Attention in narrative comprehension: The dynamic interplay between the story and the self.

Dissertation

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Abstract

This dissertation examines the role of attention in narrative comprehension research and processing. After a comprehensive review of the literature, with a deep dive into the multidimensional aspect of attention, two studies were executed. In Study 1, current narrative comprehension research was analyzed for the conceptualization and operationalization of mental models and Attention-Dependent Narrative Experiences (ADNE), particularly on their inclusion of attention in both explications and study measurement. Findings from Study 1 reveal the extent to which attention is assumed rather than examined, and how reliance on indirect and adapted measures may have obscured our understanding of the role of attention in narrative processing and comprehension. These findings motivate Study 2, a dynamic approach based on real-time psychophysiological measures to understand attention and comprehension to long audiovisual narratives. Study 2 involved two audiovisual narrative stimuli (television episodes) that were coded using an incremental measure inspired by the landscape and event indexing theories. Specifically, the measure of respiratory sinus arrhythmia (RSA) was used as a real-time indicator for attention, and comprehension was measured using open-ended and inference-based questions at the end of the narrative exposure. The results suggested that the interaction between self-referencing and the narrative features of the episodes, particularly causal and protagonist information, significantly affected attention to the narrative. Comprehension, measured after exposure, was not significantly predicted by real-time RSA and the narrative features, but primarily varied as a result of the stimulus condition (which narrative was viewed) in the study. Overall, the studies started exploring potential dynamic approaches to understanding narrative attention and comprehension, and provided some interesting evidence supporting the need to develop a dynamic theory and method to examine narrative processing and comprehension.

Dedication

Dedicated to my husband, my parents, my sister, my in-laws, the kids, and the cats for their unwavering support of me for the last six years.

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Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction

Narratives represent an important part of human development. Their use in learning is manifested as early as in childhood imaginative play (Singer, 1995; Oatley, 2011), where children mimic behavior seen in adults and entertainment media. Recognition of that influence has resulted in narratives explicitly designed to stimulate learning in both children and adults by placing educational information alongside the plot of popular entertainment narratives (Moyer-Gusé, 2008; Slater & Rouner, 2002). Narratives tend to be easier for the audience to consume, highlight inconsistencies more clearly, and impact memory longer than expository information (see Glazer, Garsoffky, & Schwan, 2009 for a review). They also allow for a boundary expanding phenomenon (Slater, Johnson, Cohen, Comello, & Ewoldsen, 2014) that allows an individual to experience worlds very different from their own, with the potential to overcome stigma or fear of unfamiliar others (Caputo & Rouner, 2011; Chung & Slater, 2013; Oliver, Dillard, Bae, & Tamul, 2012). However, all of the benefits of narrative are contingent on attention to the story itself and how it is presented to the audience. Individuals have limited cognitive capacity, and motivation to allocate resources to a narrative can be driven by the features of the narrative itself.

Audiovisual narrative presentations provide the brain with multidimensional information streams. Are we attending to the spoken dialogue, nonverbal information, the music, or even external distractions and/or our own thoughts and experiences? Personal experience would suggest that all of these things can draw our attention over the course of viewing, but when and how these attentional switches occur and how they affect our understanding of the text is the focus of this manuscript. It first explores how

narrative research has attempted to capture our processing of stories, with particular focus on attention and its multiple networks. It continues with a study that utilizes psychophysiological measures to capture attention as it occurs in order to better explain how real time attention dynamically impacts narrative comprehension.

Narrative researchers often study narrative processing via the pleasurable experience of flow (Csikszentmihalyi, 1990), where an individual is so thoroughly focused on a narrative that the tangible world becomes inaccessible (Gerrig, 1993; Green & Brock, 2000). Comprehension results from this full attention to the story's structures, which can be translated into mental models that map onto already understood experiences. These models help guide the individual by emphasizing important characters and plot devices, while enabling prediction of potential outcomes (Zwaan, 1999; Zwaan, Langston, & Graesser, 1995). The process of losing oneself in a story goes by many names, but these myriad titles share a common thread that the process requires full dedication of attention to be realized. However, inconsistent operationalization of attention and its dimensions has made it difficult to ascertain the significance of the process in narrative research, limiting our understanding of how the ebb and flow of focus impacts comprehension of the story as a whole.

The experience of entering the narrative world is a tricky one to measure. While the phenomenon is described as an all-in resource allocation that occurs in the moment, the majority of studies utilize post-exposure self-report measures, requiring respondents to look back at the narrative experience and attempt to reconstruct their attentional state. Additionally, relevant scale items denoted as measures of attention seem to equate the process with the absence of distraction, reducing a multifaceted process that

fluctuates during the course of narrative exposure to a single, aggregated indicator (Peterson & Posner, 2012; Posner & Peterson, 1990). Narrative structures can increase or reduce attention at given points of time, and those individual moments can impact comprehension of the plot more than an overall summation of attention paid (Bezdek & Gerrig, 2016). These fluctuations can also represent different forms of attention, including focus on the story versus focus on the self and personal experiences triggered by the narrative (Ball & Little, 2006; Berntsen, 1998; McDonald, Collier, Potocki, Sarge, & Lin, 2012), with both processes potentially aiding or impeding comprehension as a whole. The goal of the current studies is to understand and test this complex yet fundamental concept within narrative contexts. First, the research will identify how attention has been utilized as a variable in narrative processing, particularly its placement and operationalization in empirical models of comprehension. Then a dynamic model of real time attention based upon narrative structures will be tested as a predictor of comprehension outcomes.

Study 1 will involve a thorough review of extant communication literature examining what will be known as *attention-driven narrative experiences (ADNE)* in the context of narrative comprehension. These variables all describe a similar cognitive phenomenon, but are defined under a series of related terms: transportation, involvement, engagement, immersion, and absorption. Articles will be examined for their explicit definition of the ADNE in question. These definitions will be studied for their inclusion or exclusion of the concept of attention and its placement in the theoretical argument. This will be followed by analysis of operationalization of the ADNE, with particular focus on the instruments used to measure attention (if it is measured at all).

ADNE are often examined as playing a moderating role between the message and narrative outcomes (de Graaf, Hoeken, Sanders, & Beentjes, 2009; Tukachinsky, 2014). This study asks what role attention plays in that moderating position, particularly looking at discrepancies between studies that explicitly measure this cognitive process and those that cut it out of the equation.

Study 2 takes the proposed moderating role of attention in comprehension and examines how it can be predicted moment by moment by the structures of the story. In turn, a dynamic model of real time attention is used to predict comprehension outcomes. First two audiovisual narratives are coded using a combination of the landscape model (Van den Broek, Young, Tzeng, & Linderholm, 1999) and event indexing model (Zwaan, at al., 1995) to identify how main concepts are activated and/or downplayed over the course of the story. Then indicators of attention are measured using psychophysiological instruments including heart rate and heart rate variability. The coded structures of the story provide a time series.

Data are modeled and analyzed with the dynamic motivational activation theoretical approach (DMA, Banjo, et al. 2016; Wang, Lang, & Busemeyer, 2011; Wang, Vang, Lookadoo, Tchernev, & Cooper, 2015, Wang, Solloway, Tchernev, & Barker, 2012) to examine how attention, both internal and external, changes over the course of the viewing experience, and how those changes feed back into the attention system to affect the viewer's processing of the narrative as a whole. The DMA approach seeks to unpack the black box of information processing by utilizing real time measures and accounting for, rather than aggregating, dynamic feedback during information processing.

The present study utilizes DMA to link a content analysis of message structures with resulting physiological responses. DMA, when applied to message processing, has been effective in modeling real time attentional patterns during audiovisual stimuli (Wang, Morey, & Srivastava, 2012; Wang, et al., 2012; Wang, et al., 2015; Banjo et al., 2016). However, so far studies along this line have only examined external attention, defined as the mental process of "taking in external sensory information" (Wang, et al., 2015, p. 102). The proposed study extends the approach to account for two types of attention, attention to the stimulus (external attention) and self-referential attention (internal attention), and analyze their development and feedback loops over the course of a full-length narrative, a longer stimulus than those typically studied in audiovisual narrative literature.

In chapter two of this manuscript, the cognitive research and theoretical frameworks guiding the two studies will be explained. Chapter three lays out the design of the first study with its accompanying research questions, results, and discussion. Chapter four describes the second psychophysiological study design, procedure, and results. Chapter five provides the general discussion including implications for research and future directions.

Chapter 2. Theoretical Background

2.1 Attention as a multi-faceted concept.

Communication research concerns itself with the design and consumption of messages. The messages themselves are examined for their dimensions, manipulated to impact outcomes, and compared against one another for their overall effects. Although message designers are often acutely aware of the need to orient the public to a single message in the competitive and ubiquitous media environment, communication scientists often take for granted that a message they are examining is attended to, let alone *how* it is attended to. The multifaceted nature of attention that is often left unchecked may hold explanatory power for how messages are consumed.

Attention in the human brain is a complex system of networks that are critical for information processing. Posner and Peterson (1990) originally conceptualized attention as a tripartite system with three goal-oriented networks of both conscious and unconscious control. However, after two decades of advanced neuroscientific exploration, they deemed their original appraisal of the system inadequate to describe the many dimensions of attention. When revisiting the literature two decades later, the authors concluded that there was evidence for five “relatively separate” networks of attention (Peterson & Posner, 2012). Posner and Peterson’s (1990) initial review describes a system that operates in three interrelated but distinct manners: as a response to novel or notable stimuli (orienting), a conscious process of detection and selection (alerting), and a sustained state of focus (executive control).

First, the orienting system is mostly thought of as reflexive, beyond an individual’s conscious control (Lang, 2000) and has been explored via the *orienting*

response (OR), particularly in the area of audio and audiovisual advertising media (Diao & Sundar, 2004; Nielsen, Shapiro, & Mason, 2010; Le Poire & Burgoon, 1996; Sparks & Lang, 2015). An example of the OR is the involuntary act of turning one's attention to a familiar jingle on the radio (Potter, Lynch, & Kraus, 2015). Certain types of orienting information is also thought to impact comprehension, serving as a cue to reevaluate the situation at hand (Sukalla, Shoenberger, & Bolls, 2015). Orienting can be critical to the creator of an audiovisual narrative, particularly when she is trying to ensure that the viewer recognizes the significance of a critical piece of information that will aid comprehension of future events (Bradley, 2009).

Lang (2000) includes the OR in her limited capacity model of mediated message processing, noting it as a precursor to encoding. She describes the OR as "an automatic physiological and behavioral response that occurs in response to novel or signal stimuli" (p. 52), with novel stimuli changing the current environment (e.g. and increase in volume or change in color), and signal stimuli containing the individualized meaning-filled information (e.g. a person's name or the name of their significant other). The OR is measured with ECG signals, as it manifests as an initial drop in heart rate at the onset of orienting stimulus, followed by the U-shaped curve of beats-per-minute (Lang, Newhagen, & Reeves, 1996, Lang, Chung, Lee, & Zhao, 2005). Studies reveal that this pattern corresponds with an increase in reaction times that mirrors the heart rate data and suggests that ORs use up resources by pulling short-term attention away from other tasks.

However, the OR is not as straightforward as a simple reflex, and researchers have concluded that two orienting systems, a dorsal and ventral system are activated in

response to stimuli (Peterson & Posner, 2012). The dorsal system relates to the original conceptualization of the OR, a spatial reaction where the individual's brain is trying to "turn" to the appropriate location of the novel stimulus. The ventral system, however, is driven by sensory-specific information, such as auditory versus visual input. This suggests that visual attention could be overloaded, but auditory attention could still function given the right input (Keitel, Maess, Schröger, & Müller, 2013). The complexity of just a single portion of the network is significant considering how researchers may measure it. OR is short-term and involuntary, however, while other forms of attention take active control to engage them.

The alerting attention system is described as a form of arousal where the individual becomes focused on information in preparation for a response (Peterson & Posner, 2012; Posner & Peterson, 1990). It requires an active suppression of external distraction while focusing in preparation for an expected signal. This is the area of the attention networks that is addressed when giving participants distractor tasks such as searching for errors or falsehoods in text (e.g. Green & Brock, 2000; Marsh & Fazio, 2006) rather than simply reading fluently for pleasure or comprehension, thus is often used as an attempt to manipulate ADNE (Tukachinsky, 2014). Although the alerting system represents a form of resource allocation that is voluntary, it is subject to effects from the orienting nature of competing media (Lang, Potter, & Bolls, 2009).

Finally, the executive control element attention to stimuli is seen as an effortful process designed to keep the brain vigilant for information and details (Lang, et al, 2009; Sarter, Givens, & Bruno, 2001). The demands on working memory require a level of resource allocation that prevents external influences from impacting processing of the

stimulus. Individuals must be motivated to put in the effort to maintain attention for an extended period of time (Hansen, Johnsen, & Thayer, 2003). Therefore, the executive control network is especially important in narrative research that utilizes long-form stimuli, such as the present research, where individual differences in executive control and the difficulty of the task moderate the sustained attention necessary to successfully process a narrative (Stuss, 2011).

Although initial research supported a unified executive system, Peterson and Posner's (2012) review suggests that the control network actually involves two separate processes, one that requires attention during moment-to-moment tasks, and one that maintains focus throughout. The former is task-related and relevant for focus switching and adjustments during the course of the stimulus, while the latter "acts as stable background maintenance for task performance as a whole" (Peterson & Posner, 2012, p. 81). A portion of this background consciousness is dedicated to an ongoing state of awareness of the self (Posner & Rothbart, 1998), which comes to the surface when activated by appropriate stimuli; in this case, the story.

2.2 Attention allocation to the self or the story

The ability of a narrative to capture the attention of the individual is central to the area of narrative persuasion, particularly focusing on how the story lowers an individual's defenses (Moyer-Gusé & Nabi, 2010; Slater, 2002; Slater & Rouner, 2002). The crux of orienting response research is the manner in which stimuli completely refocus attention toward them. While an OR can be fleeting and rely on heuristic cues to garner that quick reorientation to the message, sustained attention is another story. The

process could be more complex in terms of how the story interacts with the person reading or watching it.

Schank and Abelson (1995) argue that when it comes to information, individuals prefer to learn via stories rather than statements of logic. This occurs primarily because stories provide the context necessary in order to relate information to our own experiences. We appear to be cognitively selfish, seeking to find ourselves in the faces and lives of others. The process of self-recognition in stories is thought to occur as a series of voluntary or involuntary *autobiographical memories,* active or spontaneous retrieval of prior mental states from the subconscious (Berntsen, 1998). While the former are often the result of a memory that has been repeatedly retrieved and well-recalled, the latter, involuntary autobiographical memories (IAMs), are often a surprise and triggered primarily by some input from the environment that pulls the memory to the forefront of the mind (Ball & Little, 2006).

The extent and manner in which IAM retrieval affects attention is debated in the literature. Some models argue that attention becomes split at the activation of IAMs, resulting in “the turning inwards of attention, the emergence of imagery, feelings, and the coming to mind of associated knowledge and memories” (Conway, 2005, p. 616). The strength of these feelings may provide a distraction from the information provided by the triggering stimulus, depending on the amount of cognitive resources necessary to process the memory. Some models argue that an attentional bottleneck can occur as resources compete for the opportunity to observe the external or internal environment, postponing one of the processes or slowing both (Pashler, 1994). Evidence exists that resources shift between different sensory paths (e.g. auditory vs. visual) if attention is

oriented toward and then held by one, which can manifest in attentional blindness in the other (Bressan & Pizzighello, 2008; Dehaene, 2014). Similar competitiveness has been examined in the control of attention to internal (top-down) versus external (bottom-up) information processing.

Corbetta and Shulman's (2002) review of the neuropsychological literature finds that unconscious/involuntary perception versus its voluntary counterpart is the key to the competitive nature between top-down and bottom-up processing. Their findings suggest that the similarity in consciousness is where the struggle for attention lies. So, for example, it would be an impossibility for the brain to simultaneously process an orienting external stimulus (e.g. someone saying your name) and an involuntary autobiographical memory (e.g. that one time someone called your name in public). Similar evidence in self-report data suggests that IAMs do not interfere with the task for the same reason: one is involuntary while the other is deliberate. Ball and Little's (2006) participants did not report lower focused attention when IAMs occurred. McDonald and his colleagues reported similar results when examining how IAMs could be triggered by entertainment media (McDonald, et al., 2012). The authors found that IAMs were positively associated with narrative involvement, a result that runs contrary to most conceptualizations of the phenomenon of transportation into the story world, to be discussed later.

These findings leave open the potential for simultaneous processing if the consciousness is different. Dixon, Fox, & Christoff (2014), for example, argue that externally and internally-focused attention are not necessarily competing with one another and could co-occur or even cooperate. The level at which these two "partially

segregated but partially convergent processing streams" (Dixon, et al., 2014, p. 326) interfere with one another depends on how intentional the attention direction is. The authors point to self-directed thinking that is spontaneously triggered by an external stimulus as an example of a dual functioning system of attention, as compared to, for example, intentional mind-wandering as a result of boredom from an uninteresting stimulus.

Dixon, et al. (2014) also argue that internally-focused attention that draws from memory can be utilized to better process external information, providing an example of how previous experience with a spatial environment may direct how the brain directs efficient perception of and movement through that environment. Familiarity aids in detecting something out of place or novel, particularly if the individual is primed to look for it (Corbetta & Shulman, 2002). Even the most attentive individual cannot perceive all of the details in place, and it would be inefficient to do so. There is a delay in accepting secondary information while the first piece of information moves through conscious processing, thus leaving it to "linger in an unconscious buffer" (Dehaene, 2014, p. 34). This highlights the importance of repeated activation of concepts. A little nudge from the stimulus can remind the brain of what was perceived but maybe not really "seen" until a repetition occurs. This type of split but cooperative attention is evolutionarily beneficial for the individual surveying the world for threats based on internal warnings, which in term stem from learned experience and instinct (Corbetta, Patel, & Shulman, 2008).

The notion of cooperative top-down and bottom-up systems reflects the dual architecture of executive attention summarized by Posner and Peterson (2012), with the background maintenance self and the foreground working self trading allocation of

resources as memories become relevant to the task. The top-down processing of the brain can help perception by filtering important from irrelevant details in external environment. This biased-competition model suggest that the knowledge of the maintenance self informs the working self on how to visually process what is important and ignore what is not (Desimone & Duncan, 1995). There exists mixed evidence that suggests that the brain's ability to modulate this type of control are impacted by the stimulus itself, particularly if it requires the dedication of a great amount of resources (Rothbart & Posner, 2015). By studying the features of the narrative as well as the approach the individual takes in consuming it can illuminate the impact of attention on narrative comprehension.

2.3 Attention in narrative research

Attention allocation and maintenance are a necessary but insufficient element of information processing. Message design and manipulation outcomes rely on the assumption that the stimulus has been attended to the extent necessary for the impact to become relevant. Narrative research is no exception. This important vein of study explores the unique impact that stories have on individuals and society. In order to facilitate this kind of impact, narrative researchers describe the phenomenon of full resource allocation, where attention is captured by the features of the story, resulting in a sort of shift from reality to the story world.

Attention-Driven Narrative Experiences (ADNE).

Focusing on a narrative does not just mean consistently leaving one's eyes on the screen or page, but instead requires a dedication of resources that should shut out

much of the outside world. This effort is rewarded by a sense of escapism, an opportunity to explore new worlds and learn from the experience (Gerrig, 1993; Slater, et al., 2014). In communication research, this pleasurable phenomenon is described under several terms including *transportation, involvement, engagement, absorption, and immersion,* all centralized around resource-allocation. The definitions of each (Table 2.1.) demonstrate that attention is the key factor in these processes, thus they will be referred to as attention-driven narrative experiences (ADNE) in this manuscript

While transportation, involvement, engagement have seen research dedicated to their explication, immersion and absorption are most often used as a synonym to these concepts. The two terms have similar visual evocations. Immersion suggests entering the story world in order to be surrounded by it, as if being submerged in the warm water of the tale. Absorption suggests that the individual is the liquid, with the story acting as a sponge that pulls the viewer into itself. Foundational research placed attention at the center of these phenomena (Tellegen & Atkinson, 1974) with modern research utilizing differences in reaction time to capture the state (Bracken, Pettey, & Wu, 2014). Green and Brock (2000) define transportation in terms of immersion *and* absorption, suggesting an interchangeability of the words.

Transportation and the resulting transportation-imagery model is arguably the most influential of concepts describing narrative processing. Green and Brock (2000) describe transportation as an experience of complete immersion into a narrative world, “a convergent process, where all mental systems and capacities become focused on events occurring in the narrative” (p. 701). The term originates from Gerrig’s (1993) concept of a reader as a traveler who leaves her tangible world for the imagined

Transportation: "*all mental systems and capacities become focused on events occurring in the narrative*" (Green & Brock, 2000) Engagement: "*four dimensions of experiential engagement in narratives: narrative understanding, attentional focus, emotional engagement, and narrative presence*" (Busselle & Bilandzic, 2009) Involvement: "*being primarily engaged in the storyline rather than in one's immediate environment*" (Moyer-Gusé, 2008) Immersion: "*perceiving oneself to be enveloped by, included in, and interacting with an environment*" (Witmer & Singer, 1998) Absorption: "*a state of "total attention" during which the available representational apparatus seems to be entirely dedicated to… the attentional object*" (Tellegen & Atkinson, 1972)

Table 2.1 Attention-focused definitions of the five attention-driven narrative experiences (ADNE)

environment and is changed by the experience upon her return. Gerrig's language, along with the total resource allocation described in the definition, suggest an "all-in" attentional focus must be placed on the stimulus. Green and Brock (2000) assert that the experience requires imagery, affect, and attentional focus, and their original work yielded a scale developed with these variables in mind. Tal-Or and Cohen (2010) later argued that the scale itself loads on three separate factors: identification with characters, the transportation experience (the sense of "being there"), and attention, each of which can be manipulated separately.

The transportation scale is used widely across conceptualizations of ADNE as a self-report, post-hoc measure of transportation into a narrative. Rather than address attention directly, the scale taps into the experience of broken attention, i.e. mind-wandering. The scale is often reduced and adapted for specific purposes, on occasion eliminating the attention dimension completely. Recently, potentially in response to the frequency of its adjustments, a new, abbreviated version of the transportation scale has been developed (Appel, Gnambs, Richter, & Green, 2015). This six-item, transportation scale – short form (TS-SF) was tested across three studies and found to be valid and

reliable in its current form. During analysis, questions loaded on three factors of cognition, emotion, and imagination. The final six-item scale reliably loaded on the single transportation factor, allowing it to represent a one-dimensional construct. However, all items directly related to attention were eliminated. Does this suggest that attention is separate from the transportation process? If so, how can researchers determine the “all in” resource allocation to the stimulus that defines transportation? The new scale leaves a single item to hint at attention, but using language that is vague and broadly defined. Given the variability in the term’s use, it may be difficult for respondents to determine what is meant by “I was mentally involved in the narrative.”

Involvement is arguably the most diversely defined ADNE discussed in this analysis. The term has multiple uses in psychology and communication, as well as literary studies. Perhaps the most frequently used conceptualization of involvement in social science is issue or ego involvement, a type of personal relevance or investment in the message. By this definition, involvement differs from transportation in that it seems to represent a narrow part of the narrative experience that includes *caring* about the story (Oliver, et al., 2012). The ELM posits that individuals presented with a high-involvement message are more motivated to centrally process it and thus recognize weak arguments (Petty & Caccioppo, 1986). This type of shift in processing suggests that involvement might actually *cue* a change in attention that could lead to more thorough comprehension. It will be crucial to determine the explication of involvement within studies included for analysis that utilize the term. If involvement plays an exogenous role upstream from attention, manipulation of it within a narrative should impact attentional outcomes, which in turn affect comprehension.

While transportation and involvement research leans toward persuasion outcomes, engagement has emerged as a comprehension model of narrative. Rather than existing as a narrow concept within the narrative experience, narrative engagement represents a multidimensional relationship with a story, encompassing attention, enjoyment, comprehension, and movement into the story world (Busselle & Bilandzic, 2008). The explication even addresses different types of attention maintaining or breaking the experience. This is particularly evident when flaws in the narrative are caught due to attention to detail, which result in an interruption to the pleasurable sensation of being effortlessly carried along by the narrative (Csikszentmihalyi, 1990). Engagement, therefore, allows the individual to maintain an active role in the process, but one that may ruin the experience if attention is shifted from the intended message to holes in the plot or characters.

Busselle and Bilandzic (2008) carefully explicated engagement as an attempt to collapse many narrative phenomena (Csikszentmihalyi's flow, transportation, narrative enjoyment) under one umbrella that could be tested for its role in narrative comprehension. The authors posit that engagement is preceded and maintained by complex mental models, a set of previously-held knowledge and beliefs that serve to set up expectations of the story world. The model places engagement as a result of comprehension, rather than vice versa, although the authors' discussion suggests a more recursive relationship, with given points of the story helping build or collapse the mental models. Attention is described in terms of Lang's (2000) limited capacity resource allocation, which is posited to be affected by the *quality* of the narrative itself.

ADNE describe the phenomenon of being drawn into a story and rely heavily on the concept of full resource allocation. With many dimensions of attention outside of our conscious control, stimuli can be designed to acquire and hold our focus. In narrative, stories are built with predictable structures, leaving out some details to provide a motivation for continued focus and then rewarding individuals by coming through with the promises built by the suspense (Bezdek & Gerrig, 2016; Oliver & Bartsch, 2010). Features of the narrative can alert the viewer that something important is afoot, helping them follow along causal paths and make predictions of what comes next. Research suggests that individuals build mental models during narrative exposure, which translate the story into meaningful structures that help make sense of the narrative world.

2.4 Conceptualizing mental models for comprehension

Mental models can be understood as the brain's attempt to organize new ideas into previously understood structures. Johnson-Laird (1983) explained mental models in terms of prototypes – expectations of how a situation will play out based on previous experience and mental representations. Mental models provide a framework for scenarios that can be updated or reinforced as new information comes in (Zwaan, et al., 1995), aiding the individual in navigating unfamiliar territory. By approaching information with previously-established models, it is filtered and processed through the lens of individual experience that helped to build the original model (van Dijk, 1999).

These mental models are constructed and reconstructed as part of an individual’s comprehension of language. Using models to represent background knowledge of a concept takes pressure off of the brain as resources are freed up to

process new information. Fisch's (2000) capacity model describes how prior knowledge can be thought of as schema into which information can be integrated. These schema are automatic and often genre-specific, developed as experience with different situations expands. The predictability of situations aids in comprehension (Zwaan, 1994) and allows the individual to focus on the specific actions that occur within them. Unpredictability and complexity may serve as a cue for novelty that causes individuals to lean into the message (Lang, 2006; Potter & Choi, 2006), but an overly complex message can lead to challenges for comprehension as the brain struggles to dedicate more resources to accurately decode the content. Here, attention overload is a risk, with the effort spent attending to the narrative leaving little room to appreciate it as a story, perhaps preventing the individual to look inward to the sense-making tool of experience.

Sherry (2004) suggests that there is an ascribed narrative form that informs many screenplays, and deviating from that form risks making the story inaccessible by affecting both the ability to follow along with the plot and the likelihood of enjoyment. Ease of comprehension has been demonstrated to facilitate the flow state, which allows the individual to be taken away by the story and the less he or she is preoccupied with the real world (Bilandzic & Busselle, 2011; Johnson, et al., 2015). Other narrative features, such as poor production quality or bad acting, can disrupt models and take individuals out of the flow state, serving as a distraction from the content of the story (Busselle & Bilandzic, 2008). In these cases, the stimulus may still hold attention, but the type of attention is more critical, focusing in on the errant features and no longer processing the plot. Although some may experience a great deal of enjoyment from

consuming ridiculously bad narratives (Clewes, 2012), it is not usually the goal of the narrative's creator nor the typical experience sought out by paying audiences.

While production features and complex subplots can distract and disrupt the construction of accurate mental models in the moment, the overall comprehension of the narrative may be able to hold up against these errors if they are not repeatedly made. Mental models can be reconstructed and updated accurately as long as these distractions don't overload working memory (Valadao, Anderson, & Danckert, 2010), driven by the available resources of executive attention necessary to maintain focus on the task at hand. Comprehension of a narrative, thus, is thought to be a result of the combination of the background knowledge necessary to quickly set up a prototypical model for the situation coupled with the features of the story that guide the individual's updating of the model and highlight what is important. Specific mental models account for how individuals create and update models based upon information in the text. Particularly of interest to this research is the event-indexing model.

The Event-indexing Model

Mental representation is an individualized experience of a narrative, but there are similarities between what each reader or viewer of a text gleans from the same story. Zwaan, et al. (1995) identified five dimensions of events and actions that were deemed key to comprehending how a story unfolds, making up their event-indexing model. The five event indices were *temporality, spatiality, protagonist, causality,* and *intentionality*. The first two relate to the phenomenon of the deictic shift (Segal, 1995), where a successful narrative takes an individual out of their tangible time and space and moves him or her into the reality of the story world. Cues from the narrative allow the individual

to know when time has elapsed or events are taking place in a new physical space, information that updates the mental model. These cues can be explicit or implied by something as simple as the tense used by characters in their dialogues or a fadeout on screen.

The identity of protagonists in the model does not necessarily reflect the “good guy” as the term is commonly used. Instead, it represents active characters with goals and motivations that the audience can follow. These motivations are mapped onto the other actions of the story, where one event can lead to or stem from another (causality) and whether or not they are related to the goals set out by the characters (intentionality). The extent to which these dimensions are activated together can strengthen perceived interconnectedness, particularly if events occur within the same time and space (Bower & Morrow, 1990; Sundermeier, van den Broek, & Zwaan, 2005; Zwaan, et al., 1995). Each dimension is demonstrated to contribute unique information to the audience in order to build the cohesive model. The model also suggests that the audience expects a certain amount of continuity in order to easily maintain these connections, resulting in a kind of reset of expectations when disruptions occur. Another model can highlight exactly what these disruptions are, how often they activate, and other concepts that might be activated alongside them.

The Landscape Model

Comprehension driven by text or audiovisual narratives are dependent on the concepts and structure of those stories. A detailed model that identifies patterns of such concepts within a narrative is the landscape model of text comprehension (van den Broek, et al., 1999). The model is a coding-based methodology of examining the

activation of concepts and their relative importance and repetition over the course of the story. These activations serve as both a source for memory and comprehension, highlighting important concepts early and often, while guiding the individual to recognize connections between them and the characters. Although designed initially for coding text, it has been used successfully on audio-visual narratives (Anderegg, Alade, Ewoldsen, & Wang, 2017; Yang & Roskos-Ewoldsen, 2007).

In the model, each pre-identified concept is activated at some point in the narrative and then erodes in importance until it is reactivated. For example, in the famous "Chekhov's gun" argument, when the gun is seen for the first time in the first act, it would at that moment be activated. If it is neither discussed nor seen again, the memory of that gun degrades until it reappears as a key plot point again in the third act. However, emphasis placed on the gun at its first appearance can make that erosion slower. It serves an orienting function, telling the viewer to look and remember and allowing a more careful mental model to be built around the gun. Other production features such as music can also help add even more emphasis to the importance of that particular moment (Potter & Choi, 2000; Potter, Lang, & Bolls, 2008). Furthermore, any concepts that were activated (be it character or idea) simultaneously with the gun's first appearance, may help keep the memory alive if they are reactivated during the interval. When a narrative is coded using the landscape model, the results are a topography of events and concepts within the story that reflect a corresponding interconnected mental representation in the minds of the audience (van den Broek, et al., 1999).

Recently, Anderegg et al (2017) utilized the landscape model to predict recall and comprehension of concepts from television show clips. The authors utilized the

event-indexing model to identify key concepts central to the tenets of protagonist, temporality, spatiality, causality, and intentionality noted above and found that the combined model explained a great deal more variance than the landscape model alone. Additionally, the authors separately coded visual and audio presentation of information to support arguments for the dual coding nature of narrative processing (Paivio, 1968). Anderegg, et al. (2017) broke ground in identifying narrative structures that affect comprehension, but relied on post-exposure cued recall as the measure of their impact.

The landscape model demonstrates that concepts are activated, decay, and reactivate over time. The resulting topography represents the dynamic ebb and flow of information contained within a narrative, with which audience members need to interact in order to accurately update their mental models in order to comprehend the story. Measurement of reactions to these fluctuations requires a dynamic model that can identify when and how the changes occur at different time points during the viewing experience. Additionally, dynamic modeling can account for how these activations feed into the individual and change how they are processed downstream.

2.5 The Dynamic Motivational Activation approach

The event-indexing and landscape models represent structures of cognitive processes and narrative features respectively, which impact comprehension by building foundations of knowledge and adapting over time as new information comes in. Landscape coding breaks down a narrative into individual concepts and identifies time points of activation – moments where the concept should make an impression upon the individual. When viewed as a series of activating concepts, an audiovisual stimulus can

be considered a dynamically changing input, transmitting symbols through language, imagery, and sound. In order to process these symbols and make meaning without pausing the stimulus every few moments to catch up, the individual “must be able to make internal adjustments to knowledge structures on the fly” (Newhagen, 2004, p. 396). However, few narrative studies have examined the process using dynamic approaches.

The dynamic motivational action (DMA, Wang et al., 2011; Wang et al. 2012a; Wang et al., 2015) approach is a mathematical theoretical framework designed to examine and predict real time information processing and motivated choice behavior. DMA creates an experimental paradigm that recognizes the dynamic situation in which information is delivered and utilizes integrative and dynamic models to predict how individuals respond to this ever-changing mediated environment. DMA models are designed to independently examine the dual influences of mediated variables and individual cognitive responses as they adapt over the course of a media experience. As a fine-tuned theoretical model, DMA estimates the influence of the stimulus per time unit and aggregated over the course of exposure. Real time cognitive responses to these variables can be ascertained by utilizing dynamic instruments, such as continuous response measurement or, as in the proposed study, physiological responses (heart rate, skin conductance, eye tracking data, etc.). DMA has been used with these methodologies to examine processing and choice for entertainment media (Wang et al., 2011), political ads (Wang et al. 2012a), PSAs (Wang et al., 2012b; Wang et al., 2015), and racial humor (Banjo et al., 2016).

DMA theorizes that effects of the motivational inputs from stimuli “do not occur or cease instantaneously, but instead, build up and ramp down over time” (Wang et al., 2011 p. 74). Effects are influenced by dynamic feedback factors, changes in physiological responses in the cognitive system that are activated and deactivated over the course of the media experience. These updates mean the system is constantly changing, and DMA provides a framework to theorize, collect data, and model how these changes predict subsequent responses to ongoing real-time stimuli (Wang et al., 2012a).

The DMA approach seeks to examine both systems involved with changes in information processing – the stimulus and the self – by utilizing real time measures and accounting for, rather than only aggregating, the dynamic and looping dimensions of processing during stimulus viewing. DMA analyzes the dimensions of the stimulus for their causal impact on processing, but also accounts for self-causing inputs from the cognitive system that feed the motivation to continue attending to the message. In the case of audiovisual narratives, dimensions could include characters, emotional information, music, and changes in setting. An individual’s attention could be affected and rewarded by these dimensions, and earlier attentional efforts become a part of it, predicting patterns of attention allocation across time (Wang et al., 2012a). DMA models information processing mathematically, generating a total effect from a time series of input and feedback effects operating in a dynamic system. The model factors in delayed effects in its equations – both lagged feedback effects from the individual’s physiological system and delayed effects of the stimulus inputs (Wang et al., 2011). By modeling processing rather than endogenous and exogenous variables, DMA shifts focus to the

black box, revealing when and how dimensions of stimuli and the self interact to produce observable outcomes.

DMA has been used to examine patterns of attention captured from both the sympathetic (SNS) and parasympathetic (PNS) nervous systems with psychophysiological instruments (Wang, et al., 2011; Wang, et al., 2012a, Wang, et al., 2012b, Wang, et al., 2015), specifically utilizing heart rate data to identify periods of focused attention. Cardiac deceleration is indicative of an increase in attention because it is associated with greater cognitive effort (Berntsen, Quigley, & Lozano, 2007), a redistribution of resources to focus on the stimulus, matching the executive and alerting systems described by Peterson and Posner (2012). DMA can identify not just overall trends in attention, but how particular moments during stimulus exposure can impact processing downstream, linking changes in attention to comprehension in the moment and as a whole.

The landscape model (van den Broek, et al., 1999) discussed above reveals the topography of a story as concepts are introduced, emphasized, and fade into the background to either be dismissed or reintroduced in the future. The model not only represents the story, but also the expectation of how these features will reflect mental model updating and maintenance during exposure to the narrative. The landscape model is quantitative, and rather than looking at a total score for each concept, it highlights the strength of activation over the course of a particular scene and subsequent scenes. It represents a dynamic interplay between concepts, characters, and the story as a whole. DMA is well set up to deal with these interactions and their accumulated impact on the self, particularly when the story is coded to predict moments

of self-reflection where resources are divided. With psychophysiological measures capturing real-time responses to stimuli, the approach can identify how the structure of the story affects attention across time, and how these changes in attention can affect how much the individual understood the plot of the narrative.

DMA is uniquely qualified to examine the dynamic interaction of attention to the story and the self when comprehending long-form audiovisual stimuli. But this type of analysis requires a real-time measure of attention, a methodology that captures changes as they occur and can map these against changes in the stimuli. However, most narrative comprehension research does not utilize psychophysiological measures. In order to understand how attention has been placed and operationalized in models of comprehension in communication science, a review of what has been done is necessary. The following exploration of narrative research involves the five aforementioned attention-dependent narrative experiences (ADNE), which have been historically defined as centralized around resource allocation. It includes another attention-dependent series of theories: those centered around the construction of mental models. It seeks to identify how attention is accounted for in both modeling and operationalization.

Chapter 3. Study 1

3.1 Introduction

Previous research has examined the consumption of narratives using a variety of methods to capture the process, and identifying the features of the story that guide comprehension. Although often acknowledged as a feature of the narrative experience, attention is not always explicitly included in the theoretical puzzle, and less so in its operationalization. Study 1 represents a deep dive into narrative comprehension research and its experimental designs. The study is a content analysis of extant literature on the role of attention driven narrative experiences (ADNE) and mental modeling within the context of narrative comprehension. The review examines how ADNE and mental models are explicated and operationalized, and to assess if and how the role of attention within the phenomena is measured.

Communication literature uses a number of terms for a very similar concept: absorption into a narrative. This stems from transportation literature (although the concepts predate it in different terms) and is defined as full resource allocation to the story world to the extent that the tangible world is out of immediate reach. The concept requires attention as a key process to enable the experience as described, but it is often taken for granted, or measured with one or two items. Original conceptualizations of transportation, for example, define the experience as a combination of imagery, affect, and attentional focus (Green & Brock, 2000). The transportation scale measures the attentional focus aspect of the phenomenon with two items. However, as noted above, the transportation scale is often adapted to suit different stimuli and better reliability of the remaining items. The newly adapted TS-SF (Appel et al., 2015) eliminates the

attention aspect and limits the concept to a single item – involvement. With all of these inconsistencies in measurement, the role of attention in this concept alone is up for debate. Other concepts, often treated as synonymous, are measured in a variety of ways, with attention conceptualized as part of the experience but measured inconsistently. For the study, transportation, engagement, involvement, absorption, and immersion are the ADNE that are examined.

Synthesized findings will answer the following research questions:

RQ1: How often is attention directly measured in modern narrative comprehension research?

RQ2: How does direct measurement of attention explain variance in the strength and direction of comprehension outcomes?

RQ3: Where are ADNE included in the theoretical equation?

3.2 Sample

Articles pulled for the review were limited by a number of factors. The first criterion was that of date; only articles after 2000 were included. This requirement was designed to limit research to the post-transportation era, reflecting research that came after the publishing of Green and Brock's (2000) groundbreaking series of studies on the multi-dimensional phenomenon of "traveling" into the story world, which largely defined current story or narrative research. The second criterion required that research be empirical, which helped encompass only those articles that sought to *measure* the narrative experience, thus allowing for the possibility that attention be operationalized in a quantitative manner. Remaining criteria narrowed the search to those that would fit in

the specific realm of interest: utilization of narrative stimuli with comprehension included as a theoretical variable of note. Only studies printed in English were included, though researchers came from a variety of nations.

With these criteria set, searches were conducted within the EbscoHost databases *Academic Search Complete* and *Communication and Mass Media Complete*. First, each phenomenon was individually searched with the terms “narrative comprehension” to isolate the particular outcome variable. However, limited results occurred as a consequence of the search terms, leading to broadening the search to include mental model studies and filtering out irrelevant studies as they emerged. The resulting search keywords were “absorption + narrative comprehension”, “immersion + narrative comprehension”, “transportation + narrative comprehension”, “involvement + narrative comprehension”, “engagement + narrative comprehension”, and “mental models + comprehension.”

Original results included 33 articles containing 65 studies that were published in 18 journals and one conference paper. With a further reading examination, one full article (containing three studies) and one of the studies from an included article were removed for lacking a clear narrative element, yielding 61 studies from 32 articles from 17 journals, which are listed in Table 3.1. Nearly half of the articles contained multiple studies (n = 14, 45.2%), with some as many as five studies examining their concepts. These multi-study articles skew on smaller sample sizes of participants (e.g., fewer than 50 per study), thus the average number of participants belies the range of samples involved (M = 115; range 18 – 669 participants).

3.3 Analysis

Studies were examined for several features. First, in order to follow the process of explication to operationalization, the authors' definition of their key phenomenon was noted, including both ADNE and mental model theories. This also uncovered the explicit or implicit nature of attention as a key player within the concept. If articles failed to provide a definition but clearly referenced an extant model for an ADNE, this absence was noted and the cited work's definition assumed as implicit. Most articles provided their own or quoted others in their explication of key theoretical concepts.

Second, the measurement of attention – or lack thereof – was recorded. This process involved identifying explicit and often implicit operationalization of attentional focus. As many studies did not focus directly on attention as a variable of interest, often individual items or even manipulations were scrutinized for their indirect examination of attention. These implicit measures will be discussed thoroughly so as to avoid subjectivism in analysis.

Third, the role of the ADNE or mental model within the overall hypothesized model was examined. It was expected that each ADNE would be overwhelmingly analyzed as a mediating or moderating variable between message structures and comprehension outcomes. This assessment follows the organization of the transportation-imagery model (Green & Brock, 2002) and the model of narrative comprehension and engagement (Busselle & Bilandzic, 2008), two influential conceptualizations of narrative processing.

Table 3.1. Study 1 data summary: Narrative comprehension studies utilizing ADNE or Mental Models

Article	Relevant theory	Explication	Measure of theory	Measure of attention	Location of theory in model	N
Appel (2011)	Mental models	**mental models** "Recipients actively construct a representation of the events described in written or audiovisual texts...Narratives require the recipient to use his or her own knowledge to infer meaning in order to comprehend the text...Inferring information enables the recipient to build a dynamic mental representation of a situation, an event, or an object. Moreover, a recipient is required to locate himself or herself within the mental model of the story in order to comprehend the narrative. Recipients adopt a cognitive standpoint within the narrative world and interpret the text from this perspective" (p. 147)	Active self items	Transportation scale (α = 0.76)	Correlation	81
Appel & Richter (2010) *Study 1*	Transportation	"The term **transportation** is based on the metaphor that readers undertake a mental journey into the world of a narrative. When an individual is transported into the narrative world 'all mental systems and capacities become focused on the events occurring in the narrative'" (p. 103)	Transportation scale (0.82)	Attention focus on the transportation scale	Moderator	181
Appel & Richter (2010) *Study 2*	Transportation	"The term **transportation** is based on the metaphor that readers undertake a mental journey into the world of a narrative. When an individual is transported into the narrative world 'all mental systems and capacities become focused on the events occurring in the narrative'" (p. 103)	Transportation scale (0.82)	Attention focus on the transportation scale	Moderator	133
Argo, Rui, & Dahl (2008) *Study 1*	Transportation	**transportation** Not specifically defined but stated as "absorption" in abstract and on pg. 615	Perceived fictionality single item	Single bipolar item: did not pay any attention/paid a lot of attention	Moderator	265
Argo, Rui, & Dahl (2008) *Study 2*	Transportation	**transportation** Not specifically defined but stated as "absorption" in abstract and on pg. 615	Coded thought listing	Single bipolar item: did not pay any attention/paid a lot of attention	Moderator	80

Argo, Rui, & Dahl (2008) *Study 3*	Transportation	**transportation** Not specifically defined but stated as "absorption" in abstract and on pg. 615	Emotional empathy scale	Unclear	Moderator	147
Bailey, Kurby, Sargent, & Zacks (2017) *Study 1*	Mental Models: Event Indexing model	**"Situation models** are representations constructed during narrative text comprehension that are thought to represent information about the protagonists, their goals, and the objects they interact with, as well as the spatial locations where they interact" (p. 940).	Participant segmentation choices	Condition (instructions)	DV	62
Bailey, Kurby, Sargent, & Zacks (2017) *Study 2*	Mental Models: Event Indexing model	**"Situation models** are representations constructed during narrative text comprehension that are thought to represent information about the protagonists, their goals, and the objects they interact with, as well as the spatial locations where they interact" (p. 940).	Recognition probe responses	Condition (instructions). Response time used to eliminate Ps who weren't "engaged" in the task	DV	105
Bezdek & Gerrig (2016) *Experiment 1a*	Transportation	**transportation "**narratives can focus viewers' cognitive and emotional processing into the story world, while simultaneously diminishing viewers' processing of the immediate surroundings" (p. 61).	Tal Or & Cohen (2010) Transportation scale	RT to audio cue	DV	26
Bezdek & Gerrig (2016) *Experiment 1b*	Transportation	**transportation "**narratives can focus viewers' cognitive and emotional processing into the story world, while simultaneously diminishing viewers' processing of the immediate surroundings" (p. 61).	Tal Or & Cohen (2010) Transportation scale	RT to audio cue	DV	26
Bezdek & Gerrig (2016) *Experiment 2a*	Transportation	**transportation "**narratives can focus viewers' cognitive and emotional processing into the story world, while simultaneously diminishing viewers' processing of the immediate surroundings" (p. 61).	Tal Or & Cohen (2010) Transportation scale	RT to audio cue	DV	28
Bezdek & Gerrig (2016) *Experiment 2b*	Transportation	**transportation "**narratives can focus viewers' cognitive and emotional processing into the story world, while simultaneously diminishing viewers' processing of the immediate surroundings" (p. 61).	Tal Or & Cohen (2010) Transportation scale	RT to audio cue	DV	28

Bezdek & Gerrig (2016) *Experiment 3*	Transportation	**transportation "**narratives can focus viewers' cognitive and emotional processing into the story world, while simultaneously diminishing viewers' processing of the immediate surroundings" (p. 61).	Tal Or & Cohen (2010) Transportation scale	RT to audio cue	DV	52
Busselle & Bilandzic (2008)	Engagement	Experiential **engagement** with a narrative is facilitated when a text challenges the viewer and comprehension is not disrupted by distractions from outside the narrative (e.g., noise, hunger, job stress) or distractions related to the narrative (e.g., observed inconsistencies or plot flaws). When these conditions are met and comprehension progresses smoothly, a number of phenomena may occur. As their attention is focused on comprehension, readers or viewers may experience a flow-like sensation... Audience members may lose conscious awareness of their own surroundings and their own identity... Losing self-awareness may facilitate mentally constructing a story world and deictic shift into that story world" (p. 4)	Narrative engagement scale (adapted)	Five items on the engagement scale (attentional focus subscale)	DV	413
Caputo & Rouner (2011)	Transportation	**"Transportation** is as a distinct mental process with an integrative melding of attention, imagery, and feelings, focused on story events... This mental process is linked to a person's level of immersion into a story—the extent that a person is absorbed into a story narrative" (p. 596)	Transportation scale (- adapted into two of four dimensions: story involvement - .73; story relevance - .59)	Transportation scale attentional focus items but not used in analysis	Not in analysis	137
Cohn & Kutas (2015)	Mental models: Situation models	**Situation models**: not clearly defined but involves "filling in the unexpressed information" (p. 268)	ERP data	ERP data arguably, but not used in analysis	DV	36
Curiel & Radvansky (2002) *Experiment 1*	Mental models: Situation models	**Situation models:** not clearly defined but involves debate on inclusion of spatial info; i.e. mental maps (pp. 114-115)	Object recognition reaction times	Arguably comprehension questions (indirect)	IV	48
de Graaf, Hoeken, Sanders, &	Transportation	**Transportation** "a convergent mental process in which attention, emotion, and imagery become focused on events occurring in the narrative" (p. 386).	28 item scale incl. 10 item transportation scale + emotion	Four items: (.90) "During reading, my attention was fully captured by the story" "During reading I was fully	DV	150

Beentjes (2009)		**Engagement** "narrative understanding, attentional focus on the story, emotion for and with characters, and the sensation of being there in a narrative world" (p. 389)	questions, 6 items based on presence, 12 items on absorption	concentrated on the story" "During reading, I was hardly aware of the space around me" "When I was reading, my thoughts were only with the story"		
Egidi & Gerrig (2009) *Experiment 1*	Mental models: Affect	**Affect models** "select, learn, and interpret novel information about a target and to relate this information to preexisting knowledge structures" (p. 548)	Reading latencies	Comprehension item at end of stories	DV	95
Egidi & Gerrig (2009) *Experiment 2*	Mental models: Affect	**Affect models** "select, learn, and interpret novel information about a target and to relate this information to preexisting knowledge structures" (p. 548)	Evaluations of endings	None	MV	60
Emde, Klimmt, & Schluetz (2016)	Mental models and Involvement	**mental models** *(quoting Graessar, Olde, & Klettke, 2002)* "'a microworld with characters who perform actions in pursuit of goals, events that present obstacles to goals, conflict between characters, emotional reactions of characters, spatial settings, the style and procedure of actions, objects, properties of objects, traits of characters, and mental states of characters'" (p. 609). **involvement** "the intensity of cognitive and particularly affective engagement with a mediated message that is currently received" (p. 611).	Comprehension items	Items from the Cognitive Involvement scale (Appel, 2002) adapted for adolescents: During reading, I hardly thought about the article's content. During reading, I let my mind wander.	DV	669
Foy & Gerrig (2014) *Experiment 1*	Mental models: Norms	**Norm model "**new events serve as probes that resonate through memory, activating representations of related information" (p. 1251)	Reading rate (RT)	Comprehension items (used to eliminate)	DV	32
Foy & Gerrig (2014) *Experiment 2a*	Mental models: Norms	**Norm model "**new events serve as probes that resonate through memory, activating representations of related information" (p. 1251)	Reading rate (RT)	Comprehension items (used to eliminate)	DV	30
Foy & Gerrig (2014) *Experiment 2b*	Mental models: Norms	**Norm model "**new events serve as probes that resonate through memory, activating representations of related information" (p. 1251)	Reading rate (RT)	Comprehension items (used to eliminate)	DV	36
Gernsbacher, Robertson, Palladino, & Werner	Mental models: Mental representation	**mental models** "Through the process of mapping, comprehenders build mental structures by mapping related information onto their representations of previously	Response times (RT)	Continuation sentences - not explicit though. Cited use to "encourage general comprehension")	DV	80

(2004) *Experiment 1*		comprehended information. However, if the incoming information is less related, a comprehender will shift to build a new substructure" (p. 146)				
Gernsbacher, Robertson, Palladino, & Werner (2004) *Experiment 2*	Mental models: Mental representation	**mental models** "Through the process of mapping, comprehenders build mental structures by mapping related information onto their representations of previously comprehended information. However, if the incoming information is less related, a comprehender will shift to build a new substructure" (p. 146)	Response times (RT)	Should also have continuation sentences because procedure was "identical" but not explicitly stated	DV	88
Gernsbacher, Robertson, Palladino, & Werner (2004) *Experiment 3*	Mental models: Mental representation	**mental models** "Through the process of mapping, comprehenders build mental structures by mapping related information onto their representations of previously comprehended information. However, if the incoming information is less related, a comprehender will shift to build a new substructure" (p. 146)	Response times (RT)	unclear	DV	96
Hartung, Burke, Hagoort, & Willems (2016)	Immersion	**immersion** "the state of feeling cognitively, emotionally, and imaginally immersed in a narrative world' (p. 2)	Adapted immersion questionnaire (31 items) with subscales for attention, mental imagery, emotional engagement, transportation, and narrative understanding	Adapted immersion questionnaire (31 items) with subscales for attention, mental imagery, emotional engagement, transportation, and narrative understanding	DV	52
Johnson & Rosenbaum (2015)	Transportation	**transportation** "'[t]he process of becoming fully engaged in the narrative world' (Green et al., 2004, p. 312), can be likened to the notion of “spatial presence” (Wirth et al., 2007), which has been defined as 'a sense of being there' (p. 495), with 'there' including mediated environments... a virtual journey into a text" (pp1073-1074)	Transportation scale (15 item – α = 0.87) affective scale not reliable (.36)	Transportation scale items	DV	412

Karapanos, Barreto, Nisi, & Niforatos (2012)	Transportation and immersion	**immersion** (quoting Reid et al., 2005) 'the senses are heightened to the coincidence of the event and it feels almost supernatural, as if events in the virtual world have somehow moved across into the physical world' p. 273. Distinguish between two types: "McMahan (2003) distinguished between *perceptual immersion*, which is accomplished by 'blocking as many of the sense [sic] as possible to the outside world', and *psychological immersion*, which 'results from the user's mental absorption in the world'"(pp. 273-274) *Also cites Green & Brock for* ***transportation*** "Narrative transportation is a rather broad concept incorporating various facets of immersion into the narrative world such as emotional involvement in the story, cognitive attention to the story, feelings of suspense, lack of awareness of surroundings, and mental imagery" (p. 274)	Transportation scale (separated into immersion - essentially attention, mental imagery, and emotional involvement) α = .61	Transportation items	DV	45
Ledoux & Gordon (2006) *Experiment 1*	Mental models: mental representation	**mental model** "The surface representation captures several aspects of the text (including lexical and syntactic information) verbatim, and is thus an exact mental representation of the text. The propositional or semantic representation captures the meaning of a text at both a local and a global level. Finally, the situational representation is further removed from the given text than the other two, and represents those aspects of prior knowledge that are triggered by the reading of the text; it is thus a representation based on schematic knowledge" (pp.789 - 790)	Reading time	Arguably comprehension items	DV	64
Ledoux & Gordon (2006) *Experiment 2*	Mental models: mental representation	**mental model** "The surface representation captures several aspects of the text (including lexical and syntactic information) verbatim, and is thus an exact mental representation of the text. The propositional or semantic representation captures the meaning of a text at both a local and a	Reading time	Arguably comprehension items	DV	64

		global level. Finally, the situational representation is further removed from the given text than the other two, and represents those aspects of prior knowledge that are triggered by the reading of the text; it is thus a representation based on schematic knowledge" (pp.789 - 790)				
Lee, Roskos, & Ewoldsen (2013) *Experiment 1*	Mental models	**mental model (loosely)** "attention to and processing of the current visual and verbal information as well as remembering previous visual and verbal information"… "The coherence of a mental model depends critically on inferences that can be drawn from the narrative" (p. 413)	Thought listing	Not measured, but manipulated by condition	DV	27
Lee, Roskos, & Ewoldsen (2013) *Experiment 2*	Mental models	**mental model (loosely)** "attention to and processing of the current visual and verbal information as well as remembering previous visual and verbal information"… "The coherence of a mental model depends critically on inferences that can be drawn from the narrative" (p. 413)	Sorting task	Not measured, but manipulated by condition	DV	53
Magliano, Miller, & Zwaan (2001)	Mental models: Event indexing model	**"Situation models** can capture the peple, spatial and temporal settings, the goal plans and actions, and event sequences that are depicted in a story" (p. 533)	Timecode when participant paused film	none	DV	60
Margolin, Driscoll, Toland, & Kegler (2013)	Mental models: Construction integration model	**Mental models: "**Over the course of a reading cycle, while reading a single sentence, a reader begins by activating in their mental representation the verbatim information that is presented on the page…creating a surface level representation of the text" (p. 512)	Condition (narrative presentation)	none	IV	90

McDonald, Sarge, Lin, Collier, & Potocki (2012) *Study 1*	Involvement	**involvement** "the level of absorption or immersion into a storyline" (p. 9)	Transportation scale (not included in analysis)	none	Not included in analysis	153
McDonald, Sarge, Lin, Collier, & Potocki (2012) *Study 2*	Involvement	**involvement** "the level of absorption or immersion into a storyline" (p. 9)	Transportation scale (for each stimulus – α = .734, .752, .719, .759)	Transportation scale items	IV	616
McDonald, Sarge, Lin, Collier, & Potocki (2012) *Study 3*	Involvement	**involvement** "the level of absorption or immersion into a storyline" (p. 9)	Thought listing	From McDonald, Schumaker, Anderegg, and Quenette (2010) - conference paper: While watching, I was thinking of things I could have been doing instead of watching. (R) Several times while watching the video, I was thinking about other things.(R) (both from Busselle & Bilandzic, 2008)	IV	239
Mensink & Rapp (2011) *Experiment 1a*	Mental Models: Trait models	**mental model** "readers build models of characters based on text descriptions and use those models to generate predictions about future character behavior" (p. 1104)	Agreement ratings	None	DV	66
Mensink & Rapp (2011) *Experiment 1b*	Mental Models: Trait models	**mental model** "readers build models of characters based on text descriptions and use those models to generate predictions about future character behavior" (p. 1104)	Agreement ratings	None	DV	63
Mensink & Rapp (2011) *Experiment 2a*	Mental Models: Trait models	**mental model** "readers build models of characters based on text descriptions and use those models to generate predictions about future character behavior" (p. 1104)	Agreement ratings	None	DV	32
Mensink & Rapp (2011) *Experiment 2b*	Mental Models: Trait models	**mental model** "readers build models of characters based on text descriptions and use those models to generate predictions about future character behavior" (p. 1104)	Agreement ratings	None	DV	31
Mensink & Rapp (2011) *Experiment 3*	Mental Models: Trait models	**mental model** "readers build models of characters based on text descriptions and use those models to generate predictions about future character behavior" (p. 1104)	Reading rates for final sentence	Arguably comprehension items (indirect)	DV	52

Murphy, Frank, Moran, & Patnoe-Woodley (2011)	Involvement	**Involvement with character** "This overarching category incorporates the related constructs of identification, wishful identification (a viewer's wish to be like the character), similarity, liking, and parasocial interaction" (p. 410). **Involvement with the story (Treated as synonymous with transportation)** "the sensation of flow in a narrative plus the loss of awareness of self and surroundings" (p. 411)	Specially designed involvement with character scale Transportation scale (9 items) (reliability not reported)	Potentially Transportation scale items but unclear on which were adapted and how	IV	170
Murphy, Wilde, Ogden, Barnard, & Calder (2009)	Mental models:	**mental models "**when people read stories, they form rich cognitive representations of the events, people, and settings described within" (p. 43)	RT for reading times	written completion sentences (indirect)	Moderator	71
Nahari, Glicksohn, & Nachson (2009)	Absorption	**"Absorption** is considered a normal form of dissociation ...associated with fantasy proneness... and with hallucinations and pseudo-hallucinatory experiences" (p. 289)	Absorption scale	None. The absorption scale is a 34 item scale that is about hallucination not Communication description of absorption.	Moderator	75
Quintero Johnson, Harrison, & Quick (2013)	Involvement/Transportation	**"transportation** is defined by the phenomenological experience of being cognitively and emotionally involved in the unfolding events of a story" (p. 161)	Transportation scale (adapted by dropping "several" items) - 5 item "While I was reading the story, I could easily picture the events in it taking place" "While I was reading the narrative, activity going on in the room around me was on my mind"	"I found my mind wandering while reading the story"	IV	267

			"I could picture myself in the scenes of events described in the story" "I was mentally involved in the story while reading it" "I found my mind wandering while reading the story" (α = .72)			
Rapp, Klug, & Taylor (2006) *Experiment 1*	Mental models: Situation models	**mental models** "Readers' representations of texts are a function of prior knowledge, goals, expectations, and attentional focus in the narrative" (p. 1206) "**Situation models** are memory representations constructed as readers connect ongoing text information with prior knowledge" (p. 1207)	Response time (RT)	comprehension questions (indirect)	DV	42
Rapp, Klug, & Taylor (2006) *Experiment 2*	Mental models: Situation models	**mental models** "Readers' representations of texts are a function of prior knowledge, goals, expectations, and attentional focus in the narrative" (p. 1206) "**Situation models** are memory representations constructed as readers connect ongoing text information with prior knowledge" (p. 1207)	Response time (RT)	comprehension questions (indirect)	DV	52
Sangalang, Quintero Johnson, & Ciancio (2013)	Involvement	**involvement (made synonymous to transportation)** **"**The phenomenological experience of transportation can be seen as the result of a deictic shift, wherein individuals 'relocate' to the story world and the real world is inaccessible, thus participating in a flow-like state" (p. 129)	Transportation scale items (scale adapted to eliminate mental imagery items α = .79)	Transportation scale items	IV	157
Speer & Zacks (2005) *Experiment 1*	Mental models: Situation models	**"Situation models** are said to capture information about a number of different dimensions of the narrated situation, such as the spatial and temporal location of an event, the characters and objects present,	event segmentation	Nothing specific. Set up of the process potentially.	DV	36

		characters' intentions and goals, and the causal relations between characters and objects. Situation models are not simply images of the characters, etc., in a given scene, but are thought to be representations that capture the relations between components of the scene" (p. 125)				
Speer & Zacks (2005) *Experiment 2*	Mental models: Situation models	**"Situation models** are said to capture information about a number of different dimensions of the narrated situation, such as the spatial and temporal location of an event, the characters and objects present, characters' intentions and goals, and the causal relations between characters and objects. Situation models are not simply images of the characters, etc., in a given scene, but are thought to be representations that capture the relations between components of the scene" (p. 125)	probe words response times	Comprehension questions	DV	41
Speer & Zacks (2005) *Experiment 3*	Mental models: Situation models	**"Situation models** are said to capture information about a number of different dimensions of the narrated situation, such as the spatial and temporal location of an event, the characters and objects present, characters' intentions and goals, and the causal relations between characters and objects. Situation models are not simply images of the characters, etc., in a given scene, but are thought to be representations that capture the relations between components of the scene" (p. 125)	reading times	Comprehension questions	DV	36
Speer & Zacks (2005) *Experiment 4*	Mental models: Situation models	**"Situation models** are said to capture information about a number of different dimensions of the narrated situation, such as the spatial and temporal location of an event, the characters and objects present, characters' intentions and goals, and the causal relations between characters and objects. Situation models are not simply images of the characters, etc., in a given scene, but are thought to be representations	reading times	Comprehension questions	DV	32

		that capture the relations between components of the scene" (p. 125)				
Sundermeier, van den Broek, & Zwaan (2005) *Experiment 1*	Mental models: Situation models	**mental models** "Comprehenders of a narrative can mentally represent many dimensions of the world described by a text, including spatial relations, temporal information, goals, and causal structure" (p. 462)	Encoding of read aloud utterances	None	DV	18
Sundermeier, van den Broek, & Zwaan (2005) *Experiment 2a*	Mental models: Situation models	**mental models** "Comprehenders of a narrative can mentally represent many dimensions of the world described by a text, including spatial relations, temporal information, goals, and causal structure" (p. 462)	RT	comprehension questions (indirect)	DV	37
Sundermeier, van den Broek, & Zwaan (2005) *Experiment 2b*	Mental models: Situation models	**mental models** "Comprehenders of a narrative can mentally represent many dimensions of the world described by a text, including spatial relations, temporal information, goals, and causal structure" (p. 462)	RT	comprehension questions (indirect)	DV	38
Sundermeier, van den Broek, & Zwaan (2005) *Experiment 3a*	Mental models: Situation models	**mental models** "Comprehenders of a narrative can mentally represent many dimensions of the world described by a text, including spatial relations, temporal information, goals, and causal structure" (p. 462)	RT	comprehension questions (indirect)	DV	41
Sundermeier, van den Broek, & Zwaan (2005) *Experiment 3b*	Mental models: Situation models	**mental models** "Comprehenders of a narrative can mentally represent many dimensions of the world described by a text, including spatial relations, temporal information, goals, and causal structure" (p. 462)	RT	comprehension questions (indirect)	DV	43
Wojcieszak & Kim (2016)	Immersion	**immersion** "narratives can psychologically engage or transport individuals in the story... Such immersion disengages the cognitive system responsible for carefully evaluating attitude-discrepant information and, as individual mental capabilities are dedicated to processing the	Adapted transportation and engagement scale: "While I was reading the comment, I could	None. Adapted Trans and Engagement scales to 5 items, but none were attention/distraction	Moderator	601

	narrative, people counter-argue the message less and do not focus on its faults" (p. 790)	easily picture the situation of the person who wrote the comment” “I was mentally involved in the comment while reading it” “After finishing reading, I wanted to learn more about the situations of people like the comment’s author” “The reader’s comment affected me emotionally, “I felt sorry for the people like the comment’s author.” (α =.74)

With ADNE centered in the causal chain, attention alone would be expected to be a mediating or moderating factor. In this situation, the influence of attention in facilitating outcomes was expected to be highlighted, but not necessarily operationalized. However, in studies utilizing mental models, their location most often at the end of the causal chain, with expectations that manipulations will affect how the reader/viewer constructs them. As discussed below, manipulations of attention can often be part of the independent variable, demonstrating a recognition of its role in model building, but the nature of these manipulations shed light on how attention is conceptualized as a process.

Finally, the measurement of the ADNE or mental model in each study was collected, with particular items listed if available. This helped identify patterns in measurement of attention, specifically when a certain set of items was repeatedly utilized. These were compared across ADNE with the expectation that studies examining very similar variables using the same terminology would have varied or contradictory outcomes and that this variation would correspond with inconsistency in the measurement of attention. Data was also be collected on sample size, stimulus type, stimulus manipulation, and other intervening variables to identify moderating relationships that could affect attention as a process in Study 2.

3.4 Results

3.4.1 Study demographics

As noted, all studies came from 2000 or earlier, following the publishing of Green and Brock's (2000) seminal work on the transportation experience. Table 2 lays out the leading conceptual paths for each article covered, which reveals that half led with

ADNE, while the other half involved mental models. Within these articles, other concepts and mechanisms were discussed, but Table 2 covers the most prominent theoretical lens through which the study was conducted that fell into the concepts of interest for this manuscript.

Of the ADNE, transportation held a small majority (n = 5, 15.6%) of the articles' theoretical thrust. However, transportation was mentioned in more articles and the transportation scale was not limited to articles where the theory itself was cited as the concept of interest, as will be discussed below.

Mental models were primarily focused on examining situation models, though general or other mental model theoretical discussions made up the bulk of the studies. These included mental model approaches to affect infusion model (Forgas, 1995) and Kahneman and Miller's (1986) norm theory, mental representations (2), construction integration model (Kintsch, 1998), and trait models (mental models of individual characters – 2), with a more general approach to mental modeling rounding out the concept.

Table 3.2. Key concepts examined in Study 1 articles

Concept Group	Concept	N	%
ADNE		16	50%
	Absorption	1	3.1%
	Engagement	2	6.3%
	Immersion	4	12.5%
	Involvement	4	12.5%
	Transportation	5	15.6%
Mental Models		16	50%
	Event-Indexing Model	2	6.3%
	Situation Models	6	18.8%
	Other/General	8	21.9%

N = 32 articles

Age trends were as expected for social science research, with 91.8% of the studies (*n* = 56) utilizing college-aged participants. The remainder featured adults (25-69 y.o.; *n* = 4, 6.6%) and a single adolescent population study. Twenty-nine studies reported gender, yielding a 63.4% female average. After removing one 100% female study, this dropped to 60%. Interestingly, the remaining 32 studies (52.5%) did not report their gender breakdown, perhaps due to it not presenting as a significant factor in analysis. However, two studies by Argo & Rui (2008) included gender as a proxy for empathy, a key variable of interest. Considering gender to have such a significant impact on narrative processing to utilize it as a manipulation stands in stark contrast to the more than half of studies that treated it as irrelevant.

3.4.2 Conceptualizations of ADNE and mental models

When examining the explication of key theoretical concepts, particular focus was placed on the centrality or even inclusion of attention within these definitions. Full wording of these definitions can be found for each study in Table 1, but specific trends are noted here.

Transportation is often defined by the terms laid out in Green and Brock (2000), which in turn is based on Gerrig's (1993) conceptualization of the reader as a traveler. These direct links to the original authors usually included a nod to attention as a key part of the process (Appel & Richter, 2010; de Graaf, Hoeken, Sanders, & Beentjes, 2009). Others take some of the elements of the original definition. Bezdek and Gerrig (2017), for example, define transportation via its function, citing the deictic shift (Segal, 1995) and loss of awareness of one's surroundings. Karapanos, Barreto, Nisi, and

Niforatos (2012) expand this to include mental imagery and “feelings of suspense” (p. 274). While Bezdek and Gerrig (2017) only hint at attention when they note how “narratives can *focus* viewers’ cognitive and emotional processing” (p. 61 – emphasis mine), Karapanos, et al. (2012) and Caputo and Rouner (2011) explicitly cite attention.

Other transportation definitions demonstrate the perceived interchangeability of ADNE terms. Quintero Johnson, Harrison, and Quick (2013) define transportation in terms of involvement, while Sangalang, Quintero Johnson, and Ciancio (2013) do the inverse. Argo, Rui, & Dahl (2008) equate transportation with absorption. Caputo and Rouner (2011) describe it as “linked to a person’s level of immersion into a story—the extent that a person is absorbed into a story narrative" (p. 596). Johnson and Rosenbaum (2015) place weight on presence in their definition, while quoting Green, et al. (2004) to bring to concept of engagement into the fray as yet another element/synonym to the process.

Immersion is also subject to definitional commonality with other concepts. Hartung, Burke, Hagoort, and Willems (2016) describe immersion as “a state of *absorption*, which overlaps conceptually with flow, and *transportation*” (p. 2 – emphasis mine). Later, the authors add engagement as a synonymous experience to the phenomenon of immersion. Wojcieszak and Kim (2016) also express it in terms of engagement and transportation.

While Sangalang et al. (2013) treat involvement as synonymous with transportation, others take it as more of a sense of relevance or personal connection to the narrative. Murphy, Frank, Moran, and Patnoe-Woodley (2011) even segment involvement with characters and with the story, the latter of which is defined as a

transportationesque flow state. But involvement is not immune from the synonym phenomenon, despite its multi-conceptual history. Emde, Klimmt, and Schluetz (2016) associate it with engagement, but define it in terms of the intensity of that experience, and put particular emphasis on the affective side of the experience, leaning toward personal connection via emotion. McDonald, et al. (2012) describe it as “the level of absorption or immersion into a storyline” (p. 9) as well as equating it with transportation and measuring it with the transportation scale.

Overall, attention is directly noted when explicating five of the 16 ADNE articles, representing less than a third of the definitions (31.3%). As the definitions often point to other concepts that have been defined historically in terms of attention, there is a nod to or assumption of attentional focus in a majority of the definitions. For example, McDonald, et al’s (2012) above conceptualization could arguably assume attention as a key element in “the level of absorption or immersion” (p. 9), as could Hartung, et al’s (2016) description of “a state of absorption” (p. 2). However, without explicit identification of attention in the process, it cannot be assumed that the researchers intended its inclusion.

Mental model studies were less likely to directly mention attention in their explication, with only two articles including it (12.5%). Lee, et al. (2013) refer to mental model construction as “"attention to and processing of the current visual and verbal information as well as remembering previous visual and verbal information" (p. 413). This sets attention up as a critical first step in the building of models. Rapp, et al. (2006) have a similar approach, describing how "[r]eaders’ representations of texts are a

function of prior knowledge, goals, expectations, and attentional focus in the narrative" (p. 1206).

In all ten of the studies that fell under the direct mention of attention, attention was measured either directly through specifically designed items or the transportation scale, or indirectly through condition manipulation or comprehension items. In the remaining 51 studies where it was not mentioned, attention was left out of the equation in nearly a third (31.4%) of the studies.

Definitions of the process of building and resulting structure of mental models rarely included explicit references to attention. Of the sixteen articles that lead with mental model-based theories, only two (12.5%) directly address attention in their definitions (Lee, Roskos, & Ewoldsen, 2013; Rapp, Klug, & Taylor, 2006). The majority focus on the concept of representation as the key feature of models, but describe it in a manner that requires attention to be accurately fulfilled.

Mental models are constructed via information provided by the text. Information such as “the spatial and temporal location of an event, the characters and objects present, characters’ intentions and goals, and the causal relations between characters and objects” (Speer & Zacks, 2005, p. 125). In order to comprehend this information, an individual “can mentally represent many dimensions of the world described by a text” (Sundermeier, et al., 2005, p. 462), which are “a function of prior knowledge, goals, expectations, and *attentional focus* in the narrative” (Rapp, et al., 2006, p. 1206 – emphasis mine). These definitions describe an interplay between the text and the self, with an expectation that “aspects of prior knowledge that are triggered by reading the text” (Ledoux & Gordon, 2006, p. 790) will aid the individual in using “these models to

generate predictions about future character behavior" (Mensink & Rapp, 2011, p. 1104). Rapp, et al.'s (2006) explicit identification of attentional focus, coupled with a loose definition provided by Lee, et al. (2013), which points to the "attention to and processing of current visual and verbal information" (p. 413) in the construction of models, provide the only two examples of centralized attention. However, mental model research did not always neglect to measure or manipulate attention as a variable.

3.4.3 Operationalization of attention and its effects

Before examining specifically how attention was measured, the studies were analyzed for the location of the theoretical phenomenon in the experimental model. Contrary to expectations, ADNE did not reside in the moderating/mediating position a majority of the time. Instead, as seen in Table 3, they were most often placed as the dependent variable, an outcome of manipulation or condition. Independent and interaction variable positions were not drastically different, with moderators and mediators making up 7 studies (29.2% of the ADNE sample) and IV's representing just two fewer. Two studies, despite noting ADNE in their arguments and literature review, did not include their measurement in the analysis.

Table 3.3. Position of theory within experimental models

	Attention Dependent Narrative Experiences *n* (%)	Mental Models *n*(%)
Independent Variable	5 (20.8%)	4 (10.8 %)
Moderator/Mediator	7 (29.2%)	2 (5.4%)
Dependent Variable	10 (41.7 %)	30 (81.1%)
Not in analysis/Other	2 (8.3%)	1 (2.7%)
Totals	*24*	*37*

Measurement of ADNE plays a key role in how they are defined and whether or not attention was noted. Transportation scale usage is highly prevalent in narrative research in general (see Tukachinsky, 2014 for a review) and made up the majority of the measurement of all ADNE in this particular sample of studies. As noted above, the scale is often adapted to suit particular purposes of a study, or simply because of a lack of reliability with original items. Quintero Johnson, et al. (2013) adapted the scale by dropping “several” items that resulted with a 5 item scale with Cronbach’s α = .72. The resulting scale was very attention heavy, contrasted with Wojcieszak & Kim’s (2016) five-item adaptation which eliminated all attention items (α = .74). Caputo and Rouner (2011) factored the scale into four dimensions, utilizing only two of them: *story involvement* (α = .73), which focused on the immersive experience, and *story relevance* (α = .59), representing “enduring characteristics of personal self-concept” (p. 600) and only included two items.

Only two articles utilized the full transportation scale with an acceptable to high range of reliability. Appel (2011) used all 14 items on the scale (α = .76), while also measuring attention through an “active self” item. Appel and Richter (2010) successfully implemented the full scale with high reliabilities in both of their experiments (α = .82 and .86 respectively). Both studies translated the scale into German, which may have had an influence on the way the questions were interpreted, considering German’s fondness for ultra-long compound words that can express an idea more specifically (Johnson, 2010). For those who reported reliabilities, the average reported reliability was .76, with two-thirds of the studies adapting the scale by eliminating between three and nine items, often including those that assessed attention.

As expected, operationalization of mental models was concentrated in the independent variable position where it was often manipulated as part of the condition (*n* = 17, 45.9%). The remainder were split nearly evenly between interactions and endogenous variables. With the construction of mental modeling placed early in the theoretical puzzle, the role of attention in that development is important to examine. Eleven studies out of the 17 IV examples utilized post-exposure comprehension items to identify how well participants attended, including 9 comprehension tests and 2 post-exposure writing tasks, the latter involving sentence continuation. These are all semi-direct measures of attention, and some were used to eliminate data from participants deemed not sufficiently engaged in the task.

Comprehension questions in general made up the vast majority of attention measures in the mental models studies, and the highest percentage of all measures, just edging out the none/unclear category noted in Table 4 In ADNE studies, a similar pattern emerged with the transportation scale making up a third of the attention measures, followed by no measurement or unclear assessments with just over twenty percent of the studies. Although reaction times equaled the amount of none/unclear measurements, the five studies that utilized the direct measure all occurred within the same article (Bezdek & Gerrig, 2017).

When analyzing reported results of studies that measured attention (*n* = 45) versus those that did not (*n* = 16), there was a notable difference in whether or not findings were significant. Studies that did not measure attention or were unclear in their inclusion of it had higher rates of significance across results ($t(59) = 2.11$, $p = .04$). A lot could be read into the direction of this result, but all would be conjecture without further

examining effect sizes, interaction versus main effects, and direction of findings. Instead, it is important to note the significant difference itself as an indicator that the measurement of attention or lack thereof could have an impact on the results.

Table 3.4. Measurement of attention in experiments

Attention Measure	ADNE* n (%)	Mental Models** n (%)	All Studies %
Transportation Scale	8 (33.3%)	1 (2.7%)	14.8%
Adapted multiple items	4 (16.7%)	1 (2.7%)	8.2%
Single item	2 (8.3%)	0	3.3%
Reaction/Response Times	5 (20.8%)	0	8.2%
Comprehension items	0	17ˆ (45.9%)	27.9%
Post-exposure writing	0	3 (8.1%)	4.9%
Condition	0	4 (10.8%)	6.6%
None/Unclear	5 (20.8%)	11 (29.7%)	26.2%
Total	*24 (100%)*	*37 (100%)*	

ˆComprehension questions were used both directly and indirectly. Nine studies (24.3% of mental model, 14.8% of all studies) used it as an implicit measure of attention

3.5 Discussion

It is evident from the results that ADNE are often treated as synonymous with one another, though conceptually they may differ in their scope. Absorption is often seen as an element of transportation, which in turn is a part of the engagement process (Busselle & Bilandzic, 2008). Involvement varies from a concept of personal relevance to another form of engagement. Immersion is treated as another dimension of transportation, but in other cases, it becomes the broader phenomena that ADNE seeks to describe. This is seen when Wojcieszak & Kim (2016) explain that they “choose the term immersion because our scale combines items from both the transportation…and narrative engagement…scales” (p. 805). All of these vagaries when dealing with

conceptual terminology can leave attention, ostensibly one of the phenomena's central processes, out of the analysis.

Reliance on the transportation scale for attention, which Green and Brock (2000) admit maintains moderate reliability, was common among the ADNE articles. The transportation scale measures attention with two items, both related to distraction. One covers mind-wandering, which suggests attention to the self, but not in a constructive or integrative manner. The other is distraction by events occurring in the room – attention away from the stimulus, but again not to relevant thoughts. These two items reduce attention to two states: either on the stimulus or completely disengaged. Importantly, the myriad of adaptations to the scale to attain reliability, can see these items dropped. The scale's adapted version, the aforementioned TS-SF, has dropped the attention items completely, yielding a scale that is purer to the measurement of the movement aspect of the phenomenon while setting aside the attentional precursor (Appel, et al., 2015). Studies that utilize the adapted scale or their own versions have left open the possibility that attention was assumed and its contributions to outcomes ignored.

Mental model research relies heavily on manipulations and comprehension to impact and/or detect moments of attention. Some studies utilized comprehension items as a way to eliminate participants deemed unfocused on the material. This use of recall to ascertain attention is of concern as it can conflate confusion or even working memory capacity with disengagement (Fisch, 2000; McInnes, Humphries, Hogg-Johnson, & Tannock, 2003; McVay & Kane, 2012; Valadao, Anderson, & Danckert, 2015) or eidetic text memory with comprehension or attention (Carpenter & Boster, 2013). An individual's inability to accurately answer questions about a narrative does not

necessarily mean that they were not attending to it. It could simply be the result of a lack of understanding.

Manipulations, on the other hand, can represent a clever way to ensure attention is *not* being paid, or at least is affected in some way. As Tukanchinsky (2014) noted, attention manipulations consistently prevent engagement with a narrative, calling attention "a critical component, perhaps even a necessary condition for transportation" (p. 20). This standard can apply to mental models as they require text-driven updating to ensure accuracy (Kurby & Zacks, 2012). Making it more difficult for participants to attend to the source material can inhibit model construction, thus impacting processing of the narrative (Bailey, et al., 2017; Foy & Gerrig, 2014). While these manipulations may not be considered a measure of attention, they recognize it for its key role in narrative comprehension.

The multifaceted aspect of attention is difficult to capture, particularly in the moment when it occurs, without utilizing psychophysiological or response time tools. The latter does not provide a great deal of insight on the type of attention or distraction at hand, but can account for dynamic changes over time. The former requires interpretation of physiological indicators of cognitive activity in order to tease apart the internal and external directionality of attention. Although this type of cognitive research is speculative, it represents a step toward identifying the multidimensional and self-driven nature of attention, particularly during long-form stimuli.

Since not all researchers seek to utilize real time attention measures, particularly those as complex and costly as psychophysiological instruments, another solution must be presented. First, the transportation scale needs to be clearly defined as either a

multifaceted or single-issue scale. The development of the TS-SF (Appel, et al., 2015) suggests a shift to utilizing a shortened format that is highly focused on the presence aspect of transportation and its related ADNE. When utilizing such a scale, it is recommended to report very clearly that presence is what is being measured, rather than transportation in its original terms, which clearly references the key role of attention. To supplement this scale or serve as a freestanding measure of narrative attention for non-transportation research, a series of attention items could be utilized as a separate data point. The development of an effective attention scale will take time, and should reflect the complex nature of attention, addressing attention to the stimulus, distraction due to external factors, distraction due to mind wandering, and thoughts directed to the self. In order to be considered representative of the dynamic fluctuations of attention over time, scales can be validated with a combination of separate post-exposure attention items (for convergent validity) and a small scale psychophysiological study that measures only heart rate (construct validity).

In the meantime, the extant narrative engagement scale represents a multifaceted look at ADNE (Busselle & Bilandzic, 2008). This scale itself is multidimensional, encompassing attention, enjoyment, comprehension, and presences, with a myriad of items addressing narrative features and their impact on all of these. The scale is specifically designed for narrative comprehension research, though is significantly under-utilized, perhaps due to its length. This researcher is equally culpable of using the transportation scale in Study 2 when the narrative engagement scale may have been more useful of an instrument. Reaffirmation of this scale with psychophysiological validity could help it arise as a strong contender for a post-

exposure measure of dynamic phenomena that directly questions attention and utilizes it as key factor in the comprehension model.

Real time measures are among the best ways available to capture attention and its role in narrative comprehension. Study 2 seeks to utilize the research-backed cognitive connection between heart-rate and attention to identify how features of a narrative and thoughts about the self impact one another and overall comprehension of the story. Psychophysiological instruments were combined with post-exposure self-reports of both attention and the higher-level cognitive concepts that fluctuations attention affect as both systems – the story and the self – change over time.

Chapter 4. Study 2

4.1 Introduction

Study 2 is designed to place real time attention in the center of a predictive model for comprehension outcomes. The study utilizes the DMA-based dynamic approach, to explore whether the patterns of narrative features interact with an individual reviewer' features to determine the viewer's real-time attention, which can interact with narrative features to predict real-time comprehension of the story. Study 2 addressed a few missed research opportunities of narrative processing research as revealed in Study 1 and analyzes real-time measures of attention during narrative exposure, with a focus of the interaction of self and narrative features. The study uses psychophysiological data during exposure to full-length television program stimuli and analyzes the interplay between the inputs and responses as they develop over time.

Recently, Bedzek and Gerrig (2017) examined the variability of attention during specific narrative elements, utilizing reaction time measures to determine increased attentional focus during suspenseful "hot spots" in film excerpts. They found that the effect of heightened attention carried over into the subsequent scene, supporting the DMA concept of lagging effects from the stimuli feeding back into the system. The authors' robust results reflect the strength of real time attention's impact in even a short clip from a film. Study 2 extends the phenomenon of stimulus and self-based attentional variability over the course of an entire program.

Bedzek and Gerrig (2017) manipulated scenes to include or downplay suspenseful events. Study 2 takes the narrative as it already exists and examines its features as the crucial building blocks of the viewer's mental model. The landscape

model identifies important concepts within a narrative (characters, types of interactions, objects, etc.) and plots their activation over the course of the story (Van den Broek, et al., 1997). The event indexing model identifies how these concepts are processed by the individual in the form of a mental model for the story, constructed with a combination of background knowledge and the information garnered from scene to scene (Zwaan, et al., 1995). Mental models provide a framework for understanding the story, and research suggests that adherence to a somewhat predictable structure aid in the comprehension of the story as a whole (Bilandzic & Busselle, 2011).

Study 2 takes four indices of the event-indexing model and utilizes them to determine the key concepts coded for in the landscape model analysis of audiovisual stimuli. Intentionality was removed as an index of interest to better utilize the teased apart dimensions of the landscape model used by Anderegg, et al. (2017). The remaining indices are mapped onto the narrative in short time segments, which can be connected to the biological indicators of participants' attentional focus collected with psychophysiological measures. In particular, respiratory sinus arrhythmia (RSA) is deemed a clean physiological indicator of state attention.

RSA is a naturally occurring variation in heart rate pattern that transpires during a breathing cycle at approximately the frequency of spontaneous breathing (Porges, 2007). Heart rate data in general reflects inputs from the two branches of the automatic nervous system: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS is activated as a readiness system, engaged in preparation for actions such as fight or flight (Berntsen, Quigley, & Lozano, 2007). PNS, on the other hand, serves as suppressant of sorts, reducing the number of resources

available for action as effort is placed on narrowing attention. When examining heart rate variability (HRV), RSA can be found in the high-frequency band (0.15 – 0.4 Hz) and is considered a relatively unspoiled indicator of PNS alone (Berntsen, et al, 1997; Berntsen, Quigley, & Lozano, 2007). RSA can thus be reliably utilized as an indicator of psychological processes that are reflective of the inhibitory processes that engage when devoting attention to a particular external stimulus.

Hypothesis 1a: *Attention to the stimulus (as indicated by RSA) will be predicted by causal, temporal, spatial, and protagonist dimensions of the narrative.*

Attention is expected to follow a specific pattern in the analyzed segments. It is anticipated that certain dimensions will trigger great attention directed at the stimulus, while others create a switch in focus to the self. Specifically, causal information is expected to require more focus on the story in order for the participant to successfully follow along with the plot. However, when the role of characters is emphasized in the story, attention is expected to turn to the self, and spark the participant's ideas of how *they* might behave in the situation.

Hypothesis 1b: Causal-related features of the narrative will increase RSA.

Hypothesis 1c: Protagonist-related features of the narrative will decrease RSA

A particular driving force of internal attention is self. Whether involuntarily remembering one's own experiences (Ball & Little, 2006; McDonald, et al., 2012) or considering how one might behave in the same scenario (Cohen, 2001), when thoughts turn to the self, it is expected to lead to a decrease of attention to the external stimulus as indicated by RSA as RSA is.

Hypothesis 2a: Self-referencing will decrease RSA.

The concept of self-referencing is expected to interact with narrative features in two ways. First, it is expected that self-referencing and the causal dimensions will interact to increase attention to the stimulus, as the individual leans into the plot of the story in order to understand its sequences before reflecting on what he or she might do in that situation. However, when protagonists are featured on screen and/or discussed, it is expected that the audience will be more likely to look inward as they connect the self to each featured character, thus reducing external attention and increasing RSA.

Hypothesis 2b: Self-referencing will interact with causal dimensions to increase RSA

Hypothesis 2c: Self-referencing will interact with protagonist dimensions to decrease RSA

Mental models are expected to update as new information comes in and accurate updating should yield stronger comprehension. However, in the moment of information revelation, the viewer should be engaged with the stimulus and demonstrate similar levels of attention when these concepts are revisited. With comprehension questions set up to address ongoing revelations during the course of the story, the following dynamic interaction in expected.

Hypothesis 3: The interactions between the activation of concepts (as defined by the landscape model) and viewer's RSA will predict post-exposure comprehension of questions regarding those concepts.

This relationship will be measured across two time points for each comprehension item, thus providing a first and second opportunity to acquire the information necessary to answer the associated post-exposure question accurately. In addition, an

autoregressive turn that predicts the current state from a lagged previous state will be factored into the model.

4.2 Stimuli

Participants were randomly assigned to one of two English-language television dramas: an episode of the Canadian crime series “Intelligence” (Haddock & Frazee, 2006) and an episode of the Australian hospital series “All Saints” (Webb & Bufalo, 2008). These programs were selected for their expected novelty for American participants while still utilizing familiar English. Indeed, no participant had seen either program before exposure, yielding an uncontaminated first-time experience of the narrative. Although nested within the context of a prolonged series, both episodes contain story arcs that are introduced and resolved to some extent over their approximately 45-minute durations. Stimuli were presented uncut from opening credits to closing credits allowing for natural exposure. Additional information about the stimuli can be found in Appendix A.

4.3 Sample

Participants were drawn from a communication research pool at The Ohio State University. They participated in a two-phase study that began with a series of survey measures, which will be thoroughly analyzed outside of this manuscript. This first phase resulted in a pool of 360 participants from which the psychological phase participants were selected. Participants were selected at random from this sample, but with an exclusion of those who reported high anxiety on the General Anxiety Disorder Scale

(GAD-7, Spitzer, Kroenke, Williams, & Lowe, 2006). Three items in particular were used as exclusion criteria (“Feeling nervous, anxious, or on edge”, “Not being able to stop or control worrying”, and “Being so restless that it is hard to sit still”). The reason for this was three-fold. First, restlessness and fidgeting can negatively impact the data collection process, particularly when utilizing electrodes. Continuous shifting can create noise in the data as electrode lead wires are pulled upon and potentially dislodged. Second, the data collection process itself can be a high anxiety situation, from the initial affixing of electrodes on the skin, to the requirement of sitting in one place for an extended period of time while hooked up to electronic systems. High anxiety participants were eliminated to prevent them from suffering during these processes. Finally, research suggests that trait anxiety has an impact on attentional control, particularly in the executive region, which is our focus of study (Derakshan & Eysenck, 2009; Osinsky, Gebhardt, Alexander, & Hennig, 2012). By excluding high anxiety individuals from the second phase of study, variability in executive control as a result of this cognitive discrepancy could be addressed upstream.

From the phase one sample, 57 participants were selected to participate in the psychophysiological phase of the study. Of these participants, one was excluded for falling asleep during the stimulus presentation. Five participants were excluded for incomplete or corrupted/missing responses to the post exposure questionnaires. A total of 51 participants remain for the final complete analysis, though other analyses did not necessitate the comprehension items and included 55 individuals. The sample of 51 participants was 58.8% female (one participant elected not to report sex) and a mean

age of 21.4. Participants were given course credit and $25 compensation for their involvement in the experiment.

4.4 Procedures

Psychophysiological measures - attention

Each lab session began with an explanation of the procedure and a thorough reading of the consent form before consent was obtained. Then, 7 electrodes were affixed to the torso to collect heart rate and respiratory data. These included three positive/negative electrode pairs: electrocardiogram (ECG) electrodes placed on the front, accompanied by impedance data driven by two constant current (CCS) electrodes on the back that sent a signal collected by SNS electrodes on the front. A final electrode was placed on the torso to ground the signal. All heart rate equipment and data collection software was produced by Biosemi software (Mindware Technologies, Gahanna, OH).

Once hooked up to the equipment, participants watched one of the two programs to which they had been randomly assigned. The stimuli was presented using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA), which sent XDAT codes to the physiological data collection computer to trigger the start and end point of the program. Participants were instructed to watch the program naturally, but to minimize movement as possible. After the program was finished, participants were disconnected from the electrodes and completed a series of post-exposure questionnaires that allowed for self-report of the narrative experience.

Transportation

Self-reported transportation was measured using the transportation scale (Green & Brock, 2000), a highly utilized measure that addresses attention, presence, and identification. This scale was slightly adapted for an audiovisual stimulus, and included 11 items. Analysis found the scale to be unreliable (α = .374), even after removing all attention items from the scale (α = .543). An acceptable alpha for the scale could only be attained if all reverse coded attention items and one additional item ("I wanted to learn how the narrative ended") were removed from analysis (α = .721), leaving an 8 item scale that only addressed attention through the question "I was mentally involved in the narrative while watching it". Interestingly, remaining attention items on the scale could not be analyzed for reliability because they shared a negative average covariance. This result adds fuel to the fire that suggests that the scale may not serve as an effective measure of attention within the transportation phenomenon.

Comprehension

Participants answered nine open-ended inference and recall questions about the program they had watched. This measure was designed to assess the overall comprehension of the show, particularly for information that was not explicitly stated on screen, but had to be interpreted from dialogue and behaviors. These questions were presented in random order but were linked to specific timepoints throughout the program. Participants were instructed to answer as completely as possible, though some questions only required a single word response to be accurate. A full list of the questions, along with all measures from both phases of Study 2, can be found in Appendix A.

Self-reported attention measures

A series of post-exposure evaluative questions that mirrored what had been used in Tchernev, et al.'s (2013) CRM study were utilized to capture these same dimensions as an aggregate, post-exposure experience. A total of fourteen questions targeted affective, cognitive, attitudinal, and attentional responses to the narrative. Participants used a scale from 1-100, as in the CRM study, which allowed for a broad range of responses.

Other narrative measures

Self-reported arousal was measured using the perceived message sensation value (PMSV) scale (Palmgreen, Stephenson, Everett, Baseheart, & Francies, 2002), a 17-item semantic differential scale. Oliver and Bartsch's (2011) multidimensionality of viewer's entertainment scale (MVES) captured hedonistic and eudaimonic impressions of the show. Cohen's (2001) identification scale was supplemented by Iguarta and Páez's (1998) empathy and identification scale. These measures were utilized to examine how psychophysiological responses might overlap with perceived relationships with particular characters, but were not used in the present analysis.

After the questionnaires were completed, participants were compensated for their time and provided with a paper or digital copy of the consent form. They were thanked and released. The entire experiment took on average 90 minutes from arrival to dismissal.

4.5 Analysis

4.5.1 Stimulus coding

Following the analysis style of Anderegg et al. (2017), both stimuli were coded utilizing the Landscape Model method, with concepts derived from four of the event-indexing model's five indices (protagonist, temporality, spatiality, and causality). The stimuli were coded in 4 second segments, each of which was analyzed for numerous concepts. In addition to their innovative concept coding, Anderegg, et al. (2017) defined each concept across three dimensions: presence, importance, and explicitness. For Study 2, this same strategy was employed to code the identified concepts.

Presence is simply the location of a concept or character the scene (0 = not present, 1 = present, in background, 2 = present in foreground/direct involvement in action). Importance relates a concept to the plot itself (0 = not important at all, 1 = diminishing in importance, 2 = important to the plot). A concept is important when it is activated and then relates directly to the plotline, but can remain present without being directly referenced or utilized, causing its salience to the viewer to fade. Once a concept is activated, its code would begin as a 2, and even if it is not mentioned in the following segment, it remains in the viewer's mind until it is displaced. If it is not reactivated within two segments of the importance activation, the concept is thought to have faded from accessibility and replaced with currently relevant information. Since the landscape model relates to memory, this diminishing importance without reactivation could cause a key piece of information to be temporarily lost to the viewer. As noted above, creators may influence the sense of importance of an item or concept by placing a degree of emphasis on it (e.g. the camera lingering on an item that is dropped), but lack of

activation can allow for the concept's return to provide a sense of surprise, or the "ohhh" reaction when the viewer recalls the moment of activation from before.

Explicitness refers to the degree to which a concept is explicitly referred to in the scene (0 = not applicable, not present; 1 = implicit; 2 = explicit). For a character, mere presence on screen is considered explicitness, with the presence and importance codes reflecting how active the character is in the storyline at that moment. However, for both concepts and characters, presence is not necessary if they are the explicit topic of discussion. If the concept can be inferred from the context in the scene, then it is considered implicit. As with the three other dimensions, explicitness will be activated and then decay until activated again, yielding a topographic indicator of the concept's direct or implied mentions over the course of the story.

The procedure was performed by two coders. First, a list of concepts was derived from the program including critical characters, locations, and events. These were debated and tested in a pilot code until a definitive list was agreed upon for each stimulus. The final concept list for the *All Saints* episode included a total of 57 concepts, including 18 characters, 7 locations, and 4 pieces of temporal information. The remaining items were deemed "general concepts" and included broad ideas ranging from addiction to radiotherapy, which made up the causal element of the analysis. *Intelligence* contained slightly fewer characters but more general concepts. The total count for the episode of *Intelligence* was 71 concepts, comprising 17 characters, 14 locations, and 3 pieces of temporal information. Causal concepts ranged from murder to invoices, representing key plot features. The complete concept summary list can be found in Appendix B.

Utilizing a codesheet developed with the concepts broken down into each of their three dimensions, coders watched each program in 4 second segments (totals: *All Saints* – 645; *Intelligence* – 638) and recorded scores for the activated concepts as they occurred in the scene. Coders came together to compare results after the first ten minutes of one stimulus to ensure both were following the procedure accurately. Once confirmed, coding continued for both programs. After completion, codes were compared and mismatched topography was resolved together by rewatching the segment in question and coming to an agreement for each discrepancy.

The resulting codesheet was utilized to create smaller codesheets for each of the nine comprehension questions. This provided researchers with information on which relevant concepts were activated and the exact time frames when they occurred. This allowed for comparison between accuracy in question responses and psychophysiological responses during the time when attention could most directly impact comprehension. However, open-ended questions received a variety of responses, which also needed to be coded for levels of accuracy.

4.5.2 Comprehension response coding

Comprehension scoring is often approached as a recall and recognition measure, with questions posed to determine that passages were read or some modicum of attention was paid to the narrative. This, unfortunately, opens responses up to the possibility of a conflation of comprehension with memorization and retrieval. Additionally, asking questions that are closed-ended (e.g. true/false, multiple choice),

allows for guessing or even priming individuals to retrieve information that was not meaningful to them at the time of consuming the narrative.

Since this study seeks to identify how attention changes moment to moment and builds upon itself to affect outcomes, closed-ended comprehension measures were not appropriate. Instead, individuals were asked nine open-ended questions about certain plot points throughout the story. These questions were occasionally satisfied with a right or wrong response, but mostly left room for partial correctness and more complete demonstrations of understanding. A five-point scale for each item was developed that ranged from completely incorrect (0) to including all context for correctness (4). This scale varied in specificity from question to question.

The questions themselves often included two-step inferences, not just identifying the what, but also the why. For example, a question specific to *All Saints* asked "Why does the couple on the couch let Jack sit between them when he arrives?" This requires an understanding of the relationship between the three characters, which had been alluded to in two previous short conversations and just before Jack's arrival. Therefore, in order to satisfy the full 4-point score, respondents had to note three factors: the couple’s desire to make Jack feel included, the fact that they were all three roommates, and that Jack had been feeling like a third wheel. If two of these three concepts were identified, the score would be 1-3 depending on the importance of the dropped concepts. Full question and answer rankings are listed in Appendix C.

The act of scoring these items reliably proved to be almost as complex as the coding of the stimuli. Initially the correctness scale was developed before responses were collected, and some categories were irrelevant for the types of responses found in

the data. Addressing this discrepancy required a collaborative redevelopment of some items on the scale after analyzing scores from both coders. Reliability tests were run repeatedly until the correctness scales were developed into something that could be utilized independently by each coder and yield the same scores. The resulting answer options should be effectively utilized by any researcher using these specific stimuli to capture the vast majority of possible responses that the questions could incur.

4.5.3 Connecting real-time RSA measures to the comprehension questions

Comprehension questions were tied to specific timecodes in the narrative where the information to solve them was most directly provided. Because the length of time needed to address or allude to the answer to the questions, each segment was of varying length, though all were a multiple of four, stemming from the 4-sec codes organized in the landscape code. These lengths ranged from 8 seconds to as long as 80 seconds for the episodes of *Intelligence* (M = 19 secs) and *All Saints* (M = 17.3). There were no significant differences between the lengths of segments between stimuli, but yet the varying length within stimuli made it very difficult to engage in time-series analyses with RSA, which requires at least 30 seconds to capture. As a result, segments were expanded or reduced to 32 second timecodes that included at least the necessary information.

Segments that were extended were done so with care to avoid scene transitions and other new information that could trigger psychophysiological reactions and muddy the data. This was achieved by adding moments either before or after the original segments, or occasionally both. For example, one of the 8 second segments in

Intelligence included the main character explaining who he thought had committed a murder. The segment was so short because it was coded to only include the reveal of the murderer's name. The segment was able to be extended to include the run up to that utterance and some of the conversation that followed that questioned the assertion.

For each comprehension item, two critical segments were identified in the stimulus. These included the key moment where the answer to the affiliated question was mostly directly provided and a secondary moment that alluded to the answer or provided more context. Occasionally, the key moment and secondary moment were just as direct as one another, only with the secondary moment coming later in the program. However, there were also secondary moments that came far earlier in the stimulus and would be referenced to or settled by the key moment. When organizing the data, segments were presented in chronological order to ensure a true time series that allow for identifying how attention accumulates over time and affects the system.

4.5.4 Heart rate data preprocessing

Heart rate data was cleaned using the HRV component of Mindware's data processing software (Mindware technologies, Gahanna, OH). In order to identify attention to the stimulus, RSA was drawn from the cleaned heart rate data at the key 30-second long moments when the stimulus provided the information for answering each comprehension items. The time-related changes in heart rate intervals is known as heart period variability (HPV). This data goes through a Fourier Transformation to convert HPV into a frequency domain from which the high-frequency band (.15-.40 Hz) representing RSA can be observed (Berntson, et al, 2007). As noted above, RSA is

considered a cleaner measure of attention than simple heart rate variability as it relatively devoid of the influence of the sympathetic nervous system.

4.5.5 Data Analysis

RSA, comprehension scores, and other relevant individual difference data were placed into Stata for analysis (Statacorp, College Station, TX). Models were tested using the xtreg function, which explores between, random, and fixed effects in panel modeling. Data was declared as a time series in the RSA models by stacking the heart rate data for both segments for each of the nine questions in chronological order, yielding 18 segments per participant. The lag term for RSA and one set of missing self-report data led to 15-17 observations per participant.

Data from the small stimulus code sheets for each of the nine questions were organized into the four event-indexing categories: causal, people, location, and temporal. The data was analyzed in two patterns. First the fine-tuned, three dimension format included the subcategories of presence, importance, and explicitness. Second, these categories were collapsed into a single index for each of the four categories, providing a coarser variable to map onto the psychophysiological data.

4.6 Results

There was no significant difference between the average RSA for the two stimuli ($F(54) = 1.71$), despite a difference in comprehension results. *All Saints* viewers scored significantly higher on average on comprehension items ($M = 2.82$) than those who watched *Intelligence* ($M = 2.26$), despite attentional similarities, $t(49) = 3.15$, $p = .003$.

Viewers seemed to recognize their own difficulty with the story, as *Intelligence* viewers reported more confusion (M = 37.56) about what was happening than those from *All Saints* (M = 21.57), $t(55) = -2.33$, $p = .01$. There were no significant differences in self-reported enjoyment, transportation, identification, or attention.

4.6.1 Original RSA model

Results demonstrated that a great deal of variance within and between subjects in the heart rate data could be explained with a model that took into account the details of the narrative scene and certain key individual differences. The original model included a coarse expression of the dimensions collapsed into the four event indices: Protagonist, Spatial, Causal, and Temporal. These were aggregated across the 32 second segments and three dimensions for each index. Although the original model represented a good fit for the data (Wald $\chi^2 = 1009.43$, $p < 0.001$), each individual element and interaction provided little explanatory power. The model, particularly when including all relevant interactions, proved less than optimal for a parsimonious explanation of the process at hand. Notable in this model, which does not support H1a, is the strength of self-referencing as a predictor of external attention reflected in RSA. Continued analysis produced a model that provided a stronger explanation for the relationships found in the data and further highlighted the impact of self-referencing.

4.6.2 Revised model

The final model (summarized in Table 4.1) represents the best fit for the data. There are individual differences that hold mixed explanatory power, including the

interaction between the stimulus and self-referencing, particularly in the dimensions of the causality. Temporal and spatial information were dropped from the model as they demonstrated little influence on the participants' reaction to the scenes. Rather than utilize the collapsed indices, the best fit came from fleshed out dimensions for both the causal and protagonist categories, allowing for recognition of the impact of ideas via their importance or explicitness. Simple character and causal concept presence on screen was also removed from the model as it added little influence on RSA. The fact that a character or object was present or absent was less relevant to attention than their importance to the plot or their explicit mention in the script. Presence on screen also combined with explicitness a great deal since on-screen presence counted as direct explicitness of that object or character.

As shown in Table 4.1, RSA was first predicted by a lagged RSA, which represents the system feeding back into itself. Here, effects from the stimulus and the self build up in the system and affect responses down the road. This feedback turn significantly impacted the timepoint RSA figures ($\beta = .63$, $p < .001$), supporting the DMA approach to examining the data (Wang, et al., 2011; Wang, et al., 2012), which controls for these internal mechanisms to disentangle their effects from those of other measured variables.

Causal information was less sturdy of a predictor than expected. Direct effects were mixed in direction, though neither of the two dimensions proved significant, failing to support H1b. Similarly, protagonist dimensions shared directionality of effect, but with not enough significance to interpret the relationship, thus providing no support for H1c. While these stimulus dimensions have no significant direct effect on RSA, self-

referencing does demonstrate a direct effect on the attention indicator in the model (β = -.007, p = .048). This single-item, post-exposure question predicted a negative relationship with RSA at each of the data collection points, suggesting that external attention is more likely to be reduced for those who experienced an increased sense of self-reflection as a result of the program. The data are in the direction expected, providing support for the central argument of H2a, that attention to the self could manifest in a different type of focus than that of external attention.

Self-reflection affects RSA in conjunction with other narrative features as well, but unlike the predicted aggregated effect from H2b and H2c, the impact is dependent on teasing apart the dimensions. When interacting with self-referencing in the dimension of importance, causal features increase RSA (β = .001, p = .03). This suggests that the concepts' significance to the plot results in greater external attention, providing partial support for H2b. The impact on RSA is moderated by the degree to which self-referencing occurred, however, resulting in a three-way interaction effect. Figure 4.1 shows the interaction effect between three categories of self-referencing (low, moderate, and high) depending on the self-report. These levels affect the impact of the story elements of causal importance and causal explicitness on RSA for a three way interaction.

For causal importance, high self-referencers had lower overall RSA than the other two groups with the same pattern of decreased focus as and number of concepts and their importance increased. Low self-referencers attention started at a higher RSA than the two other categories, but decreased more dramatically as the concepts increased in importance.

Table 4.1 Revised attention model: Stimulus dimensions and individual difference predictors of attention

		β (Std Err)	z
	Intercept	5.434 (.569)	9.39***
	System Feedback$_{i,t-1}$	.632 (.025)	25.10***
Causal concepts			
	Causal Importance$_t$	-.036 (.025)	-1.46
	Causal Explicitness$_t$	.036 (.032)	1.12
Protagonist concepts			
	Protagonist Importance$_t$	.042 (.029)	1.47
	Protagonist Explicitness$_t$	-.047(.031)	-1.51
Self-referencing	Self-referencing$_i$	-.007(.004)	-1.98**
Interaction effects	Self-referencing$_i$ x Causal importance$_t$	.0011 (.0005)	2.14**
	Self-referencing$_i$ x Causal explicitness$_t$	-.0013 (.00067)	-1.89*
	Self-referencing$_i$ x People importance$_t$	-.001 (.001)	-1.15
	Self-referencing$_i$ x People explicitness$_t$	.001 (.001)	1.25
Individual differences	Transportability$_i$	-.053 (.024)	-2.19**
	Transportation$_i$	-.006 (.048)	-0.12
	Age$_i$	-065 (.014)	-4.79***
	Sex$_i$	-.175 (.075)	-2.33**
	Respiration Rate$_i$	-.048 (.011)	-4.48***
	Respiration Amplitude$_i$	-83.334 (136.62)	-0.61
	R^2 within	0.012	
	R^2 between	0.948	
	R^2 overall	0.528	
	Observations	916	
	Wald χ^2 test (df)	1004.49*** (16)	

i = 54, t = 1-9 * p = 0.058 ** p < .05 *** p < .01

When separated from other dimensions, the revised model saw explicitness of causality interacting with reported self-referencing approaching significance and in the expected direction predicted by the H2b (β = -.001, p = .058). Rather than attentional resources narrowing to the story when the concepts are *explicitly* noted, the viewer's mind appears turn inward, spurring reflection and maintaining a background self. Although preliminary findings suggested a similar but opposite trend is found when *characters'* importance and explicitness in the story increased, results did not reach significance (z = -1.15 and 1.25 respectively), thus H2c is not supported.

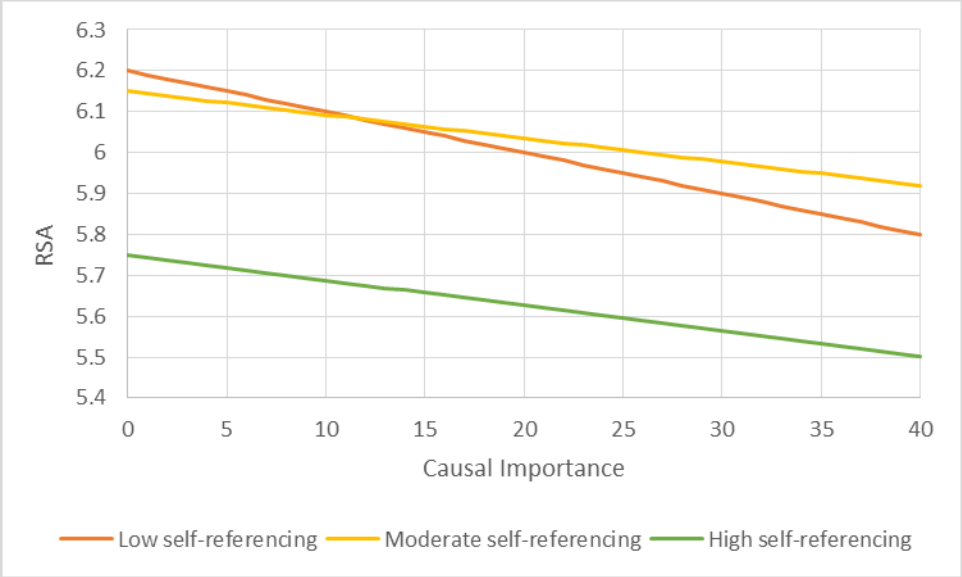

Figure 4.1 Interaction of self-referencing and narrative causal importance on attention

When probing the interaction, there was a similar trend to that with causal importance when applying the categorical self-referencing groups to causal explicitness (Figure 4.2). Again, low self-referencers appear to be more greatly impacted by causal explicitness, but in this case, a certain level of explicitness results in low self-referencers

to break external attention at the same level as those in the highest group. This may be influenced by the sheer number of causal concepts on screen at once (as noted above, explicitness and presence were strongly associated), resulting in information overload that challenged resource allocation. However, that degree of response appears to be unique to the low group, as moderate and high self-referencers maintained a comparable pattern to the interaction with the causal importance dimension.

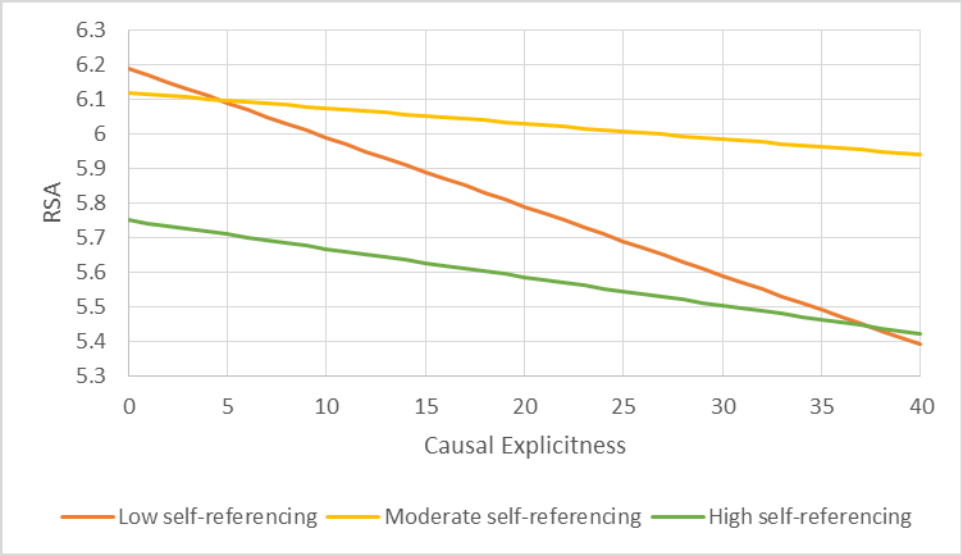

Figure 4.2 Interaction of self-referencing groups and narrative causal explicitness on attention

Transportability also played a central role in the model, though it was not a predicted one. This pretest measure was inserted into the model as a control variable to account for individual differences, but helped predict attention through a reduction in RSA (β = -0.053, p = 0.029). Those who reported greater ease in being able to "get into" a story surprisingly demonstrating reduced external attention. Interestingly, after adjustments to the scale to reflect transportation clean of attention questions, the results of the post-exposure transportation scale do not connect significantly with attention,

supporting the argument that transportation is a separate phenomenon outside of the attentional focus necessary to get it started (Appel, et al., 2015, Tal-Or & Cohen, 2010).

4.6.3 Comprehension

For purposes of comparison, overall comprehension scores were calculated for a simple linear regression analysis with non-psychophysiological measures. A significant regression model was identified ($F(7, 48) = 2.66$, $p < 0.02$) with an R^2 of 0.194 and some surprising results. Aggregated comprehension scores were predicted by self-report data from pre- and post-exposure questionnaires. Transportation ($b = -1.33$, $p > .10$) and transportability ($b = - 0.31$, $p > .10$) were both negatively related to comprehension outcomes, though controlling for sex and age rendered their impact nonsignificant. Self-reported attention ($b = - 0.03$, $p > 0.10$) and distraction ($b = -.13$, $p < 0.01$) both contributed to comprehension in predictable ways, with attention increasing and distraction decreasing as scores went up. Self-referencing $b = 0.09$, $p < 0.01$) increased with comprehension scores, with a high partial correlation within the model ($r = .41$). However, this linear model does not honor the dynamic nature of the self that the study seeks to probe. A time series model was developed and tested to include the dimensions of the narrative and account for changes in RSA at each segment that introduced information critical to responding to the questions.

The predicted model for comprehension is summarized in Table 4.4. Included in the model were RSA results from the key moments described above. To balance with the attention model, the comprehension model utilized both the causal and protagonist (people) indices broken down into two of their three dimensions. This led to a 12

variable model, with additional controls for age and sex, as each dimension interacted with the RSA. Although the model lacks parsimony, it provides more explanatory power than collapsed and aggregated versions. The model does not support Hypothesis 3 as it represents a subpar fit for the data. Although the overall model is significant (Wald $\chi^2(14) = 26.40$, $p = .02$), each individual part proved to contribute too little to suggest a reliable prediction of the comprehension outcomes. Condition proved to be the most robust factor in the model and competing models.

A difference of impact between the two stimuli was not uncovered by traditional statistical means comparisons. However, condition emerges as a key factor when probing the relationships between the participants' individual differences and their comprehension outcomes in the time series. Out of the two programs, *All Saints* seemed easier for the audience to understand from question to question, despite participants not reporting any significant differences in their experiences of attention, distraction, or even identification with characters. Both groups reported the same raw figure for identifying with none of the characters (*All Saints* 12/31 – 38.7% *Intelligence* 12/25 – 48%), and overall identification with the program was similar (*All Saints: M* = 4.20 *SD* =1.22; *Intelligence: M* = 4.05 *SD* = 1.27). There were no also significant differences between average RSA or self-reported enjoyment between the groups.

Table 4.2 The effects of attention from each person during each time window and narrative features during the time window on the person's comprehension to the relevant story content during the time window

		β (Std Err)	z
	Intercept	2.43 (1.737)	1.40
	$RSA_{i,t}$	0.008 (.194)	0.04
Causal concepts			
	$Causal\ Importance_t$	-0.038 (.130)	-0.29
	$Causal\ Explicitness_t$	.0428 (.169)	0.25
Protagonist concepts			
	$Protagonist\ Importance_t$	-0.236 (.220)	-1.07
	$Protagonist\ Explicitness_t$	0.242 (.235)	1.03
Interactions			
	$RSA_{i,t}$ x $Causal\ importance_t$	0.008 (.022)	0.37
	$RSA_{i,t}$ x $Causal\ explicitness_t$	0.007 (.031)	-0.21
	$RSA_{i,t}$ x $People\ importance_t$	0.048 (.041)	-1.17
	$RSA_{i,t}$ x $People\ explicitness_t$	-0.048 (.048)	1.00
Individual differences			
	$Condition_i$	-.691 (.226)	-3.05**
	$Transportability_i$	.004 (.069)	0.05
	$Transportation_i$	.129 (.105)	1.23
	Age_i	0.022(.040)	0.57
	Sex_i	-.158 (.186)	0.85
	R^2 within	0.019	
	R^2 between	0.315	
	R^2 overall	0.100	
	Observations	440 (9 per group)	
	Wald χ^2 test (df) = 26.40^{*} (14)		
	i = 1-49, t = 1-9 $^{*}p = 0.023$ $^{**}p = .002$		

4.7 Discussion

The results of Study 2 are mixed and posit that interactions between self-referencing and the causal dimensions of the stimulus account for a significant portion of variance in attention across a long-form narrative. The fact that the broader model could not represent the data well suggests that the devil is in the details and coding a stimulus with a fine instrument such as the landscape model (van den Broek, et al., 1999), especially when driven by the event indexing model (Zwaan, et al., 1995) can tease apart narrative features in order to isolate their impact. In addition, the ability to tease apart these features in a real-time manner requires a model such as DMA, which allows for time-series analysis of changes in both systems – the stimulus and the self.

The importance of causal information to the plot as demonstrated in these results supports previous research on learning from narratives. Education entertainment (E-E) studies have often argued that a core message must be closely tied to the plot to be attended to by an audience (Fisch, 2000; Slater & Rouner, 2002), particularly due to cognitive capacity and elaboration ability. The results from the present study suggest that it is a natural response to “lean in” to the narrative when things are more important, particularly when interacting with an individual’s tendency to think about his or her own experiences.

The role of self-referencing, as a proxy for IAMs (Ball & Little, 2006; Berntsen, 1998, McDonald, et al, 2012), is a clear indicator that attention is a complex system. What might appear as a lack of attention, even in psychophysiological data, may be in fact a misinterpreted resource reallocation to the internal thoughts. This can be intensified by the features of the narrative either calling for more resources to be

allocated to the stimulus or stimulating more introspection. The complexity of a long-form audiovisual narrative coupled with intricate attentional systems results in a dynamic ebb and flow of resource allocation that either causes a bottleneck that can interrupt the narrative experience (Corbetta & Shulman, 2002; Dehaene, 2014) or aid it by providing a structure upon which to understand it (Dixon, et al., 2014). Accounting for these fluctuations provides insight into the black box of narrative processing as a result of narrative features such as plot devices and character behavior.

Identification with characters represents a well-studied area of narrative communication research, and these results inform how scene by scene interactions between characters and the viewer can influence attention. Importantly, the coding scheme allowed for the importance and explicitness of characters to stand out from their mere presence on the screen. This level of detail allows for more direct manipulation of stimuli, particularly if developing narratives in order to transmit a prosocial message.

An interesting outcome from the study is the lack of impact from self-reported transportation. As noted, the scale had to be adapted to reach an acceptability level of reliability. The adapted scale no longer included attention and trended toward a negative relationship with RSA in both the original and revised models. The outcomes are inconsistent with the scale is purported to measure. If transportation is an all-in resource allocation experience, then RSA should increase with it. Although this is a small sample experiment, the results with transportation should raise concerns with the dependence on the scale in narrative comprehension studies seen in Study 1.

Comprehension outcomes were not consistent enough to support a dynamic model over a simple linear regression model. The fine-tuned examination using RSA

interacting with all dimensions may have provided the best fit for the data, but it was too bulky of a model to argue for a parsimonious explanation of the comprehension outcomes. It is evident, however, that attention has an impact on comprehension. The particular direction of influence that internal resource allocation has is unclear from these results, suggesting that further research should include this element of attention in order to better understand how these systems interact with one another.

Additionally, the nature of the measurement of comprehension is worth repeating in future studies. The study utilized open-ended and often inference-based questions rather than simple recall. This allowed for direct assessment of understanding rather than just what was remembered from the story. Furthermore, the coded responses provided a range of “correct” answers that added variance to the response data in order to make connections between attentional indicators and completeness of understanding. Richer data can be obtained with this methodology than what is ascertained from simple recall items.

Chapter 5. General discussion

5.1 Study implications

Narratives are powerful tools for learning, perhaps because they tap into humans' natural mental modeling. Although classic theories might suggest we learn from narratives via observation (Bandura, 1986, 2001), more recent research considers viewers as actively representing and simulating the language present (Bergen, 2012; de Nooijer, et al., 2016; Glenberg, 2015; Liu & Bergen, 2016) and placing themselves in the center of the experience (Slater, et al., 2014). This deictic shift (Segal, 1995) brings with it the entirety of the self, including the stock of mental models and personal experiences that inform individual perceptions of the story. In addition, the individual's capacity to attend to the narrative plays a role in the opportunity to become fully immersed into the story world in the first place, let alone generate accurate and complete mental models as a result.

Psychophysiological measures can identify moments of real time attention that map onto narrative features and reveal the dance between the story and the self. The results of Study 2 suggest that moment to moment attention is affected by multiple aspects of the situation: the nature of the stimulus, individual differences in transportability, and importantly the amount to thinking that is directed to the self. The complexity of a stimulus, particularly one of an audiovisual nature, requires the brain to keep up with a variety of sensory inputs in order to effectively and accurate update mental models. These models are not constructed from scratch or the process would be quite an arduous challenge every time we turned on the television. Rather they quickly appear as scaffolding in the forms of individualized prototypes based on personal

experience and knowledge (Johnson-Laird, 1983; Smith & DeCoster, 2000) upon which new information can be built. The stimulus may trigger a prototype model into salience but the original framework comes from the self.

While mental models can be maintained and adapted as an ongoing progression, the process of attending to the information that updates them, as well as the experience of ADNE, represents a state. Just as focused attention is a necessary precursor to the flow-like state of transportation and its associated phenomena, lack thereof can break the state suddenly (Weber, et al., 2016) leaving the model incomplete and undoing the sense of “being there”. While a temporary loss of the flow state might not be critical for enjoyment, the gaps that the loss of focus incurs can impact comprehension of the plot. Thanks to DVR and online streaming technology, an individual can pause and rewind entertainment at home to catch up when this happens, but not every narrative experience happens in that sort of environment, just as the lab is not representative of the real world. Modern viewers often multitask during media experiences, diminishing their available attentional resources further (Jeong & Fishbein, 2007; Rothbart & Posner, 2015; Wang & Tchernev, 2012).

Despite its purported central role in ADNE and mental model construction, Study 1 demonstrates how rare direct measures of attention are in narrative comprehension research. The results indicate that there are significant differences in outcomes when attention is omitted or included. Even if these discrepancies are not central to the arguments made in the studies, they hold some explanatory power for variation in outcomes. The ability to hold attention varies greatly from person to person due to traits such as anxiety and attention deficit spectrum disorders (Gazzaley & Nobre, 2012;

McInnes, et al., 2003; Osinsky, et al, 2012). It is important to measure of attention simply to control for these differences lest they give an incomplete or inaccurate picture of the outcomes of narrative experiments.

Both mental model and ADNE research could benefit from a mathematically predictive dynamic model that takes into account inputs from both self and the stimulus and how both change and fluctuate over time. The dynamic motivational activation or DMA model is able to account for individual choices and motivations that each participant brings to the table when interacting with the stimulus (Wang, 2014). Each interaction that the individual has with the stimulus influences how that stimulus is interacted with in the future (Banjo, et al., 2016; Wang, 2014). Because the model is dynamic, the dynamic nature of the stimulus and attention can both be included in analysis when using DMA.

5.2 Limitations

As noted in the discussion for Study 1, there is much more comparative analysis to be done to determine the bearing attention (mis)measurement or oversight has on previous narrative comprehension research. A full meta-analysis examining effect sizes, interaction versus main effects, and direction of findings, would provide greater insight into this research area. The eligible research was also limited to those studies that were measuring comprehension. An analysis similar to Tukachinsky's (2014) breakdown of transportation research, but with specific focus on the operationalization or omission of attention measurement, would illuminate the broader narrative field, including narrative persuasion and non-comprehension focused ADNE studies. It would also be beneficial

to separate self-report studies from those that utilize more fine-tuned measures such as response times and psychophysiological methods.

Although psychophysiological research provides the assurance of “hard science” approaches to social questions, results remain open to interpretation. Despite our knowledge of the sympathetic and parasympathetic nervous systems, the data that come as a result of these physiological changes only serve as a proxy for what is a complex interaction between an individual and an array of stimuli in the moment. The results above have been carefully isolated and analyzed, but the influence of outside factors unaccounted for in the research remains a risk to interpretation.

Additionally, the sample size for the research is small. The benefit of time series analysis increases the number of data points to examine, but with participants split between two stimuli that proved to result in discrepant comprehension scores, there remains a lack of power driving outcomes. There is also increased risk that unmeasured individual differences are impacting the results, muddying the data. Nonetheless, even with a small sample size, dynamic changes of attention from moment to moment clearly emerged from the data, reifying attention’s complexity and the necessity to include it in future ADNE research.

5.3 Future research

Narrative research has had an issue with the measurement of both attention and comprehension. The latter relies heavily on what is remembered rather than what is understood. The former, as Study 1 reveals, is often assumed or addressed with limited self-report measures that require the individual to reconstruct an attentive state long

after it has occurred. Measurement of attention is difficult, and in-the-moment instruments such as psychophysiological tools and reaction time measures are not feasible for many studies. Self-report questionnaires after exposure may be the only choice for some researchers. What is important to recognize is that inattention is not just a feature of low-energy or uninterested participant; it is a natural part of the ebb and flow of resource allocation that can be driven by the narrative, the environment, and the self, more likely a combination of all three. Furthermore, it is a critical piece of the puzzle of transportation and its fellow ADNE, as well as mental model construction.

The evolving entertainment world places attention in its center, and research is evolving along with it. The role of narrative comprehension research is to understand how the processes of the individual interact with the dimensions of the narrative. Communication researchers are moving away from treating cognitive functions as a black box that cannot be decoded. Modern communication science takes advantage of cognitive tools that can capture psychophysiological responses to stimuli as they occur, through tools such as fMRI (Coronel & Falk, 2017; Weber, Mangus, & Huskey, 2015), HRV/RSA (Bar-Haim, Fox, VanMeenen, & Marshall, 2004; Lang, Geiger, Strickwerda, & Sumner, 1993; Zhang, et al., 2016), ERP (García-Marco, Beltrán, León, & de Vega, 2016; Manifredi, Cohn, & Kutas, 2017; Suess & Rahman, 2015), and skin conductance (Banjo, et al., 2016; Wang, et al., 2012; Zhang, et al., 2016).

The movement of communication, and particularly narrative, research into the psychophysiological realm provides science with the opportunity to validate the self-report measures upon which the majority of studies rely. By connecting and adapting current scales to the physical indicators of their purported phenomena, narrative

research can find assurance of validity. This is particularly important for attention measures, which, as noted above, rely heavily on the individual's ability to reconstruct a cognitive state long after it was experienced. If a self-report tool can be created to measure attention in a multidimensional manner, psychophysiological measures could be implemented to ensure that the heart rate data matches the reported experience. However, even a strong post-exposure tool represents an aggregated evaluation of a fluctuating cognitive process and cannot necessarily connect moments of increased or broken attention with the elements of the stimulus that produced them.

Dynamic tools require dynamic analysis and predictions. DMA serves as a strong framework to explore what we know to be multidimensional and time-dependent processes. Future research should consider how prior experience and moment to moment motivational changes impact overall experiences of narratives, particularly in terms of comprehension outcomes. In order to capture those changes, dynamic mathematical models such as DMA can shine light into the black box of cognitive functions that contains the multidimensional processes of attention and the higher level cognitive phenomena it impacts.

5.4 Conclusions

Immersion into a story world is a near universal human experience. Those who have an inability to imagine the world itself, either from text or the broader context of an audiovisual narrative, are a small minority who struggle to even reconstruct their own experiences (Jacobs, Schwarzkopf, & Silvanto, 2017; Watkins, 2017). But even an individual who naturally pictures the language they encounter can build an inaccurate or

incomplete mental model if attention is inconsistent or missing at the right spots. In addition, models require a foundation of knowledge and experience from which to draw to fill in the gaps that the story leaves. The ability to comprehend the story requires flexible attention that picks up on the subtleties of the narrative message while integrating the self and what is already known. As time goes on, attention can vary as a result of the dimensions of the story and the state of the individual.

This dance should be of concern to narrative researchers, particularly those concerned with crafting educational narrative messages that can subtly delineate a complex or sensitive issue to the public (Moyer-Gusé, 2008). Comprehension is multifaceted, with constantly updating mental models with a lifetime of individualized experience creating their foundation. Audiovisual narratives express themselves through multiple dimensions, requiring attention to both what is said, the messages in the music, and what is happening visually, sometimes both in the foreground and background. Understanding message processing as an ongoing interaction between the message and the self means including the manner in which this interaction changes overtime in the theoretical model (Wang, et al., 2012).

It would be preferable to address attention noninvasively in the moment, with psychophysiological tools that can capture natural attention. However, all studies cannot utilize psychophysiological measures, nor should they. What is important, however, is that attention receives…attention. Study 1 reveals the extent to which attention is left out of the comprehension equation, particularly due to adaptation of the moderately reliable transportation scale. If it is necessary to rely on post-exposure self-report of

experienced attention, a dedicated measure should be developed; one that touches on the multifaceted nature of attentional focus.

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Appendix A

Study 2 Measures Phases I and II

Phase I

Demographic and Enrollment Questions

Are you native English speaker? Yes_____ No_____

Do you have normal vision (that is, you do not wear any glasses or contact lenses)? Yes____ No____
Do you usually wear glasses? Yes___ No_____
Do you usually wear contact lenses? Yes___No_____
If you wear glasses/contact lenses, is your current prescription adequate? Yes____ No___

Do you have normal hearing? Yes____ No____
If not, do you wear a hearing aid? Yes____ No___

Are you male or female? Male___ Female____

Age: _____

Are you right or left handed?
Right handed_____ Left handed____

The Big Five Inventory of Personality (BFI)
John, Naumann, & Soto (2008)

Extraversion (8 items): 1, 6R, 11, 16, 21R, 26, 31R, 36
Agreeableness (9 items): 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42
Conscientiousness (9 items): 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R
Neuroticism (8 items): 4, 9R, 14, 19, 24R, 29, 34R, 39
Openness (10 items): 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

BFI Scale:

I see myself as someone who…

1. _____ is talkative
2. _____ tends to find fault with others
3. _____ does a thorough job
4. _____ is depressed, blue
5. _____ is original, comes up with new ideas
6. _____ is reserved
7. _____ is helpful and unselfish
8. _____ can be somewhat careless
9. _____ is relaxed, handles stress well
10. _____ is curious about many different things
11. _____ is full of energy
12. _____ starts quarrels with others
13. _____ is a reliable worker
14. _____ can be tense
15. _____ is ingenious, a deep thinker
16. _____ generates a lot of enthusiasm
17. _____ has a forgiving nature
18. _____ tends to be disorganized
19. _____ worries a lot
20. _____ has an active imagination
21. _____ tends to be quiet
22. _____ is generally trusting
23. _____ tends to be lazy
24. _____ is emotionally stable, not easily upset
25. _____ is inventive
26. _____ has an assertive personality
27. _____ can be cold and aloof
28. _____ perseveres until the task is finished
29. _____ can be moody
30. _____ values artistic, aesthetic experiences
31. _____ is sometimes shy, inhibited
32. _____ is considerate and kind to almost everyone
33. _____ does things efficiently
34. _____ remains calm in tense situations
35. _____ prefers work that is routine
36. _____ is outgoing sociable
37. _____ is sometimes rude to others
38. _____ makes plans and follows through with them
39. _____ gets nervous easily
40. _____ likes to reflect, play with ideas
41. _____ has few artistic interests
42. _____ likes to cooperate with others
43. _____ is easily distracted
44. _____ is sophisticated in art, music, or literature

Interpersonal Reactivity Index (IRI)
Davis (1980)

IRI Scale Scoring

PT = perspective-taking scale
FS = fantasy scale
EC = empathic concern scale
PD = personal distress scale

ANSWER SCALE:

A	B	C	D	E
DOES NOT DESCRIBE ME WELL				DESCRIBES ME VERY WELL

1. I daydream and fantasize, with some regularity, about things that might happen to me. (FS)

2. I often have tender, concerned feelings for people less fortunate than me. (EC)

3. I sometimes find it difficult to see things from the "other guy's" point of view. (PT) (-)

4. Sometimes I don't feel very sorry for other people when they are having problems. (EC) (-)

5. I really get involved with the feelings of the characters in a novel. (FS)

6. In emergency situations, I feel apprehensive and ill-at-ease. (PD)

7. I am usually objective when I watch a movie or play, and I don't often get completely caught up in it. (FS) (-)

8. I try to look at everybody's side of a disagreement before I make a decision. (PT)

9. When I see someone being taken advantage of, I feel kind of protective towards them. (EC)

10. I sometimes feel helpless when I am in the middle of a very emotional situation. (PD)

11. I sometimes try to understand my friends better by imagining how things look from their perspective. (PT)

12. Becoming extremely involved in a good book or movie is somewhat rare for me. (FS) (-)

13. When I see someone get hurt, I tend to remain calm. (PD) (-)

14. Other people's misfortunes do not usually disturb me a great deal. (EC) (-)

15. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. (PT) (-)

16. After seeing a play or movie, I have felt as though I were one of the characters. (FS)

17. Being in a tense emotional situation scares me. (PD)

18. When I see someone being treated unfairly, I sometimes don't feel very much pity for them.
(EC) (-)

19. I am usually pretty effective in dealing with emergencies. (PD) (-)

20. I am often quite touched by things that I see happen. (EC)

21. I believe that there are two sides to every question and try to look at them both. (PT)

22. I would describe myself as a pretty soft-hearted person. (EC)

23. When I watch a good movie, I can very easily put myself in the place of a leading character. (FS)

24. I tend to lose control during emergencies. (PD)

25. When I'm upset at someone, I usually try to "put myself in his shoes" for a while. (PT)

26. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me. (FS)

27. When I see someone who badly needs help in an emergency, I go to pieces. (PD)

28. Before criticizing somebody, I try to imagine how I would feel if I were in their place. (PT)

Transportability Scale

Dal Cin, Zanna, & Fong (2004)

Scoring:

Scored along a nine-point Likert-type scale from Strongly Disagree to Strongly Agree.
Items 3, 6, and 15 are reverse-scored.

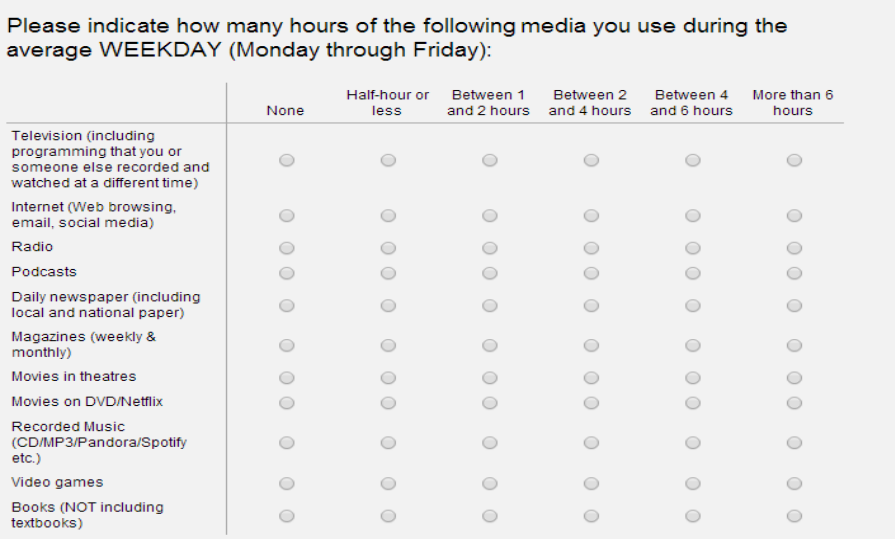
When watching movies/videos for pleasure...

1. I can easily envision the events in the story.
2. I find I can easily lose myself in the story
3. I find it difficult to tune out activity around me (Reverse-scored)
4. I can easily envision myself in the events described in a story
5. I get mentally involved in the story
6. I can easily put stories out of my mind after I've finished watching them (Reverse-scored)
7. I sometimes feel as if I am part of the story
8. I am often impatient to find out how the story ends.
9. I find that I can easily take the perspective of the characters in the story
10. I am often emotionally affected by what I've watched.
11. I have vivid images of the characters.
12. I find myself accepting events that I might have otherwise considered unrealistic
13. I find myself thinking what the characters may be thinking
14. I find myself thinking of other ways the story could have ended
15. My mind often wanders (reverse-scored)
16. I find myself feeling what the characters may feel.
17. I find that events in the story are relevant to my everyday life.
18. I often find that watching movies/shows has an impact on the way I see things.
19. I easily identify with characters in the story.
20. I have vivid images of the events in the story.

General Media Exposure Measure (GME)
Lee, Hornik, & Hennessy (2008)

Scoring:

Respondents are asked how many hours they utilized media on an average weekday and an average weekend. They are asked to rate on a six-point scale (1 = none, 2 = half-hour or less, 3 = between 1 - 2 hours, 4 = between 2 – 4 hours, 5 = between 4 - 6 hours, 6 = more than 6 hours).



Please indicate how many hours of the following media you use during the average WEEKDAY (Monday through Friday):

	None	Half-hour or less	Between 1 and 2 hours	Between 2 and 4 hours	Between 4 and 6 hours	More than 6 hours
Television (including programming that you or someone else recorded and watched at a different time)						
Internet (Web browsing, email, social media)						
Radio						
Podcasts						
Daily newspaper (including local and national paper)						
Magazines (weekly & monthly)						
Movies in theatres						
Movies on DVD/Netflix						
Recorded Music (CD/MP3/Pandora/Spotify etc.)						
Video games						
Books (NOT including textbooks)						

Generalized Anxiety Disorder 7-item scale (GAD-7)
Spitzer, Kroenke, Williams, & Lowe (2006)

0 = Not at all; 1 = Several days; 2 = More than half the days; 3 = Nearly every day

Over the last 2 weeks, how often have you been bothered by the following problems?

1. Feeling nervous, anxious, or on edge
2. Not being able to stop or control worrying
3. Worrying too much about different things
4. Trouble relaxing
5. Being so restless that it is hard to sit still
6. Becoming easily annoyed or irritable
7. Feeling afraid as if something awful might happen

Phase II Post-Exposure Questionnaire

Have you ever seen this video or an episode from this series before?
Yes No (please select one)
Please think back about your overall experience when watching the episode. All the scales will be anchored by 1 (Not at all) and 100 (Very much).

(1) How much did you share the feelings of any of the characters? (*empathy affective*)
(2) How much did you feel pleasant? (*positive affect*)
(3) How much did you feel unpleasant? (*negative affect*)
(4) How much did you feel aroused? (*arousal*)
(5) How much did you enjoy the show? (*enjoyment*)
(6) How much did you like the production of the show (for examples, camerawork, story writing, acting, visual composition)? (*aesthetic appreciation*)
(7) How much did you take the perspective(s) of any of the characters? (*empathy cognitive*)
(8) How much did you pay attention to events occurring in the show? (*attention to the narrative)*
(9) How much did you feel distracted from focusing on the events occurring in the show? (*distraction from the narrative*)
(10) How much did you feel a sensation of "being there" in the show? (*presence*)
(11) How much did the story make you think of yourself (such as what you did in the past, what you may experience in the future, and what you would do if you were the character?) (*self-referencing thoughts; elicited by the narrative*)
(12) How much did the story make you think of yourself, other people, places, or events in the real world or fictional media? (*real-world-referencing thoughts*)
(13) How much did you feel unsure about what was going on in the story? (*narrative understanding*)
(14) How complex do you think the story was? (*complexity of the story*)

Open-ended comprehension questions

All Saints: (Season 11, episode 5 – "Caught in a Trap")

1) Why were the doctors trying to reach the overdose patient's general practitioner (GP) and pharmacist? (3:30)
2) Why was the girl with cancer refusing treatment? (10:38)
3) Why did the doctor treating the fibromyalgia (pain) patient want to talk with his daughter in private originally? (13:40)
4) Why was Gabrielle (young blonde nurse) trying to get Steve (Dr. Taylor) off of the overdose patient's case? (19:00)
5) Why does Bart want Anne-Marie (cancer patient) to start radiation therapy? (24:53)
6) How does Jenny (the overdose) being pregnant change her situation? (30:30)
7) Why was the fibromyalgia patient's daughter abusing morphine? (35:28)
8) Why was it a big deal that Mike finally took the morphine for pain after his kidney surgery? (40:20)
9) Why does the couple on the couch let Jack sit between them when he arrives? (42:35)

Intelligence: (Season 1, episode 1 – "Where Good Men Die like Dogs")

1) Why were the dealers running short on profits at the beginning of the episode? (1:45)
2) Why does Jimmy's ex-wife get angry with him over the cell phone? (10:35)

3) Why is Mary (the policewoman) afraid of Adam, the man who was in her house when she came home? (16:55)
4) Why is the red-haired woman at Jimmy's shipping company complaining that they're "sitting on too much cash"? (21:15)
5) Why does Mary want to meet with the money laundering guy instead of arresting him? (25:45)
6) Why were Jimmy and his ex-wife fighting at her house? (26:30)
7) Why is the information Jimmy gave Mary about one of her department members important? (35:45)
8) Who does Jimmy think killed the informant who went to Mexico? (39:00)
9) Why does Jimmy think that Colin was shot in his driveway near the end of the episode? (41:58)

Perceived Message Sensation Value (PMSV) Scale

Palmgreen, et al (2002)

The PMSV Scale Scoring

Emotional Arousal Items: 2, 5, 6, 7, 10, 12, 16, 17
Dramatic Impact Items: 3, 8, 9, 13, 14, 15
Novelty items: 1, 4, 11

The PMSV Scale

Instructions: We would like you to rate the show (ad, PSA, etc) you just saw on the following scales. For example, on the first pair of adjectives if you thought the ad was very *unique*, give it a "1". If you thought it was very *common*, give it a "7". If you thought it was somewhere in between, give it a 2, 3, 4, 5, or 6.

1. Unique	1 2 3 4 5 6 7	Common (R)
2. Powerful impact	1 2 3 4 5 6 7	Weak impact (R)
3. Didn't give me goose bumps	1 2 3 4 5 6 7	Gave me goose bumps
4. Novel	1 2 3 4 5 6 7	Ordinary (R)
5. Emotional	1 2 3 4 5 6 7	Unemotional (R)
6. Boring	1 2 3 4 5 6 7	Exciting
7. Strong visuals	1 2 3 4 5 6 7	Weak visuals (R)
8. Not creative	1 2 3 4 5 6 7	Creative
9. Not graphic	1 2 3 4 5 6 7	Graphic
10. Arousing	1 2 3 4 5 6 7	Not arousing (R)
11. Unusual	1 2 3 4 5 6 7	Usual (R)
12. Involving	1 2 3 4 5 6 7	Uninvolving (R)
13. Not Intense	1 2 3 4 5 6 7	Intense
14. Weak sound track	1 2 3 4 5 6 7	Strong sound track
15. Undramatic	1 2 3 4 5 6 7	Dramatic
16. Stimulating	1 2 3 4 5 6 7	Not Stimulating (R)
17. Strong sound effects	1 2 3 4 5 6 7	Weak sound effects (R)

Transportation Scale
Green & Brock (2000)

1. While I was watching the narrative, I could easily picture the events in it taking place.
2. While I was watching the narrative, activity going on in the room around me was on my mind. (R)
3. I could picture myself in the scene of the events described in the narrative.
4. I was mentally involved in the narrative while watching it.
5. After finishing the narrative, I found it easy to put it out of my mind. (R)
6. I wanted to learn how the narrative ended.
7. The narrative affected me emotionally.
8. I found myself thinking of ways the narrative could have turned out differently.
9. I found my mind wandering while watching the narrative. (R)
10. The events in the narrative are relevant to my everyday life.
11. The events in the narrative have changed my life.

Identification Scale
Cohen (2001)

1. While viewing the program, I felt as if I was part of the action.
2. While viewing the program, I forgot myself and was fully absorbed.
3. I was able to understand the events in the program in a manner similar to that in which character X understood them.
4. I think I have a good understanding of character X.
5. I tend to understand the reasons why character X does what he or she does.
6. While viewing the show I could feel the emotions character X portrayed
7. During viewing, I felt I could really get inside character X's head.
8. At key moments in the show, I felt I knew exactly what character X was going through.
9. While viewing the program, I wanted character X to succeed in achieving his or her goals.
10. When character X succeeded I felt joy, but when he or she failed, I was sad.

Empathy and Identification Scale
Igartua & Páez (1998)

Questions:
• I thought I was like the characters or very similar to them
• I thought that I would like to be like or act like the characters
• I identified with the characters
• I felt “as if I were one of the characters”
• I had the impression that I was really experiencing the story of the characters
• I felt as if I “formed part of ” the story
• I myself have experienced the emotional reactions of the characters
• I understood the characters’ way of acting, thinking or feeling
• I tried to see things from the point of view of the characters
• I tried to imagine the characters’ feelings, thoughts and reactions
• I understood the characters’ feelings or emotions .74
• I was worried about what was going to happen to the characters
• I felt emotionally involved with the characters’ feelings
• I imagined how I would act if I found myself in the place of the protagonists

Multidimensionality of Viewer’s Entertainment Scale
Oliver & Bartsch, 2011

Scoring:
Seven-point, Likert-type scale from Strongly disagree (1) to Strongly Agree (7).

1. It was fun for me to watch this show.
2. I had a good time watching this show.
3. The show was entertaining.
4. I found this show to be very meaningful.
5. I was moved by this show.
6. The show was thought provoking.
7. This show will stick with me for a long time.
8. I know I will never forget this show.
9. The show left me with a lasting impression.
10. I was at the edge of my seat while watching this show.
11. This was a heart-pounding kind of show.
12. The show was suspenseful.

The Stimuli

Two television episodes that were used in the McDonald and Collier (under review) study will be used in this study. Both TV shows have been aired on television networks and are highly accessible to the general public. Both episodes are around 45 minutes long.

(1) One episode is from *All Saints*, an Australian medical drama.
According the Wikipedia introduction of the show, "*All Saints* (also known as *All Saints: Medical Response Unit*) is an Australian medical drama which first screened on the Seven Network. The series debuted on 24 February 1998 and concluded its run on 27 October 2009. It had been one of Australia's highest rating dramas and also achieved popularity overseas in many countries including UK, Ireland, Belgium and Iran."

(2) The other episode is from *Intelligence*, a Canadian crime drama.
According the Wikipedia introduction of the show, "*Intelligence* is a Vancouver-based television crime drama starring Ian Tracey and Klea Scott that aired on the CBC. With its pilot first airing on November 28, 2005, the series began regular broadcasting on October 10, 2006. CBC reaired the pilot on June 7, 2007 and began broadcasting reruns of season one on Fridays starting on June 8, 2007. A second season then aired from October 2007, concluding in December that same year."

Appendix B

Concept summary lists

Table B.1 . All Saints Concept summary list

Concept Group	Concept	Description
Characters		
	Frank	Frank Campion is the head of the Emergency Department (ED)
	Von Ryan	Von Ryan is another main doctor in the series and an older member of the ED
	Steven	Steven Taylor is an ED doctor. He is the character who fights with the suicide patient
	Dan	Dan Goldman is an ED nurse working on the suicide patient case and the live in boyfriend of Erica
	Erica	Erica Templeton is an ED nurse working on the fibromyalgia case and live-in girlfriend to Dan
	Bart	Bart West is a doctor and boyfriend/caretaker to Ann-Marie.
	Gabrielle	Gabrielle Jaeger is an ED nurse working on multiple cases and ex-girlfriend to Steven
	Jack	Jack Quade is an ED doctor working on the fibromyalgia case. He is the roommate of Dan and Erica
	Mik	Mikalos Vlasek is a surgeon but in this episode he is recovering from donating a kidney
	Jennifer Constable	Jennifer is the patient who had attempted suicide
	Kara	Kara Grieve is the daughter of the fibromyalgia patient
	Tom	Tom Grieve is a patient in the ED suffering from fibromyalgia symptoms
	Ann-Marie	Ann-Marie Preston is a cancer patient and girlfriend of Bart
	Dr. Foy	Elizabeth Foy is a visiting psychiatrist to the hospital who is doing corporate espionage for an unseen individual
	Laura	Laura McDermott is visitor to Mik and a past romantic figure in his life
	Charlotte	Charlotte Beaumont is an ED doctor working on the suicide patient's case
	Zoe	Zoe Gallagher is an ED doctor. She only appears in a conversation with Jack early in the episode
	Paramedic	A paramedic (credited as Bree Matthews) who brings the suicide patient into the hospital at the beginning of the episode
Locations		

	Hospital (ER)	This is the general ED (inside and outside) not specific to any room
	Hospital (general)	This is the general hospital area (inside and outside) not specific to any department
	Hospital (Fibro patient room)	This is the room in the hospital where Tom Grieve is cared for
	Hospital (Kidney patient room)	This is the room where Mik is recovering from surgery
	Hospital (Suicide patient room)	This is the room where Jennifer Constable receives care
	Residence (cancer patient room)	This is the apartment/bedroom where Ann-Marie receives care
	Residence (roommates apt)	This is where Jack, Erica, and Dan live
General concepts		
	Morphine	Discussion or presence of the drug morphine - a pain killer used often in the hospital
	Physical pain	Discussion or symptoms of physical pain including writhing or wincing
	Addiction	Discussion or representation of dependence on drugs or alcohol
	Antidepressants	Discussion or presence of antidepressants, generic or specific
	Cancer	Discussion or symptoms of cancer
	Emergency	When the situation includes fast paced action from the hospital staff and medical equipment making sounds indicating something is wrong
	Music player	An ipod like MP3 player that features in the plot
	Romantic relationship	Discussion of or physical evidence of a romantic connection between two characters
	Family	General family discussion not specifically naming characters listed above
	English lit exam	Kara's exam that she is scheduled to take in the afternoon
	Caretaking	Discussion or visual depiction of one person taking care of another outside of the hospital setting (e.g. Bart and Ann-Marie or Kara with her father)
	Suicide	Reference or allusion to attempts or success in taking one's own life
	Radiotherapy	Discussion of treatment for cancer that includes radiation therapy
	Death/loss	References to someone passing away and its impact
	Kidney transplant	References to Mik's kidney donation surgery and the following transplant
	Fear	References to being afraid
	Crying	A person in tears either visually or inferred by their voice
	Physical attack	Violence against another person
	Raised voice	A voice above normal levels of speech

	Asking/telling someone to leave	Requests or demands for people to leave the location (e.g "Get away from me!"
	Confession	Someone revealing information previously unknown to another character
	Comforting touch	Physical contact done in a manner to comfort the receiver (e.g. Holding a patient's hand)
	Drinking	Presence of alcohol in a scene
	Third wheel	Reference or allusion to being a third member when the other two are a couple (i.e. Jack in Dan & Erica's relationship)
	Overdose	Reference to taking too many antidepressants (separate from suicide discussion)
	Coercion	Making someone do something against their will
	Refusal	A person stating that they will not engage in a behavior
	GP	General practitioner. Used to refer to Jennifer Constable's family doctor
Temporal info		
	Morning	References to or visual representation of the early hours of the day
	Afternoon	References to or visual representation of the later hours of the day
	Evening	References to or visual representation of darkness - end of day
	Past	References to things that happened before the episode took place

Table B.2. Intelligence Concept summary list

Concept Group	Concept	Description
Characters		
	Jimmy	Jimmy Reardon is the boss of the Reardon crime syndicate. He is a principal character in the show.
	Mary	Mary Spalding is the soon-to-be new head of the Organized Crime Unit (OCU). She is principle law enforcement character on the show
	Ted	Ted Altman is Mary's colleague and rival at the OCU and is actively working to undermine her authority and work.
	Ronnie	Ronnie Delmonico is Jimmy's business partner and "right hand man". He is the proprieter of the Chick a Dee strip club where much of the business dealings go down
	Francine	Francine Reardon is Jimmy's ex-wife and mother of his daughter. They share custody.
	Mike	Mike Reardon is Jimmy's brother who was recently released from prison and is working to reestablish himself in the family business
	Stella	Stella Reardon is Jimmy's daughter of whom he has partially custody.

	Colin	Colin is Jimmy's contact for drug trade on the island. He grows marijuana and collects money from other dealers to pay Jimmy.
	Bill	Bill Sommers is a former associate of Jimmy's who turned informant for the OCU before regretting his decision and taking a deal with Jimmy to get out of the country
	Roger Deakins	Roger is the current head of the OCU about to be replaced by Mary. He is working with Ted to undermine her authority.
	Adam	Adam Spalding is Mary's estranged husband who had been hospitalized for what appears to be a mental disorder.
	Harvey	Harvey Guilford is a member of Jimmy's syndicate and friend of Bill's. He is the driver in this episode.
	Lee	Lee Ching works in the "wire room" at OCU and is a mole working for the Red Eagles
	Sweet	Sweet is a dancer at Chick a Dee and Ronnie's girlfriend
	Maxine	Maxine Reardon is Jimmy's sister and the bookkeeper for Reardon's business front, Reardon Shipping.
	Sheila	Sheila Bloom is Mary's assistant at OCU
	Arthur	Arthur Penhall does not have a clear role at OCU but appears to be Mary's supervisor of sorts
Locations		
	The Island	An island off of the coast of Vancouver (maybe Vancouver Island) where Jimmy's business extends. He travels to the island by seaplane
	City (Vancouver)	The urban location shown in establishing shots. It is where OCU headquarters are located.
	OCU headquarters	The office where Mary, Ted, and their colleagues work.
	Bill's apartment	A residential location at the beginning of the episode where Bill and Harvey pack and escape before the police pick them up
	Mexico (Vera Cruz)	Bill's destination to escape subpoena and site of his murder
	Docks (Reardon shipping)	Code for any area that represents the docks: where the seaplane lands upon its return from the island, and where Maxine works
	Strip club	Chick a Dee is a strip club run by Ronnie where Jimmy spends time and makes deals
	Restaurant	An unnamed restaurant where Roger Deakins does business with Mary and Ted
	Ottawa	The capital of Canada and location of the Canadian government who oversee the operations of the OCU. Named only.
	Hotel Suite	A suite that Mary books after escaping from her ex husband in her home
	Mary's apartment	Mary's home where she only briefly visits near the beginning of the episode.
	Francine's house	Residence of Francine and Stella
	Car trunk	Trunk of Harvey's car where Bill hides

	Hospital (psychiatric)	Location from which Adam "walks away". Mentioned only in a message
General concepts		
	Seaplane	Jimmy's mode of transportation to and from the island
	Cellphone	Any cellphone used by any character in the show
	Cash	Any reference to cash - principally referring to drug money to be laundered
	Bikers	A gang of individuals competing with Jimmy on the island
	Wife	Refers to Colin's wife
	Cancer	Colin's wife's condition
	Quit business	Any reference to leaving a job, particularly working with Jimmy
	Informant	Someone working with the OCU to expose crime syndicates in the area
	Murder	References to killing someone intentionally
	Police	Any unnamed law enforcement with or without ties to the OCU
	Reference to "war" with bikers	Direct reference to this concept
	Taking a job/job general	Positions not directly related to Jimmy's drug business. E.g. head of OCU or bartending at the Chick a Dee
	Recorder/wire	A hidden device for surreptitiously recording conversations
	Spying	Reference to non-informant based observation without consent (e.g. Lee or the police at Francine's house)
	Drugs (general/heroin)	Reference to drugs or drug trafficking: marijuana, heroin, etc.
	Intelligence service	General reference to Canadian intelligence. Excludes OCU
	Family	Unspecific reference to family
	Drinks (wine/alcohol)	Reference or presence of alcoholic beverages in a scene
	Handler	Someone who is the lead contact for an informant
	Inside information	Information on crime syndicates provided by an informant
	Invoices	References to billable services paid by Reardon shipping
	Audit	Discussions of service receipts for Reardon shipping
	Bank machines	ATM machines used to launder money
	Sexual harassment	References to or visual examples of inappropriate sexual touching or behavior
	China	References to "the Chinese" or "China" in vague terms or direct references to the Red Eagles
	Money laundering	References to the act of taking Reardon's (or vague criminal orgs') illicit money and making it appear legitimate
	Witness protection	References to protecting informants from criminal backlash
	Custody/exchange	Specific to Jimmy and Francine's agreed shared custody agreement and how it manifests in the plot
	Bad news	Specific to the term "bad news" used - maybe not a useful code
	Betrayal	References to an individual or individuals turning on an ally - separate from informant or spying behavior

	Profanity	Cursing words not usually heard on American television (goddamn, shit, fuck)
	Crying	A person in tears either visually or inferred by their voice
	Screaming	Elevated voice to the point of yelling.
	Raised voice	Increase in voice volume but not quite yelling
	"I love you"	must be explicitly stated
	Sorry	A clear apology
	Physical aggression	Violence against a person or object (does not include murder)
Temporal Info		
	Daytime	Explicit full light daytime hours clearly portrayed on screen
	Evening	Low light, sunsetting hours clearly portrayed on screen
	Night	No light, nighttime hours clearly portrayed on screen

Appendix C

Comprehension Questions and Answers – Scoring

All Saints: (Season 11, episode 5 – "Caught in a Trap")

1) Why were the doctors trying to reach the overdose patient's general practitioner (GP) and pharmacist? (3:30)
    a. They wanted to know the background of her antidepressants prescription, specifically why it was prescribed (4)
        i. Response that only addresses medical background (3)
        ii. Questions about side effects of medication (2)
        iii. Just "what medication she was on" (1)
        iv. Unrelated/fully incorrect (0)

2) Why was the girl with cancer refusing treatment? (10:38)
    a. She wanted to die with dignity, unlike her mother who had undergone radiotherapy and died in pain and confusion (4)
        i. Vaguer answer that addresses relationship between treatment and family history (3)
        ii. Death with dignity but no mention of family (2)
        iii. Very vague answer that mentions fear of treatment (1)
        iv. Unrelated/fully incorrect (0)

3) Why did the doctor treating the fibromyalgia (pain) patient want to talk with his daughter in private originally? (13:40)
    a. The doctor suspected that the patient had become addicted to the morphine and wanted to see if his daughter had seen signs of this (4)
        i. Just mentions dependency on drug (3)
        ii. Discussion of drug dosage but nothing on dependency (2)
        iii. Discussion of morphine or fibromyalgia in general but nothing on dosage or dependency (1)
        iv. Unrelated/fully incorrect (0)

4) Why was Gabrielle (young blonde nurse) trying to get Steve (Dr. Taylor) off of the overdose patient's case? (19:00)
    a. Gabby and Steve had a romantic history so she was aware of his brother's suicide and was concerned that the case was too personal (4)
        i. Mentions concern for him being too close because of brother's suicide but nothing on relationship (3)
        ii. Mentions concern on his attacking patient but nothing on relationship or suicide (2)
        iii. Mentions relationship only (1)
        iv. Unrelated/fully incorrect (0)

5) Why does Bart want Anne-Marie (cancer patient) to start radiation therapy? (24:53)
    a. Bart wants Anne-Marie to live because he is in love with her and if she doesn't fight for herself, he will fight for her (4)
        i. Mentions wanting her to survive, fight the disease, but nothing on the relationship (3)

ii. Mentions wanting her to “get better”, but not her potential death or relationship (2)
iii. Only “he loves her” (1)
iv. Unrelated/fully incorrect (0)

6) How does Jenny (the overdose) being pregnant change her situation? (30:30)
    a. Jenny has both a reason to live and a connection to her late husband so she no longer wants to commit suicide (4)
        i. Reason to live, mention of dead husband but no connection (3)
        ii. Reason to live (2)
        iii. Change of heart/vague statement of being happier (1)
        iv. Unrelated/fully incorrect (0)

7) Why was the fibromyalgia patient’s daughter abusing morphine? (35:28)
    a. Kara was using morphine to cope with the stress of her father’s medical needs on top of the pressure of trying to earn a college degree (4)
        i. Only mention of father, no school (3)
        ii. Mention of stress in general, but no specifics (2)
        iii. Mention of school stress only (1)
        iv. Unrelated/fully incorrect (0)

8) Why was it a big deal that Mike finally took the morphine for pain after his kidney surgery? (40:20)
    a. The dialogue suggested that Mike was a drug addict of some sort in the past (4)
        i. Mention of him switching from basic pain killers but not that he was an addict (3)
        ii. Mention of guilt related to operation (2)
        iii. Mention of pain/being tough (1)
        iv. Unrelated/fully incorrect (0)

9) Why does the couple on the couch let Jack sit between them when he arrives? (42:35)
    a. The three of them live together in the house as a couple and him as a third wheel (or related concept) so they made an effort to include him comfortably.
        i. Goal of inclusion, no mention of third wheel or related concept (3)
        ii. Goal of making him comfortable, but no inclusion or third wheel (2)
        iii. Vague statements of friendship (1)
        iv. Unrelated/fully incorrect (0)

Intelligence: (Season 1, episode 1 – “Where Good Men Die like Dogs”)

1) Why were the dealers running short on profits at the beginning of the episode? (1:45)
    a. They were dealing with competition from bikers, who have been spreading their influence on the island and intimidating people (4)
        i. Mention of bikers but no details (3)
        ii. Mention of competition but nothing on bikers (2)
        iii. Mention of drugs but nothing further (1)
        iv. Unrelated/fully incorrect (0)

2) Why does Jimmy’s ex-wife get angry with him over the cell phone? (10:35)
    a. Jimmy bought his daughter the phone without her permission and she sees it as suggesting that he is keeping an eye on her parenting (4)
        i. All details on spying but nothing on the secret phone (3)

ii. Details on secret phone but nothing else (2)
iii. Just mentions her not wanting him to have contact with their daughter (1)
iv. Unrelated/fully incorrect (0)

3) Why is Mary (the policewoman) afraid of Adam, the man who was in her house when she came home? (16:55)
    a. He is her estranged husband who had left a mental institution and is clearly aggressive (4)
        i. Mention of relationship, aggression, but not hospital (3)
        ii. Mention of relationship, hospital, but not aggression (2)
        iii. Only one of three: hospital, relationship, or aggression (1)
        iv. Unrelated/fully incorrect (0)

4) Why is the red-haired woman at Jimmy's shipping company complaining that they're "sitting on too much cash"? (21:15)
    a. She is trying to get invoices from Jimmy's associates to help her launder money from his drug business before they're audited (4)
        i. Mention of two of three: auditing, money laundering, invoices (3)
        ii. Mention of invoices OR auditing only (2)
        iii. Vague mention of moving cash around (1)
        iv. Unrelated/fully incorrect (0)

5) Why does Mary want to meet with the money laundering guy instead of arresting him? (25:45)
    a. She wants to take advantage of all of his connections and get him to provide information on his clients, plus it took them so long to research him (4)
        i. Mention of getting information about higher ups/clients but not length of time (3)
        ii. Vague mention of information but nothing else (2)
        iii. Related info: time it took to find him etc. (1)
        iv. Unrelated/fully incorrect (0)

6) Why were Jimmy and his ex-wife fighting at her house? (26:30)
    a. He was supposed to pick Stella up from school for his custody exchange and she wasn't there. Now he suspects that Francine is hiding Stella from him. (4)
        i. Mention of the custody/exchange and some other detail (3)
        ii. Mention of the custody/exchange but nothing else (2)
        iii. Mention of hiding daughter or argument but not custody (1)
        iv. Unrelated/fully incorrect (0)

7) Why is the information Jimmy gave Mary about one of her department members important? (35:45)
    a. He reveals that they have a mole in their department who is spying for the Red Eagles/China, which explains why they've made no progress on them for years (4)
        i. Mention of Lee being a mole for a crime organization but vague otherwise (3)
        ii. Vague mention of spying – nothing specific about Lee (2)
        iii. Mention of tit-for-tat information exchange between Jimmy and Mary, nothing specific about Lee (1)

iv. Unrelated/fully incorrect (0)

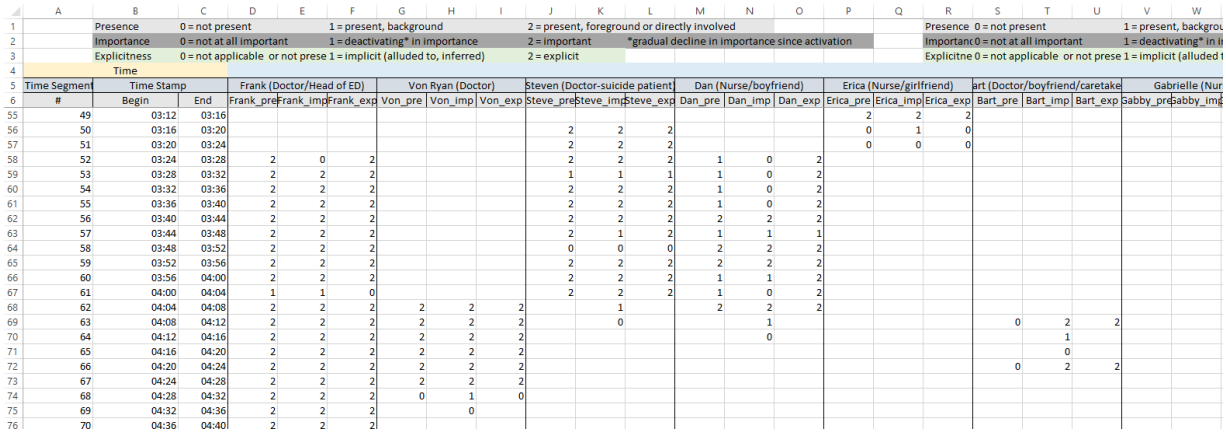
8) Who does Jimmy think killed the informant who went to Mexico? (39:00)
    a. His brother, Mike (4)
        i. Vague reference to Mike but no name or relationship (2)
        ii. Incorrect memory of Mike's name (1)
        iii. Anyone else (0)

9) Why does Jimmy think that Colin was shot in his driveway near the end of the episode? (41:58)
    a. The bikers eliminated him because he was the main connection to their competition (4)
        i. Reference to bikers and potentially a war (3)
        ii. Reference to bikers and nothing else (2)
        iii. Reference to drugs but otherwise vague (1)
        iv. Unrelated/fully incorrect (0)

Appendix D

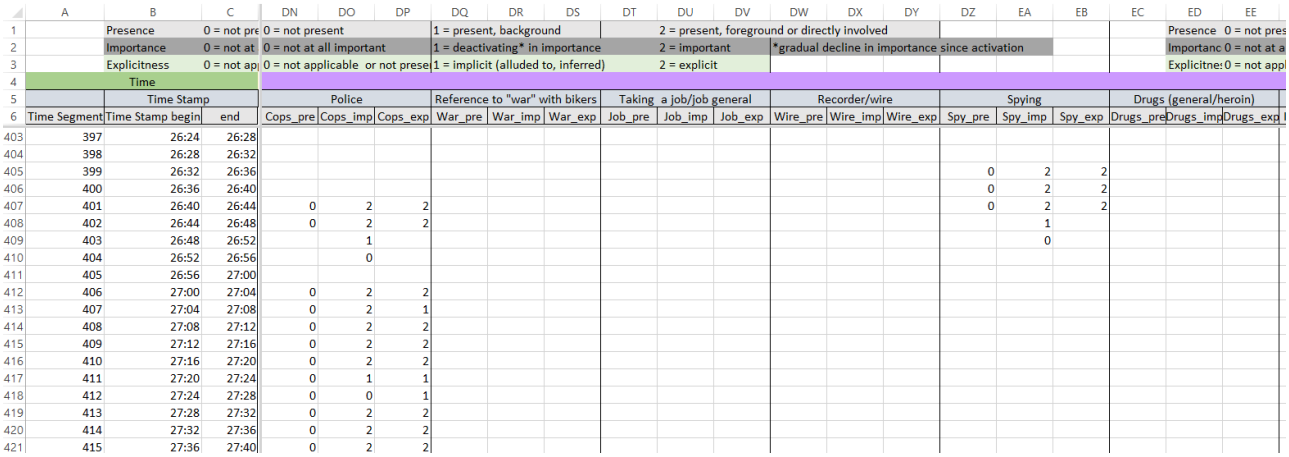
Sample Codesheets

Table D.1. All Saints Landscape code



		Presence	0 = not present			1 = present, background			2 = present, foreground or directly involved								Presence 0 = not present					1 = present, backgrou						
		Importance	0 = not at all important			1 = deactivating* in importance			2 = important			*gradual decline in importance since activation					Importanc 0 = not at all important					1 = deactivating* in i						
		Explicitness	0 = not applicable or not prese			1 = implicit (alluded to, inferred)			2 = explicit								Explicitne 0 = not applicable or not prese					1 = implicit (alluded t						
		Time																											
	Time Segment	Time Stamp		Frank (Doctor/Head of ED)			Von Ryan (Doctor)			Steven (Doctor-suicide patient)			Dan (Nurse/boyfriend)			Erica (Nurse/girlfriend)			art (Doctor/boyfriend/caretake			Gabrielle (Nur						
	#	Begin	End	Frank_pre	Frank_imp	Frank_exp	Von_pre	Von_imp	Von_exp	Steve_pre	Steve_imp	Steve_exp	Dan_pre	Dan_imp	Dan_exp	Erica_pre	Erica_imp	Erica_exp	Bart_pre	Bart_imp	Bart_exp	Gabby_pre	Gabby_imp						
55	49	03:12	03:16													2	2	2											
56	50	03:16	03:20							2	2	2				0	1	0											
57	51	03:20	03:24							2	2	2				0	0	0											
58	52	03:24	03:28	2	0	2				2	2	2	1	0	2														
59	53	03:28	03:32	2	2	2				1	1	1	1	0	2														
60	54	03:32	03:36	2	2	2				2	2	2	1	0	2														
61	55	03:36	03:40	2	2	2				2	2	2	1	0	2														
62	56	03:40	03:44	2	2	2				2	2	2	2	2	2														
63	57	03:44	03:48	2	2	2				2	1	2	1	1	1														
64	58	03:48	03:52	2	2	2				0	0	0	2	2	2														
65	59	03:52	03:56	2	2	2				2	2	2	2	2	2														
66	60	03:56	04:00	2	2	2				2	2	2	1	1	2														
67	61	04:00	04:04	1	1	0				2	2	2	1	0	2														
68	62	04:04	04:08	2	2	2	2	2	2		1		2	2	2														
69	63	04:08	04:12	2	2	2	2	2	2		0			1					0	2	2								
70	64	04:12	04:16	2	2	2	2	2	2					0						1									
71	65	04:16	04:20	2	2	2	2	2	2											0									
72	66	04:20	04:24	2	2	2	2	2	2										0	2	2								
73	67	04:24	04:28	2	2	2	2	2	2																				
74	68	04:28	04:32	2	2	2	0	1	0																				
75	69	04:32	04:36	2	2	2		0																					
76	70	04:36	04:40	2	2	2																							

Table D.2. Intelligence Landscape code



		Presence	0 = not pres	0 = not present			1 = present, background			2 = present, foreground or directly involved														Presence 0 = not pres					
		Importance	0 = not at	0 = not at all important			1 = deactivating* in importance			2 = important			*gradual decline in importance since activation										Importanc 0 = not at a					
		Explicitness	0 = not ap	0 = not applicable or not prese			1 = implicit (alluded to, inferred)			2 = explicit														Explicitne 0 = not appl					
		Time																											
		Time Stamp		Police			Reference to "war" with bikers			Taking a job/job general			Recorder/wire			Spying			Drugs (general/heroin)									
	Time Segment	Time Stamp begin	end	Cops_pre	Cops_imp	Cops_exp	War_pre	War_imp	War_exp	Job_pre	Job_imp	Job_exp	Wire_pre	Wire_imp	Wire_exp	Spy_pre	Spy_imp	Spy_exp	Drugs_pre	Drugs_imp	Drugs_exp							
403	397	26:24	26:28																										
404	398	26:28	26:32																										
405	399	26:32	26:36													0	2	2											
406	400	26:36	26:40													0	2	2											
407	401	26:40	26:44	0	2	2										0	2	2											
408	402	26:44	26:48	0	2	2											1												
409	403	26:48	26:52		1												0												
410	404	26:52	26:56		0																								
411	405	26:56	27:00																										
412	406	27:00	27:04	0	2	2																							
413	407	27:04	27:08	0	2	1																							
414	408	27:08	27:12	0	2	2																							
415	409	27:12	27:16	0	2	2																							
416	410	27:16	27:20	0	2	2																							
417	411	27:20	27:24	0	1	1																							
418	412	27:24	27:28	0	0	1																							
419	413	27:28	27:32	0	2	2																							
420	414	27:32	27:36	0	2	2																							
421	415	27:36	27:40	0	2	2																							

Table D.3. Comprehension sample code (*All Saints* Question 4)

Time Stamp		Frank (Doctor/Head of ED)			Steven (Doctor-suicide patient)			Gabrielle (Nurse)			Romantic relationship			Family			Suicide		
17:52	17:56				2	2	2												
17:56	18:00				2	2	2												
18:00	18:04				2	2	2												
18:04	18:08				2	2	2							0	2	2			
18:08	18:12				2	2	2								1	0	0	2	1
18:12	18:16				2	2	2											2	1
18:16	18:20				2	2	2	1	0	2				0	2	2		2	1
18:20	18:24				2	2	2	2	2	2					1	0		1	0
18:24	18:28				2	2	2	2	2	2								0	
18:28	18:32				2	2	2	2	2	2								2	1
18:32	18:36				2	2	2	2	2	2								2	1
18:36	18:40				2	2	2	2	2	2								1	
18:40	18:44				2	2	2	2	2	2								0	
18:44	18:48					1		2	2	2									
18:48	18:52					0		2	2	2									
18:52	18:56	2	2	2				2	2	2									
18:56	19:00	2	2	2				2	2	2									
19:00	19:04	2	2	2				2	2	2									
19:04	19:08	2	2	2				2	2	2									