td><td>Clip Length</td><td>2'56"</td></tr>
<tr><td>Target affect</td><td>Negative</td></tr>
<tr><td rowspan="3" colspan="3">Clip – Part 8</td><td>Start (h:mm:ss)</td><td>0:41:02</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:42:22</td></tr>
<tr><td>Clip Length</td><td>1’20"</td></tr>
<tr><td colspan="2">Scene description – Clip 8</td><td colspan="3">Boy playing in hallway.</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">Boy's hands are visible (one flat on the floor and the other in a fist). There are toy trucks and cars on a red, brown, and orange carpet.</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">An open door with a key in the lock is visible, and one full second has passed since the boy has said “Mom, are you in there?” Can see the inside of the room.</td></tr>
<tr><td colspan="5">Additional Notes:
Clip 8 used in: Gross and Levenson (1995) – 1’22”, Rottenberg et al. (2007) – 1’22”, target emotion was fear. The current study added additional scenes to increase overall clip length.
Schaefer et al. (2010) used this film but selected a different clip (i.e., Man pursues his wife with an axe – 4’15”), target emotion was fear.</td></tr>
</table>

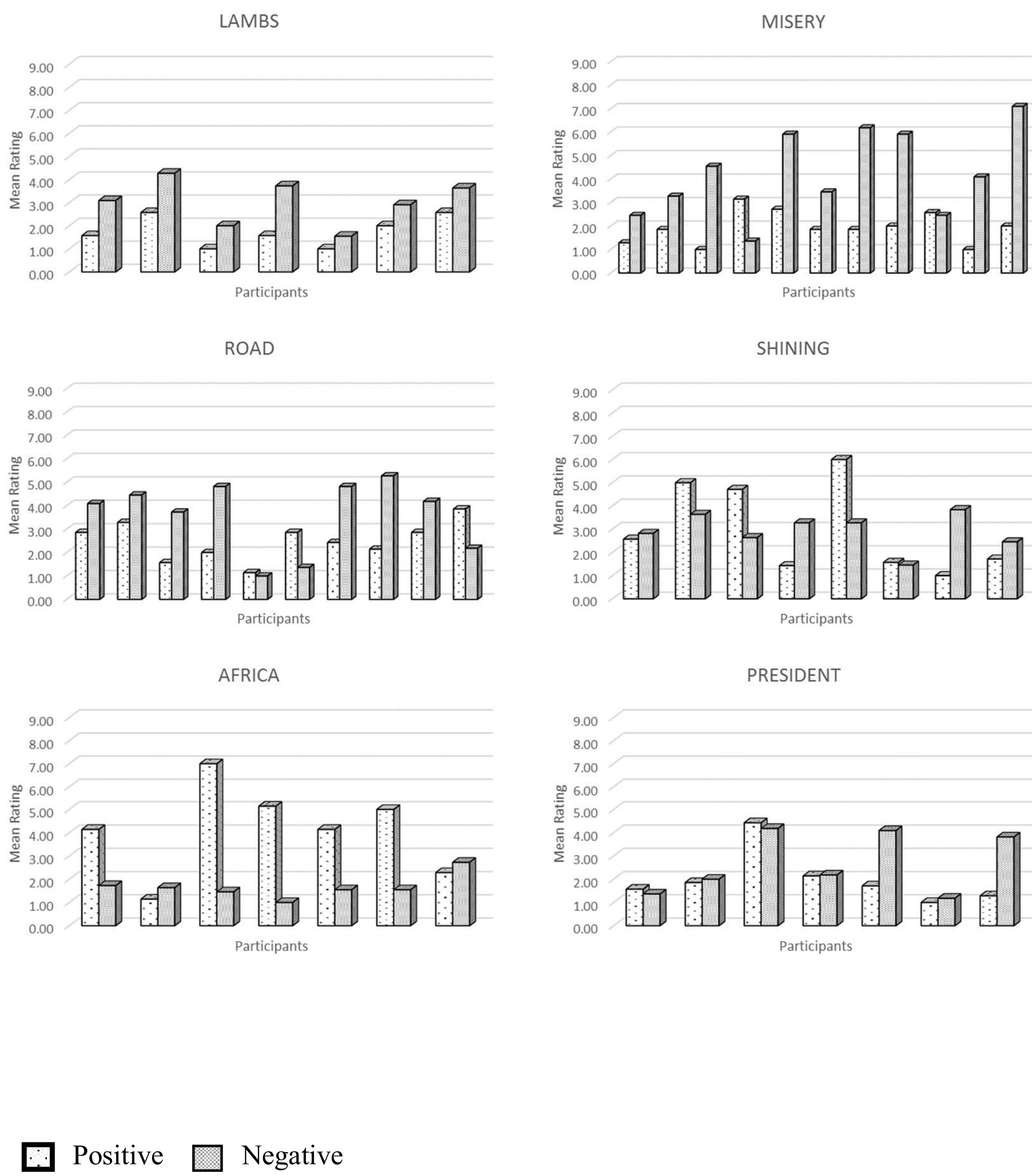
<table>
<tr><td rowspan="4">Film</td><td rowspan="4" colspan="2">When Harry Met Sally</td><td>Start (h:mm:ss)</td><td>0:44:36</td></tr>
<tr><td>End (h:mm:ss)</td><td>0:47:28</td></tr>
<tr><td>Clip Length</td><td>2'52"</td></tr>
<tr><td>Target affect</td><td>Positive</td></tr>
<tr><td colspan="2">Scene description</td><td colspan="3">Harry (Billy Crystal) and Sally (Meg Ryan) talking in a restaurant about faking an orgasm.</td></tr>
<tr><td colspan="2">First scene</td><td colspan="3">People eating in a restaurant. Camera pans left and we hear Sally asking "So what do you do with these women?"</td></tr>
<tr><td colspan="2">Last scene</td><td colspan="3">Woman says to waiter "I'll have what she's having."</td></tr>
<tr><td colspan="5">Additional Notes:
Same clip (albeit slightly different duration) used in: Gross and Levenson (1995) – 2’35”, Hagemann et al. (1999) – 2’35”, Hewig et al. (2005) – 2’29”, Jenkins and Andrewes (2012), Rottenberg et al. (2007) – 2’35”, Schaefer et al. (2010) – 2’45”, target emotion was amusement. The current study extended the end of the clip.</td></tr>
</table>

Appendix I

Mean Ratings per Participant for Film Clips Across 18-item Emotion Scale.

The seven positive items were *amusement, happiness, interest, joy, love, pride,* and *tenderness.* The eleven negative emotion items included *anger, anxiety, confusion, contempt, disgust, embarrassment, fear, guilt, sadness, shame*, and *unhappiness*. Participants rated how they felt after viewing a film clip on the 18 emotion-related items. Ratings were on a 9-point Likert-type scale with scores ranging from 1 (*not at all*) to 9 (*extremely*). These items were similar to those outlined in Rottenberg et al. (2007) with two changes. First, the item *surprise* was removed as it was unclear whether it was positive or negative. For example, being surprised when a loved one appears holding a longed-for gift is a different from being surprised when a stranger appears next to you in a dark alley. Second, the item *tenderness* was added as two film clips (i.e., GUMP, POETS) rated highly on this item in a recent study by Schaefer et al. (2011).




LAMBS
MISERY
ROAD
SHINING
AFRICA
PRESIDENT
Mean Rating
Participants
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Positive
Negative

Appendix J

Text Passages Designed to Induce Emotion (positive, neutral, negative)

Positive emotion induction passage (highlighted terms are replaced with alternative terms in the negative emotion induction passage)

I rubbed my eyes gently trying to wake myself up after a restful nap. I felt invigorated. I was sitting against the trunk of a large bushy green tree that was bursting with life. I could feel the smooth tree bark against my back and my hands brushed gently over the soft grass around me. My hand touched something velvety and when I looked down I saw that I was touching a pink flower. There were many of these flowers dotted around and when I breathed deeply I could smell their sweet scent. The book I had been reading before falling asleep had tumbled onto my rucksack and was still open at the correct page. The day was getting brighter as the sun climbed higher in the stunning blue sky. My resting spot was dwarfed on the left by the majestic mountainside, which rose up out of sight into the blue sky. Far to my right was a dip where the land sloped down into a pretty valley. I felt carefree and had no idea how much time had passed since I'd first sat down, and there was no-one in sight nearby.

In the clear sky I saw what looked like a small, fluffy cloud rise up and drift towards me. It quickly grew nearer, and floated like a smoke trail on the wind. It resolved itself into a flock of swallows, crisscrossing the country as if they were looking for something. One of them detached from the flock and flew near me, landing on a white stone close by. I heard him whistling, and smiled at the pure joy in the sound. The air grew warmer as the sun rose in the heavens.

I looked out over the lake. I guessed it to be somewhere between four and six hundred metres wide, but how far it stretched to the south was impossible to guess, as the sunlight glinting off the water made it hard to see into the distance. The water was crystal clear and stretched like a strong arm to the hills. I had dipped my toes into that water earlier in the day and I could still feel its soothing and refreshing touch.

The day remained clear, with not a cloud in the sky, and I hoped that I wouldn't get sunburnt. The beautiful weather relaxed me, and made me dreamy. I was staring southward, but seeing little. As I looked around, everything looked sparkling and fresh, as if the land were full of life. In the bright sunlight I could see everything. I sat there feeling happy and relaxed.

I picked up my book and began to read. When I looked up again the sun had begun to sink in the sky and the light took on an orange hue. The scenery around me gradually changed. The mountains became a blue and purple mix while the shimmering lake reflected the orange of the sky. My surroundings were beautiful and peaceful, and the large trees made me feel protected. A light breeze sprang up in the growing twilight, carrying the scents of more flowers and spring with it from the south. As I beheld the glorious vista in the fading light, I thought that the entire scene looked like something from a fairytale. With the day wearing on, I decided to spend the night in this wonderful place.

Negative emotion induction passage

I rubbed my eyes harshly trying to wake myself up after a fitful nap. I felt tired. I was sitting against the trunk of a large half withered tree that was clinging to life. I could feel the uneven tree bark against my back and my hands brushed roughly over the coarse grass around me. My hand touched something spiky and when I looked down I saw that I was touching a dried-out weed. There were many of these weeds strewn around and with each breath I could smell their bitter odour. The book I had been reading before falling asleep had tumbled onto my rucksack and was closed. I could not remember what page I had been reading. The day was getting darker under the lowering sky. My resting spot was dwarfed on the left by the towering, dark mountainside, which rose up out of the gloomy land. Far to my right the land plunged downwards into a ravine, which seemed a bottomless void. I had no idea how much time had passed since I'd first sat down, and there was no-one to be seen anywhere around.

In the grey sky when I looked in the distance, I saw what looked like a small, dark cloud rise up and head towards me. It grew nearer, and floated like a smoke trail in the wind. The cloud resolved itself into a flock of black crows, flying quickly, and crisscrossing the country like they were looking for something. One of them detached itself from the main group and came nearer. He landed on a weathered tombstone close by. I heard him croaking and I shuddered at the sound. The air grew heavier and more oppressive as the threatening clouds overhead thickened.

I looked out over the lake. I guessed it to be somewhere between four and six hundred metres wide, but how far it stretched to the north was impossible to guess in the gathering darkness. The water was green and stagnant, like a slimy arm that stretched to the hills. My feet had slipped into that water earlier in the day and I could still feel its slimy and dirty touch.

The dark clouds overhead were getting thicker, and I hoped desperately that it wouldn't rain. The ominous clouds overhead sapped the life from the already bleak landscape, and I was overwhelmed by a feeling of gloom. I was staring northwards, but seeing little. As I looked around, everything looked grey and dead, as if the land had given up all life. In the fading light it was impossible to make anything out. I sat there feeling as if there was nothing to do.
I picked up my book and tried to read. When I looked up again night was well and truly falling, and the sky was densely packed with thick, heavy clouds. The scenery around me changed. The mountains became black while the foul lake reflected the grim grey-black colour of the sky. Everything around me looked ragged and grey, and the large trees made me feel vulnerable. The wind seemed to be changing direction, coming more from the north. As I looked out on the depressing scene which met my eyes, I thought that the whole area looked like a wilderness of slime and weeds. With the light almost completely faded, I resigned myself to spending the night in this depressing place.

Neutral emotion induction passage

Luxembourg is the least populated country in the European Union (EU), with a population of only 502,066. It is bordered to the south by France; to the west and north-west by Belgium; to the east and north-east by Germany. Luxembourg measures 2,586 square kilometres and of all the world's independent countries, it is the 20th smallest. The north of Luxembourg is heavily forested and slightly mountainous. Most of the country's farmland is in the south.

The original Duchy of Luxembourg was approximately three times the size of the modern country. In 1815, after 400 years of rule by various European nations, Luxembourg was granted the status of Grand Duchy by the Congress of Vienna. Luxembourg considers the Treaty of London in 1867 to be its year of independence although political autonomy was originally granted in 1839 by King William I of the Netherlands, who was also the Grand Duke of Luxembourg. Since 1890, the Crown of the Grand Duchy has been passed down through the House of Nassau. The present monarch, Grand Duke Henri, came to the throne after the death of his father Grand Duke Jean in 2000. Executive power in Luxembourg rests with the Grand Duke and a Cabinet of 12 ministers while legislative power resides with a Parliament elected by the people.

Luxembourg City is Luxembourg's capital with almost 20% of the country's population living there. Luxembourgish, French, and German are the official languages of Luxembourg. Luxembourgish is the everyday language, French is the language of government, and German is the primary language of the press. English is also taught in high schools and most Luxembourgers speak at least some English as a result. The flag of Luxembourg has three horizontal stripes; a top stripe of red, a middle stripe of white, and a bottom stripe of blue. It is virtually identical to the flag of the Netherlands except for a slightly different blue shading (sky blue instead of ultramarine).

The Euro is the official currency in Luxembourg. Iron ore, steel factories, and banking institutions are major contributors of the Luxembourg economy. Luxembourg has the greatest concentration of banks of any country in the EU. Other major industries upon which Luxembourg relies are EU agencies and tourism.

Luxembourg cuisine has traditionally been influenced by its neighbours France, Germany, and Belgium and more recently through migration by Italy and Portugal. Luxembourg has many delicacies including pastries, cheese, smoked ham, and fresh fish. During hunting season, wild game, such as hare and wild boar, also feature on many menus. Luxembourg has more Michelin-starred restaurants per capita than any other country in the world. It has a strong winemaking industry particularly white wine made from Riesling grapes.

Appendix K

The Positive and Negative Affect Schedule (PANAS)

This questionnaire consists of a number of words that describe feelings and emotions. For each item, place a number in the space next to that item, indicating to what extent you feel this way right now, that is, at the present moment. Use the following number scale to choose your answers.

1	**2**	**3**	**4**	**5**
Very slightly or not at all	A little	Moderately	Quite a bit	Extremely

_______ Interested	_______ Irritable
_______ Distressed	_______ Alert
_______ Excited	_______ Ashamed
_______ Upset	_______ Inspired
_______ Strong	_______ Nervous
_______ Guilty	_______ Determined
_______ Scared	_______ Attentive
_______ Hostile	_______ Jittery
_______ Enthusiastic	_______ Active
_______ Proud	_______ Afraid

Appendix L
Temporary Ambiguous Question as Presented to Participants

Event Perception Task

Please answer the following question.

Imagine that you are scheduled to attend a(n)friend's party/meeting/exam next Wednesday. You hear that the party/meeting/exam has been moved forward two days. What day is the party/meeting/exam now that it has been rescheduled?

____

When you have completed this task please turn the page for the next task.

**Note:* The event presented to participants corresponded to the event valence condition to which participants had been assigned: positive "a friend's party", neutral "a meeting", or negative "an exam".

Appendix M

Approach Question as Presented to Participants

Event Perception Task 2

With respect to that rescheduled party please answer the following question.

Please circle which statement best expresses how you feel.

a. I am approaching the party/meeting/exam

b. The party/meeting/exam is approaching me

c. Neither

When you have completed this task please turn the page for the next task.

**Note:* The event presented to participants corresponded to the event valence condition to which participants had been assigned: positive “a friend’s party”, neutral “a meeting”, or negative “an exam”.

Appendix N

The Westside Test Anxiety Scale (WTAS)

Exam Feelings Questionnaire

This questionnaire consists of a number of sentences that describe feelings about exams. Rate how true each of the following is of you, from extremely or always true, to not at all or never true. Use the following 5 point scale. Circle your answers.

5	**4**	**3**	**2**	**1**
extremely or always true	highly or usually true	moderately or sometimes true	slightly or seldom true	not at all or never true

1) The closer I am to a major exam, the harder it is for me to concentrate on the material.
5 4 3 2 1

2) When I study, I worry that I will not remember the material on the exam.
5 4 3 2 1

3) During important exams, I think that I am doing awful or that I may fail.
5 4 3 2 1

4) I lose focus on important exams, and I cannot remember material that I knew before the exam.
5 4 3 2 1

5) I finally remember the answer to exam questions after the exam is already over.
5 4 3 2 1

6) I worry so much before a major exam that I am too worn out to do my best on the exam.
5 4 3 2 1

7) I feel out of sorts or not really myself when I take important exams.
5 4 3 2 1

8) I find that my mind sometimes wanders when I am taking important exams.
5 4 3 2 1

9) After an exam, I worry about whether I did well enough.
5 4 3 2 1

10) I struggle with writing assignments, or avoid them as long as I can. I feel that whatever I do will not be good enough.
5 4 3 2 1

When you have completed this task please turn the page to continue this questionnaire.

Appendix O

Liebowitz Social Anxiety Scale – Self-report (LSAS-SR)

Social Feelings Questionnaire

This questionnaire assesses the way that social feelings play a role in your life across a variety of situations. Please read each question carefully and answer the two questions about each situation. The first question asks how anxious or fearful you feel in the situation. The second question asks how often you avoid the situation. If you come across a situation that you ordinarily do not experience, we ask that you imagine "what if you were faced with the situation," and then rate the degree to which you would fear this hypothetical situation and how often you would tend to avoid it.

Please base your ratings on the way that the situations have affected you *in the past week*.

Fear or Anxiety:
0 = None
1 = Mild
2 = Moderate
3 = Severe

Avoidance:
0 = Never (0%)
1 = Occasionally (1-33%)
2 = Often (34-67%)
3 = Usually (68-100%)

		Fear or Anxiety	Avoidance
1)	Telephoning in public.		
2)	Participating in small groups.		
3)	Eating in public places.		
4)	Drinking with others in public places.		
5)	Talking to people in authority.		
6)	Acting, performing, or giving a talk in front of an audience.		
7)	Going to a party.		
8)	Working while being observed.		
9)	Writing while being observed.		
10)	Calling someone you don't know very well.		
11)	Talking with people you don't know very well.		
12)	Meeting strangers.		

When you have completed this task please turn the page to continue this questionnaire.

Social Feelings Questionnaire, continued...

This questionnaire assesses the way that social feelings play a role in your life across a variety of situations. Please read each question carefully and answer the two questions about each situation. The first question asks how anxious or fearful you feel in the situation. The second question asks how often you avoid the situation. If you come across a situation that you ordinarily do not experience, we ask that you imagine "what if you were faced with the situation," and then rate the degree to which you would fear this hypothetical situation and how often you would tend to avoid it.

Please base your ratings on the way that the situations have affected you *in the past week*.

Fear or Anxiety:	**Avoidance:**
0 = None	**0** = Never (0%)
1 = Mild	**1** = Occasionally (1-33%)
2 = Moderate	**2** = Often (34-67%)
3 = Severe	**3** = Usually (68-100%)

		Fear or Anxiety	Avoidance
13)	Urinating in a public bathroom.		
14)	Entering a room when others are already seated.		
15)	Being the centre of attention.		
16)	Speaking up at a meeting.		
17)	Taking a test.		
18)	Expressing a disagreement or disapproval to people you don't know very well.		
19)	Looking at people you don't know very well in the eyes.		
20)	Giving a report to a group.		
21)	Trying to pick up someone.		
22)	Returning goods to a store.		
23)	Giving a party.		
24)	Resisting a high pressure salesperson.		

When you have completed this task please turn the page for the next task.

Appendix P

Depression, Anxiety, and Stress Scales – Short-form (DASS-21)

General Feelings Questionnaire

Please read each statement and circle a number 0, 1, 2, 3 which indicates how much the statement applied to you *over the past week.* There are no right or wrong answers. Do not spend too much time on any statement.

0	**1**	**2**	**3**
Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of the time	Applied to me very much, or most of the time

1)	I found it hard to wind down	0	1	2	3
2)	I was aware of dryness in my mouth	0	1	2	3
3)	I couldn't seem to experience any positive feeling at all	0	1	2	3
4)	I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5)	I found it difficult to work up the initiative to do things	0	1	2	3
6)	I tended to over-react to situations	0	1	2	3
7)	I experienced trembling (e.g., in the hands)	0	1	2	3
8)	I felt that I was using a lot of nervous energy	0	1	2	3
9)	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10)	I felt that I had nothing to look forward to	0	1	2	3
11)	I found myself getting agitated	0	1	2	3
12)	I found it difficult to relax	0	1	2	3
13)	I felt down-hearted and blue	0	1	2	3
14)	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3

When you have completed this task please turn the page to continue this questionnaire.

General Feelings Questionnaire, continued...

Please read each statement and circle a number 0, 1, 2, 3 which indicates how much the statement applied to you *over the past week.* There are no right or wrong answers. Do not spend too much time on any statement.

0	**1**	**2**	**3**
Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of the time	Applied to me very much, or most of the time

15)	I felt I was close to panic	0	1	2	3
16)	I was unable to become enthusiastic about anything	0	1	2	3
17)	I felt I wasn't worth much as a person	0	1	2	3
18)	I felt that I was rather touchy	0	1	2	3
19)	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	0	1	2	3
20)	I felt scared without any good reason	0	1	2	3
21)	I felt that life was meaningless	0	1	2	3

When you have completed this task please turn the page for the next task.

Appendix Q

Participant Information Statement

Participant Information Statement

Project Title: Individual differences in perceptions and feelings about events.

You are invited to participate in a study conducted by Catherine O'Gorman, PhD candidate, School of Social Sciences and Psychology, University of Western Sydney. This study is being supervised by Dr Agnes Petocz and Associate Professor Nigel Mackay. The purpose of this study is to investigate factors underlying individual differences in perceptions and feelings about events.

You will be asked to fill out a short questionnaire assessing how you feel, following which you will be asked to read carefully a short passage. You will then be asked to fill out a second feelings questionnaire, after which you will complete an event perception task. Then you will be asked to fill out another three questionnaires. Finally, you will be asked to indicate your gender, age, and first language. The study is expected to take approximately 30 minutes.

If you have registered for the project using the SONA experiment management system, you will receive course credit for your participation. All participants will gain first-hand experience of psychological research, which, for those of you studying psychology, is considered by the School of Social Sciences and Psychology as an important part of your training. However, for those participating for course credit, there are alternatives to research participation should you wish to reconsider participating in human research.

There are no direct risks associated with this experiment. You may feel anxious that your perceptions and feelings about events are being assessed. However, it is important to realise that your results are being pooled with those of all the other participants, and are completely anonymous. In addition, task performance and imagination are governed by many different factors, including fatigue, boredom, and prior exposure to the stimuli. You are simply asked to do the best you can, without worrying about your individual results. All aspects of the study, including results, will be confidential, and only the researchers will have access to the information you supply. Furthermore, your scores and information will be anonymous and not connected to your name – even for the researchers.

Participation is entirely voluntary, you are not obliged to be involved, and, if you do choose to participate, you are free to withdraw at any time without giving any reason and without any consequences.

You can tell other people about the study by providing them with the chief investigator's contact details. They can contact the chief investigator to discuss their participation and obtain an information sheet. However, you are asked not to disclose details of the study, as some participants may experience slightly different conditions during their participation.

When you have read this information, I (Catherine O'Gorman) will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact me (Catherine O'Gorman) on 0439 480 316 or via email at c.ogorman@uws.edu.au or Dr Agnes Petocz on (02) 9772 6624 or via email a.petocz@uws.edu.au. The results of this study will be disseminated in the form of a PhD thesis. It is also possible that the results of this research will be disseminated in the form of a conference presentation and/or published paper.

This study has been approved by the University of Western Sydney Human Research Ethics Committee. The Approval number is H10036.

If you experience any unexpected discomfort or distress after participating, please inform me (Catherine O'Gorman) and/or Student Counselling Service (Ph: 02 9852 5199).

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Human Ethics Officer via Tel (02) 4736 0229 or email humanethics@uws.edu.au. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you will be asked to sign the Participant Consent Form.

Appendix R

Participant Consent Form

Participant Consent Form

Project Title: Individual differences in perceptions and feelings about events.

I consent to participate in the research project titled *Individual differences in perceptions and feelings about events*.
I acknowledge that:

I have read the participant information sheet and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

The procedures required for the project and the time involved have been explained to me, and any questions I have about the projected have been answered to my satisfaction.

I understand that my involvement is confidential and that the information gained during the study may be published but no information about me will be used in any way that reveals my identity.

I understand that I can withdraw from the study, without penalty, at any time.

____ ____________________________

Participant Name   Student Number (if applicable)

____

Signature

____

Date

NOTE:
This study has been approved by the University of Western Sydney Human Research Ethics Committee. The Approval number is H10036.

If you experience any unexpected discomfort or distress after participating, please inform the research supervisor and/or Student Counselling Service (Ph: 02 9852 5199).
If you have any complaints or reservations about the ethical conduct of this research, you may contact the Human Ethics Officer via Tel (02) 4736 0229 or email humanethics@uws.edu.au.
Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix S

Participants' Instructions as Presented in the Experimental Booklet

Welcome to this study.
The details of the study are contained within this booklet. Please follow the instructions at the top of each page. Once you have completed a page and moved on please do not turn back to an earlier task. If you have any questions during the study please raise your hand and the researcher will come to you.
When you have completed this study please sit quietly and wait for the other participants to finish. You will be debriefed by the researcher at the end of this study.
This study has been approved by the University of Western Sydney Human Research Ethics Committee. The Approval number is H10036.

Appendix T

Final Page of Instructions as Presented in the Experimental Booklet

END OF EXPERIMENT

This is the end of your experimental tasks. When the other participants have completed their tasks the researcher will provide a brief explanation. Until such time please remain seated quietly.

Thank you for your time.

Appendix U

Data Screening: Amendments and Exclusions

Table U1

Action Taken to Rectify Problem Data

Issue	Action taken	ID(s)
AQ – Circle two options, crossed out one of them	"Neither" is the accepted (i.e., first) response	8277
AQ – Circle two options, crossed out one of them	"The meeting is approaching me" is the accepted (i.e., first) response	8301
AQ – Circle two options, crossed out one of them	"The meeting is approaching me" is the accepted (i.e., first) response	8607
DASS-21 – Item 19: Circled '2' and '3'. Item 21: Circled '1' and '2'.	Item 19: Value of 2.5 entered Item 21: Value of 1.5 entered	9110
DASS-21 – Item 3: Circled '0' and '2'.	Value set to 1	9103
LSAS-SR – Avoidance item 15: Circled "2-3".	Value set to 2.5	8603
LSAS-SR – Avoidance subscale had percentages rather than numbers	Percentages recalculated as number values	8033, 8060, 8808
LSAS-SR – Item 4 *Drinking with others in public places.* Participant differentiated between drinking "alcohol" rated as "3" and "normal drinking eg, water" rated as "0."	Value set to 0 ("normal drinking" rating) for item 4 across both subscales (fear or anxiety and avoidance)	8206
LSAS-SR: Anxiety: Items 10 and 11: "1 – 2" Avoidance: Items 10, 11, 17, and 18: "0 – 1"	Anxiety: Value of 1.5 entered. Avoidance: Value of 0.5 entered.	9110
PANAS (pre- or post-manipulation) – Most items missing	Discard	8247, 9007, 9216
TAQ – Answered "Friday", changed to "Monday"	"Friday" is the accepted (i.e., first) response	8211, 8201, 8207, 8266, 8271, 8285, 8515, 8703, 8802, 8951, 9003, 9203, 9211
TAQ – Answered "Monday", changed to "Friday"	"Monday" is the accepted (i.e., first) response	8040, 8206, 8264, 8621, 9107
TAQ – Answered "Saturday"	Discard	8096, 8208, 8263, 8316, 8642, 8820
TAQ – Answered "Sunday"	Discard	8005, 8328, 8510, 8803
TAQ – Entered two dates	Discard	8806
TAQ – Left blank	Discard	8333

Table U2

Data Items Outside of Prescribed Ranges and Corrective Action Taken

ID	Item	Value	
		Initial	Changed to
8206	DASS21 item 1: *I found it hard to wind down*	33	3
8805	LSAS-SR Avoidance subscale item 16: *Speaking up at a meeting*	4[a]	3
8819	Post-manipulation PANAS: item *alert*	11	1
8954	Post-manipulation PANAS: item *scared*	12	2

Note: Unless otherwise stated, values were outside of prescribed ranges due to a keying error at the point of data entry into the statistical software package. [a]Value as specified by participant.

Table U3

Details of Missing Data and Corrective Action Taken

ID	Missing Item(s)	Action Taken
8007	LSAS-SR –Responses on one subscale for each item only	Omit from all LSAS-SR involved analyses
8024	PANAS (post-manipulation) – *interested*	EMA
8036	WTAS – Item 5	EMA
8038	LSAS-SR – Avoidance item 17	EMA
8043	LSAS-SR – Responses on one subscale for each item only	Omit from all LSAS-SR analyses
8085	PANAS (pre-manipulation) - *jittery*	EMA
8089	LSAS-SR – Avoidance item 24	EMA
8102	DASS-21 –Item 15	EMA
8106	FEELINGS (pre-manipulation)	EMA
8108	PANAS (pre-manipulation) - *irritable*	EMA
8109	LSAS-SR – Fear or anxiety item 10	EMA
8204	DASS-21 – Item 3	EMA
8207	PANAS (pre-manipulation) - *attentive*	EMA
8213	AQ	Omit from all AQ analyses
8239	PANAS (post-manipulation) – *proud*	EMA
8284	LSAS-SR – Item 23 (both subscales)	EMA
8300	LSAS-SR – Item 17 (both subscales)	EMA
8312	FEELINGS (pre-manipulation), DASS21 – Item 17	EMA
8318	LSAS-SR – Fear or anxiety item 13	EMA
8326	PANAS (pre-manipulation) – *jittery*, PANAS# (post-manipulation) – *jittery*	EMA
8332	WTAS – Item 1	EMA
8429	DASS-21 – Item 8	EMA
8434	DASS-21 – Item 17	EMA
8522	LSAS-SR – Responses on one subscale for each item only.	Omit from all LSAS-SR analyses
8603	WTAS – Item 2	EMA
8614	LSAS-SR – Item 21 for both subscales, First Language	EMA
8622	DASS-21 – Item 13	EMA
8626	DASS-21 –Item 7	EMA
8629	PANAS (pre-manipulation) - *distressed*	EMA
8700	LSAS-SR – Fear or anxiety item 13	EMA
8701	DASS-21 – Items 4 -21, Age, Gender, First Language*	Omit from all DASS21 analyses
8710	PANAS (pre-manipulation) - *hostile*	EMA
8730	DASS-21 – Items 1 and 11, PANAS# (pre-manipulation) - *hostile, jittery,* PANAS (post-manipulation) - *jittery*	EMA
8731	LSAS-SR – Avoidance item 2	EMA
8810	DASS-21 – Items 20 and 21, WTAS – all items, Age, Gender, First Language*	EMA Omit from all WTAS analyses
8900	DASS-21 – Item 13, LSAS-SR – Avoidance item 14	EMA
8901	PANAS (pre-manipulation) - *irritable*	EMA
8916	LSAS-SR – Missing items: Anxiety 11 items, Avoidance 6 items	Omit from all LSAS-SR involved analyses
8918	PANAS (post-manipulation) – *nervous*	EMA
8919	DASS-21 – Item 7, WTAS – Item 3	EMA
9009	LSAS-SR – Items 19 – 24 for both subscales Age, Gender, First Language*	Omit from all LSAS-SR analyses
9013	FEELINGS (post-manipulation)	EMA
9017	FEELINGS (pre-manipulation)	EMA

Note: Expectation maximisation algorithm (EMA). *No action required for missing demographic data.

Appendix V

Actions Taken to Lessen Impact of Univariate Outliers for Pre-and Post-Induction PANAS Negative Affect Subscale

ID	Group	Score	ZScore	Next highest score	Score changed to
First pass - Pre-induction negative affect					
8325	Neutral emotion/Neutral event	35	4.26459	28	29
8407	Positive emotion/Negative event	33	3.49420	24	25
8640	Negative emotion/Positive event	35	4.03326	30	31
9100	Positive emotion/Neutral event	40	5.29644	23	24
Second pass - Pre-induction negative affect					
8640	Negative emotion/Positive event	31*	3.46353		30
Third pass - Pre-induction negative affect					
8250	Negative emotion/Positive event	30	3.30441	27	28
8640	Negative emotion/Positive event	30*	3.30441	27	28
Fourth pass - Pre-induction negative affect					
8250	Negative emotion/Positive event	28*	3.06092		
8640	Negative emotion/Positive event	28*	3.06092		
First pass - Post-induction negative affect					
8325	Neutral emotion/Neutral event	35	4.52060	25	26
8407	Positive emotion/Negative event	28	3.83254	21	22
8811	Neutral emotion/Negative event	34	3.47448	32	33
9100	Positive emotion/Neutral event	33	5.93754	17	18
9205	Positive emotion/Positive event	28	4.05153	24	25
Second pass - Post-induction negative affect					
8811	Neutral emotion/Negative event	33*	3.34140		32
9205	Positive emotion/Positive event	25*	3.47736		24
Third pass - Post-induction negative affect					
8811	Neutral emotion/Negative event	32*	3.20394		
9205	Positive emotion/Positive event	24*	3.26366		

Note: NA subscale data from SPSS file data matched data on paper questionnaire.
*Score is a changed score.

Appendix W

Experiment 2: Differences in TAQ Responses When Comparing Experimental Conditions Against Each Other Or Against a Fifty-Fifty Split

Table W1

Experiment 2: Comparing Experimental Conditions against Each Other for TAQ Responses

Exp. vs. Exp. - TAQ	Result
All nine conditions against each other	$\chi^2(8, N = 489) = 14.28, p = .075$ $\chi^2(1, N = 489) = 8.11, p = .004$*
Negative/Negative vs. Negative/Neutral	$\chi^2(1, N = 110) = 0.039, p = .844$
Negative/Negative vs. Negative/Positive	$\chi^2(1, N = 106) = 0.095, p = .758$
Negative/Neutral vs. Negative/Positive	$\chi^2(1, N = 106) = 0.013, p = .909$
Neutral/Negative vs. Negative/Negative	$\chi^2(1, N = 110) = 0.038, p = .845$
Neutral/Negative vs. Negative/Neutral	$\chi^2(1, N = 110) = 0.154, p = .695$
Neutral/Negative vs. Negative/Positive	$\chi^2(1, N = 106) = 0.249, p = .617$
Neutral/Neutral vs. Negative/Negative	$\chi^2(1, N = 111) = 2.074, p = .150$
Neutral/Neutral vs. Negative/Neutral	$\chi^2(1, N = 111) = 2.677, p = .102$
Neutral/Neutral vs. Negative/Positive	$\chi^2(1, N = 107) = 2.947, p = .086$
Neutral/Neutral vs. Neutral/Negative	$\chi^2(1, N = 111) = 1.552, p = .213$
Neutral/Neutral vs. Neutral/Positive	No test run as both conditions had same figures
Neutral/Neutral vs. Positive/Negative	$\chi^2(1, N = 107) = 2.278, p = .131$
Neutral/Neutral vs. Positive/Neutral	$\chi^2(1, N = 112) = 0.324, p = .569$
Neutral/Neutral vs. Positive/Positive	$\chi^2(1, N = 110) = 0.157, p = .692$
Neutral/Positive vs. Negative/Negative	$\chi^2(1, N = 111) = 2.074, p = .150$
Neutral/Positive vs. Negative/Neutral	$\chi^2(1, N = 111) = 2.677, p = .102$
Neutral/Positive vs. Negative/Positive	$\chi^2(1, N = 107) = 2.947, p = .086$
Neutral/Positive vs. Neutral/Negative	$\chi^2(1, N = 111) = 1.552, p = .213$
Positive/Negative vs. Negative/Negative	$\chi^2(1, N = 106) = 0.010, p = .922$

(continued)

Exp. vs. Exp. - TAQ	Result
Positive/Negative vs. Negative/Neutral	$\chi^2(1, N = 106) = 0.009$, $p = .924$
Positive/Negative vs. Negative/Positive	$\chi^2(1, N = 102) = 0.042$, $p = .837$
Positive/Negative vs. Neutral/Negative	$\chi^2(1, N = 106) = 0.084$, $p = .772$
Positive/Negative vs. Neutral/Positive	$\chi^2(1, N = 107) = 2.278$, $p = .131$
Positive/Neutral vs. Negative/Negative	$\chi^2(1, N = 111) = 3.998$, $p = .046$
Positive/Neutral vs. Negative/Neutral	$\chi^2(1, N = 111) = 4.811$, $p = .028$
Positive/Neutral vs. Negative/Positive	$\chi^2(1, N = 107) = 5.119$, $p = .024$
Positive/Neutral vs. Neutral/Negative	$\chi^2(1, N = 111) = 3.264$, $p = .071$
Positive/Neutral vs. Neutral/Positive	$\chi^2(1, N = 112) = 0.324$, $p = .569$
Positive/Neutral vs. Positive/Negative	$\chi^2(1, N = 107) = 4.232$, $p = .040$
Positive/Neutral vs. Positive/Positive	$\chi^2(1, N = 110) = 0.028$, $p = .867$
Positive/Positive vs. Negative/Negative	$\chi^2(1, N = 109) = 3.303$, $p = .069$
Positive/Positive vs. Negative/Neutral	$\chi^2(1, N = 109) = 4.042$, $p = .044$
Positive/Positive vs. Negative/Positive	$\chi^2(1, N = 105) = 4.339$, $p = .037$
Positive/Positive vs. Neutral/Negative	$\chi^2(1, N = 109) = 2.643$, $p = .104$
Positive/Positive vs. Neutral/Positive	$\chi^2(1, N = 110) = 0.157$, $p = .692$
Positive/Positive vs. Positive/Negative	$\chi^2(1, N = 105) = 3.529$, $p = .060$

Note: Chi-square test for independence analysis performed for all comparisons. Result is Pearson chi-square, unless stated otherwise. *Result is Linear-by-Linear Association.

Table W2

Experiment 2: Comparing Experimental Conditions against 50/50 Split for TAQ Responses

Exp. versus 50/50 split	Result
Positive/Positive	$\chi^2(1, N = 54) = 0.667, p = .414$
Positive/Neutral	$\chi^2(1, N = 56) = 1.463, p = .285$
Positive/Negative	$\chi^2(1, N = 51) = 3.314, p = .069$
Neutral/Positive	$\chi^2(1, N = 56) = 0.071, p = .789$
Neutral/Neutral	$\chi^2(1, N = 56) = 0.071, p = .789$
Neutral/Negative	$\chi^2(1, N = 55) = 2.200, p = .138$
Negative/Positive	$\chi^2(1, N = 51) = 4.412, p = .036$
Negative/Neutral	$\chi^2(1, N = 55) = 4.091, p = .043$
Negative/Negative	$\chi^2(1, N = 55) = 3.073, p = .080$

Note: Analysis is a chi-square goodness-of-fit against a hypothesised 50%/50% data split.

Appendix X

Experiment 2: Differences in AQ Responses When Comparing Experimental Conditions Against Each Other Or Against a Three-Way Even Split

Table X1

Experiment 2: Comparing Experimental Conditions against Each Other for AQ Responses

Exp. vs. Exp. – AQ (all three responses)	Result
All nine conditions against each other	$\chi^2(16, N = 488) = 20.279, p = .208$
Negative/Negative vs. Negative/Neutral	$\chi^2(2, N = 109) = 0.149, p = .928$
Negative/Negative vs. Negative/Positive	$\chi^2(2, N = 105) = 2.333, p = .311$
Negative/Neutral vs. Negative/Positive	$\chi^2(2, N = 106) = 3.405, p = .182$
Neutral/Negative vs. Negative/Negative	$\chi^2(2, N = 109) = 0.837, p = .658$
Neutral/Negative vs. Negative/Neutral	$\chi^2(2, N = 110) = 0.393, p = .822$
Neutral/Negative vs. Negative/Positive	$\chi^2(2, N = 106) = 4.095, p = .129$
Neutral/Neutral vs. Negative/Negative	$\chi^2(2, N = 110) = 1.601, p = .449$
Neutral/Neutral vs. Negative/Neutral	$\chi^2(2, N = 111) = 2.023, p = .364$
Neutral/Neutral vs. Negative/Positive	$\chi^2(2, N = 107) = 0.859, p = .651$
Neutral/Neutral vs. Neutral/Negative	$\chi^2(2, N = 111) = 1.791, p = .408$
Neutral/Neutral vs. Neutral/Positive	$\chi^2(2, N = 112) = 3.091, p = .213$
Neutral/Neutral vs. Positive/Negative	$\chi^2(2, N = 107) = 3.332, p = .189$
Neutral/Neutral vs. Positive/Neutral	$\chi^2(2, N = 112) = 1.499, p = .473$
Neutral/Neutral vs. Positive/Positive	$\chi^2(2, N = 110) = 0.227, p = .893$
Neutral/Positive vs. Negative/Negative	$\chi^2(2, N = 110) = 5.252, p = .072$
Neutral/Positive vs. Negative/Neutral	$\chi^2(2, N = 111) = 6.975, p = .031$
Neutral/Positive vs. Negative/Positive	$\chi^2(2, N = 107) = 0.688, p = .709$
Neutral/Positive vs. Neutral/Negative	$\chi^2(2, N = 111) = 8.249, p = .016$
Positive/Negative vs. Negative/Negative	$\chi^2(2, N = 105) = 0.541, p = .763$
Positive/Negative vs. Negative/Neutral	$\chi^2(2, N = 106) = 0.983, p = .612$

(continued)

Exp. vs. Exp. – AQ (all three responses)	Result
Positive/Negative vs. Negative/Positive	$\chi^2(2, N = 102) = 2.960, p = .228$
Positive/Negative vs. Neutral/Negative	$\chi^2(2, N = 106) = 2.532, p = .282$
Positive/Negative vs. Neutral/Positive	$\chi^2(2, N = 107) = 5.222, p = .073$
Positive/Neutral vs. Negative/Negative	$\chi^2(2, N = 110) = 0.922, p = .631$
Positive/Neutral vs. Negative/Neutral	$\chi^2(2, N = 111) = 1.811, p = .404$
Positive/Neutral vs. Negative/Positive	$\chi^2(2, N = 107) = 0.686, p = .710$
Positive/Neutral vs. Neutral/Negative	$\chi^2(2, N = 111) = 3.082, p = .214$
Positive/Neutral vs. Neutral/Positive	$\chi^2(2, N = 112) = 2.053, p = .358$
Positive/Neutral vs. Positive/Negative	$\chi^2(2, N = 107) = 0.908, p = .635$
Positive/Neutral vs. Positive/Positive	$\chi^2(2, N = 110) = 2.612, p = .271$
Positive/Positive vs. Negative/Negative	$\chi^2(2, N = 108) = 2.944, p = .229$
Positive/Positive vs. Negative/Neutral	$\chi^2(2, N = 109) = 3.406, p = .182$
Positive/Positive vs. Negative/Positive	$\chi^2(2, N = 105) = 1.205, p = .547$
Positive/Positive vs. Neutral/Negative	$\chi^2(2, N = 109) = 2.770, p = .250$
Positive/Positive vs. Neutral/Positive	$\chi^2(2, N = 110) = 3.250, p = .197$
Positive/Positive vs. Positive/Negative	$\chi^2(2, N = 105) = 5.111, p = .078$

Note: Chi-square test for independence analysis for all comparisons. Result is Pearson chi-square, unless stated otherwise.

Table X2

Experiment 2: Comparing Experimental Conditions against Three-way Split for AQ Responses

Exp. versus third/third/third split	Result
Positive/Positive	$\chi^2(2, N = 54) = 0.444, p = .801$
Positive/Neutral	$\chi^2(2, N = 56) = 5.607, p = .061$
Positive/Negative	$\chi^2(2, N = 51) = 11.412, p = .003$
Neutral/Positive	$\chi^2(2, N = 56) = 3.679, p = .159$
Neutral/Neutral	$\chi^2(2, N = 56) = 1.107, p = .575$
Neutral/Negative	$\chi^2(2, N = 55) = 7.127, p = .028$
Negative/Positive	$\chi^2(2, N = 51) = 1.529, p = .465$
Negative/Neutral	$\chi^2(2, N = 55) = 8.109, p = .017$
Negative/Negative	$\chi^2(2, N = 54) = 7.111, p = .029$

Note: Analysis is a chi-square goodness-of-fit against a hypothesised third/third/third data split.