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An Experiment on Cognitive Priming and the Book Problem in Narrative Media

Matthew T. Jones

County College of Morris
{mjones@ccm.edu}

Abstract

This article experimentally investigates content, form, and user factors in the experience of telepresence in response to narrative media. Specifically, cognitive priming and the book problem are operationalized through a comparison of participant responses to film adaptations and their comic art source material. Findings include (1) further support for the role of cognitive priming in telepresence, (2) further support for the “thematic inertia” hypothesis, and a surprising result indicating that the relatively low-immersion medium of comic art produces higher telepresence scores than a film presentation with similar content. Additional findings related to enjoyment are also discussed.

Keywords--- Cognitive Priming, The Book Problem, Enjoyment

1. Introduction

This report describes an experiment conducted to determine the effects of cognitive priming and the book problem (low-immersion media) on the experience of telepresence as it occurs in response to film adaptations of comic art and the source material upon which they are based.

The book problem is a controversial issue predicated on the idea that telepresence can be experienced in response to abstract, low-immersion media such as novels. However, because of its concern with immersion, it is situated within the dominant focus on media *form factors* prevalent not only in telepresence research, but also in the field of media studies since the work of McLuhan [1]. Conversely, cognitive priming is a topic that presupposes the importance of *content factors* (e.g. content familiarity). Additional findings described below also suggest the importance of *user factors* (e.g. preexisting interest, enjoyment) to the experience of telepresence.

Recently, Nunez and Blake [2] present evidence that content knowledge, thematic inertia, and cognitive priming effect presence experiences in users of flight simulator games. Their findings suggest that specific content knowledge – “knowledge of the actual content being simulated” (p. 42) – reduces presence by establishing more specific expectations in the user which lead to greater likelihood for noticing inconsistencies in the simulation. Conversely, thematic inertia – “the tendency to engage in thematically related activities” (p. 41) – was a powerful predictor of presence, indicating that preexisting interest in content has a positive influence on

presence. Finally, cognitive priming – “cognitively preparing users for a VE [virtual environment] experience by presenting them with materials thematically related to the VE’s content ... prior to their experience” [3] (p. 227) – was found to have almost no effect on presence. However, closer examination reveals that this likely resulted from a covariation between priming and thematic inertia which caused a drowning out of the priming effect in the initially performed multiple regression.

1.1. Cognitive Priming

Priming has an extensive history in cognitive psychology [e.g. 4, 5] both in and out of mediated contexts. A suitable example that describes the general effect that cognitive priming has on cognition is the rereading of a piece of literature. It is often the case that, upon the second reading of a text, the message is clearer and easier to decipher [6, 7, 8, 9]. The reason is that the appropriate schemata have already been activated. Citing Nell [8] (p. 77), Ryan [9] writes, “Immersion is hampered by difficult materials because ‘consciousness is a processing bottleneck, and it is the already comprehended messages...that fully engage the receiver’s conscious attention.’ The most immersive texts are therefore often the most familiar ones...” (p. 96). Nunez and Blake [10] similarly note the detrimental effect that frustrating interfaces have on our ability to experience telepresence. They attribute this to a reduction of cognitive resources available to establish the “cognitive dominance” of the virtual environment over the physical one.

Within the presence literature there are at least two additional studies that examine the phenomenon of cognitive priming as a determinant of the presence experience. The first of these [11] begins with two hypotheses: (1) “If a user has active schemata *which are related* to the virtual environment which the user is experiencing, then the user will experience more presence” (p. 102) and (2) “If the virtual environment is rendered on a higher fidelity display system, the user will experience more presence” (p. 102). To test these assertions, the experimenters introduced participants to high and low quality versions of two environments, a medieval monastery and a hospital. In addition, before interacting with these environments, participants were primed with either relevant or irrelevant materials (printed booklets with text and pictures).

For example, in “relevant” conditions, participants who were to experience the monastery were primed with printed booklets that contained content on medieval monasteries. Although no main effect was found for priming, results indicated an interaction between priming and stimulus quality, which revealed that the priming manipulation facilitated the stimulus quality effect. Thus, at the very least, priming should be considered as a mediating variable in determining the experience of presence.

A second experiment has been conducted to determine the effects of content preference on the cognitive priming manipulation. Ladeira, Nunez and Blake [3] asked participants to interact with a virtual environment (VE) in which San people, “a nomadic hunter-gatherer group indigenous to southern Africa,” (p. 227) sit around a fire and tell a story. In one condition, participants experienced the San VE directly without any introduction. In another condition, participants were first exposed to an introductory VE in which a rap artist in a modern “hip-hop” environment performs a rap/monolog about the San people. In the evaluative stage of the experiment, in addition to measuring the level of telepresence experienced in the San environment, participants were asked to rate their level of interest in “hip-hop” culture. Results indicated a significant difference in telepresence scores between participants who chose “hip-hop” as their favorite music genre (higher scores) and those who did not (lower scores). Thematic priming turned out to be a factor in constituting telepresence only if participants had a pre-established preference for the theme present in the priming condition. These findings seem to indicate that, if user content preference is taken into account, priming can serve as a determinant of the telepresence experience rather than just a mediating variable.

1.2. Thematic Vs. Structural Priming

Both of these experiments operationalize the priming stimulus in terms of content, meaning that the priming manipulation shares in common the same subject as the virtual environment. Ladeira, Nunez, and Blake [3] make use of an additional theme in the priming manipulation, but in neither case do priming manipulations have a step-by-step structural resemblance to the virtual environment that the participants are being primed for. In other words, there is no direct structural correlation between the series of events depicted in the priming manipulation and the series of events depicted in the virtual environment. In short, priming is accomplished *thematically* and not *structurally*. Would a closer structural relationship between priming manipulation and virtual environment further establish the effect of cognitive priming on experience of telepresence?

Film adaptations of comic art present a context that is relevant to the distinction between *thematic priming* and *structural priming*. If a film adaptation based upon comic art source material is thought of as the virtual environment and the source material itself is used as a priming manipulation, the

question of how previous experience of source material affects processing of an adaptation can be addressed. Various theorists of literary adaptation have come close to suggesting the existence of such a priming effect between source text and adaptation [e.g. 12, 13, 14]. Boyum [12] elaborates on this idea particularly, pointing out that “adaptations excite an extreme degree of participation from those familiar with the source” (p. 53).

Furthermore, because some adaptations share only a theme in common with their source material and others have a more direct structural correspondence, a comparison can be made, in terms of telepresence experience, between adaptations that are primed thematically and those that are primed structurally.

One reason to believe that closer structural correspondence between priming manipulation and virtual environment might yield higher levels of telepresence comes from Glenberg’s [15] notion of “mesh.” Posing the question of what memory is for, Glenberg asserts: “[i]t’s primary function is to mesh the embodied conceptualizations of projectable properties of the environment...with embodied experiences that provide nonprojectable properties” (p. 4). What this means, essentially, is that when we interact with an environment (mediated or nonmediated) our actions and expectations are guided by two things: (1) conceptualizations of what we experience with our senses (projectable properties) and (2) our previous experience, knowledge, and memory of the environment (nonprojectable properties).

Further emphasizing this point, Glenberg [15] writes, “[A]n organism is better prepared to act when changes in the situation easily mesh with the conceptualization than when changes do not easily mesh (i.e. we are surprised). This notion of preparedness underlies priming phenomena” (p. 8). Considering this statement in terms of film adaptations and their comic art source material, it can be said that adaptations which mesh with their source material structurally and thematically (or, to a lesser extent, only thematically) provide a suitable environment to meet expectations and provoke a sense of telepresence. If the film adaptation is conceived of as the current environment that is providing projectable properties, and the source material provides the set of memories and expectations that make up nonprojectable properties, then it is likely that viewing a film adaptation after being primed by the comic art source material will provide an experience conducive to telepresence. Again, it is logical to assume that this would be the case in either a structural or thematic adaptation, but more so in a structural adaptation.

Nunez and Blake [2] similarly point out that virtual environments, which effectively match a user’s expectations, provide increased experiences of telepresence. However, they also provide evidence that the more specific a user’s expectations are concerning the virtual environment, the more difficult it will be to experience a high degree of telepresence. In a survey of flight simulation hobbyists, increased specific content knowledge served as a predictor of decreased telepresence experiences in flight simulators. This result is explained as follows:

The more specific content knowledge the user has, the more detailed and specific the expectation will be. Given that the simulation is giving a set degree of fidelity, users with more specific knowledge should notice more mismatches between their expectations and the display, leading to a reduction in presence. (p. 46)

If this evidence and explanation is accurate, structural priming should result in a reduced (rather than increased) sense of telepresence because more specific expectations are provided in the priming manipulation.

Despite this evidence, though, differences do not necessarily add up to contradictions. If an adaptation is distinct from its source in ways that do not contradict expectations, but rather expand upon them through incarnation in a more immersive medium, an increased telepresence experience should be expected. To illustrate this point, consider the consonant elaborations that the film *Sin City* [16] made upon the original series of comics. While characters, settings, and events remain the same in the film, modifications such as audible sound and dialogue, realistic movement, and the addition of music enriched but did not transgress the original text.

On the other hand, the elaboration of details provided by the reader may contradict what is offered in the film adaptation, thus decreasing telepresence in the way described by Nunez and Blake [2]. Alternatively, however, it could be argued that the more structurally faithful and consistent an adaptation is (by precisely following the anchoring points detailed in the source), the more both viewer and film are guided by the inherent trajectory of the text. In other words, what comes between point A and point B is severely constrained by the characteristics of point A and B.

1.3. The Book Problem

The book problem is concerned with the question of whether less immersive media (such as comic art) are capable of providing a telepresence experience. Biocca [17] articulates the book problem in the following way:

If sensorimotor immersion is the key variable that causes presence, then how do we explain the high levels of presence people report when reading books? Books are very low fidelity, non-iconic media and are extremely low on all sensorimotor variables identified as causing presence: extent of sensory data, control of sensors, and ability to modify the environment. (p. 4)

A number of other theorists and researchers also recognize this incongruity [e.g. 18, 19, 20, 21, 22], and Biocca [23] has

observed that “[m]ost [theorists] see the illusion of presence as a product of all media” (Why a Theory of Presence Has Become Necessary, ¶ 1). Even outside the domain of presence research, Phillips [24] has argued that “[l]ow resolution media does not mean a low-resolution experience” (p. 82).

Despite the capacity for low-immersion media (such as comic art) to produce a sense of telepresence, several studies have supported the contention that less abstract and more immersive media environments (e.g. film, virtual reality) produce a stronger sense of telepresence than abstract, nonimmersive media (e.g. comic books) [18, 25, 26].

2. Hypotheses

Previous research on cognitive priming [11, 3] has initiated the priming effect using content; however, there has been no inquiry or comparison concerning the correspondence that the priming materials have with the environment. Here a distinction is made between *thematic* and *structural* priming and it is suggested, based upon Glenberg’s [15] concept of *mesh*, that priming materials which bear a structural resemblance to the mediated environment will illicit a stronger sense of telepresence than priming materials which are related thematically. Therefore, comprehending the film adaptation as the environment and the comic art source material as the prime, an adaptation which is structurally closer to the source should produce a stronger sense of telepresence in the viewer. In light of this assertion, the following hypotheses are put forth:

H1: *Viewers of film adaptations of comic art will experience higher levels of telepresence if they have prior experience reading the comic art source material than if they do not.*

H2: *Viewers of film adaptations of comic art will experience higher levels of telepresence if the film is adapted structurally from the comic art than if the film is adapted thematically.*

Predicated upon the findings of Ladiera et al. [3], in which a significant difference was found between telepresence scores of participants who had a preexisting interest in the theme of the priming stimulus (higher scores) and participants who did not (lower scores), I assert the following additional hypothesis:

H3: *Participants with a preexisting interest in the priming stimulus (comic art source material) will report higher telepresence scores in response to viewing the film adaptation than participants who have no preexisting interest.*

The fourth hypothesis recognizes the potential for a telepresence experience to take place in response to both media forms (comic art and film) and seeks to empirically test the issue at the heart of the book problem by comparing two forms of media while holding constant the content of those media (a feature unique to the study of adaptations). Because film requires less cognitive work, the following hypothesis is asserted:

H4: The medium of film will produce a stronger sense of telepresence than the medium of comics when content is held constant across media forms.

3. Method

3.1. Design and Procedure

A four-group posttest only between-subjects experimental design was employed to test the hypotheses presented above. Testing took place in a screening room located on a university campus with seating arrangements that resembled a typical movie theater. For conditions two through four, a twenty-four inch television set and DVD player was placed on a table in the front of the room. Once participants were informed of their rights, those willing to participate signed statements of informed consent before being subjected to one of the four conditions enumerated below:

1. Participants in condition one were exposed to the comic art (source) treatment and evaluated for telepresence experience using the Temple Presence Inventory (TPI) [27] and University College London (UCL) presence questionnaires [28].
2. Participants in condition two were exposed to the film (adaptation) treatment and evaluated for telepresence experience using the TPI and UCL questionnaires.
3. Participants in condition three were exposed to the comic art (source) treatment before being exposed to the corresponding film (adaptation) treatment and evaluated using the TPI and UCL questionnaires. In this condition, the film was adapted from the comic *thematically*.
4. Participants in condition four were exposed to the comic art (source) treatment before being exposed to the corresponding film (adaptation) treatment and evaluated using the TPI and UCL questionnaires. In this condition, the film was adapted from the comic *structurally*.

Once this procedure was completed, participants filled out one of two short personal experience questionnaires depending upon whether they had been exposed to comic art only or to film. These personal experience questionnaires served to assess their level of interest in and experience with the treatment material, as well as their level of interest in film and comics generally. This was deemed important based on the previously discussed findings of Ladiera et al. [3] with regard to content preference effects in cognitive priming.

Overall, experimental sessions ranged from thirty to forty-five minutes in length. The number of volunteers participating in any particular experimental session ranged from one to sixteen and the mean number of participants per group was five.

3.2. Participants

A total of 146 participants were recruited from a population of undergraduate students who were offered extra credit in their communication courses in exchange for their participation. Thirty-eight participants were randomly assigned to condition one, 57 to condition two, 25 to condition three, and 26 to condition four.

3.3. Instrumentation

To maximize validity and test reliability, two measures of telepresence were employed. First, the TPI (Temple Presence Inventory) scale developed by Lombard and Ditton [27] was used to evaluate the following dimensions of telepresence: (1) engagement, (2) spatial presence, (3) parasocial interaction, (4) social presence – passive interpersonal, (5) social presence – active interpersonal, and (6) social richness. The other dimensions of social realism and perceptual realism were deemed irrelevant to the present investigation and thus were not included. All together, there were thirty-four TPI items included. In addition, the three-item UCL (University College London) presence questionnaire developed by Slater, Steed, and Usoh [28] was used to measure the general concept of presence. Both of these measures were presented on a single thirty-seven-item questionnaire.

The TPI was chosen as the primary measure because of its inclusive approach to the concept and recognition of dimensions that apply to narrative media such as film and comic art. The UCL questionnaire was chosen because it is a short, overall measure of the presence concept that has been widely employed.

3.4. Apparatus

Comic art treatment material was presented to participants in booklet form on color photocopied sheets of paper that reproduce the exact proportions of the original work. The monitor used to present the film adaptations to participants in conditions two, three and four was a twenty-four inch Dynex television set attached to an Insignia DVD player. Because screen size has been demonstrated to be an important factor in telepresence experience [e.g. 29, 30, 31, 32], it was important to select a size that was large enough to evoke a measurable response, but not so large that the effects from comparisons with the priming conditions might be drowned out. A twenty-four inch screen was deemed appropriate because it occupies a middle ground between what has previously been operationalized as a “large screen” (46”) and “small screen” (12”) [31].

3.5. Treatment Materials

Treatment materials were composed of excerpts from six separate film adaptations and excerpts from the six corresponding sets of comic art source material which they

were adapted from. Three of these films were clear examples of thematic adaptations: *Superman* (Donner, 1978), *Catwoman* (Pitof, 2004), and *Art School Confidential* (Zwigoff, 2006). The other three were clear examples of structural adaptations: *Sin City* (Miller & Rodriguez, 2005), *A History of Violence* (Cronenberg, 2005), and *American Splendor* (Berman & Pulcini, 2003). Thematic adaptations share only a theme (e.g. character, conflict, location) in common with the source material, whereas structural adaptations have a direct correspondence of narrative events.

Film excerpts ranged from four to seven minutes in length, and comic art excerpts ranged from four pages to thirty pages in length. (Reading duration was timed to test and control for potential differences resulting from divergent page lengths.)

More detailed information for each clip is listed below:

1. *Superman* (comic art treatment: *Superman* #274, "Must There Be a Superman," Maggin, Swan & Anderson, 1972; film treatment: *Superman*, Donner, 1978, DVD chapter 20).
2. *Catwoman* (comic art treatment: *Catwoman Secret Files* #1, "The Many Lives of Selina Kyle," Brubaker, Oeming & Manley, 2002; film treatment: *Catwoman*, Pitof, 2004, DVD chapter 15).
3. *Art School Confidential* (comic art treatment: *Eightball* #7, "Art School Confidential," Daniel Clowes, 1991; film treatment: *Art School Confidential*, Zwigoff, 2006, DVD chapter 2).
4. *Sin City* (comic art treatment: *Sin City*, "That Yellow Bastard" #1 of 6, Frank Miller, 1996; film treatment: *Sin City*, Miller & Rodriguez, 2005, DVD chapter 3).
5. *A History of Violence* (comic art treatment: *A History of Violence* (pages 1-15), Wagner & Locke, 1997; film treatment: *A History of Violence*, Cronenberg, 2005, DVD chapter 5).
6. *American Splendor* (comic art treatment: *American Splendor* #2, "The Harvey Pekar Name Story," Pekar & Crumb, 1977; film treatment: *American Splendor*, Berman & Pulcini, 2003, DVD chapter 20).

4. Results

Data collected from 145 participants using personal experience measures, the Temple Presence Inventory [27], and the University College London presence questionnaire [28] were entered into a Microsoft Excel spreadsheet and cleaned before being imported to SPSS version 11.5 for statistical testing. All statistical tests were performed using additive indices of participant responses. One participant from the first condition was disqualified from the analysis as a result of insufficient personal experience information. The final data set included 36 participants in Condition 1 (comic art only), 57 in Condition 2 (film with no prime), 25 in Condition 3 (film with

thematic prime), and 26 in Condition 4 (film with structural prime). Note that the first two conditions have more participants because no distinction is made between thematic and structural priming and, therefore, must include both varieties. In addition, variations in number of participants across groups owes to the group administration of the experiment. Also, stimulus sampling was used across all conditions resulting in 17 participants exposed to *Superman*, 20 exposed to *Catwoman*, 30 exposed to *Art School Confidential*, 28 exposed to *Sin City*, 28 exposed to *A History of Violence*, and 21 exposed to *American Splendor*.

4.1. Temple Presence Inventory Cumulative Factor Analysis

An overall factor analysis was performed for all the items on the TPI grouped together as an overarching presence construct. A principle component analysis with no rotation forcing a single factor outcome produced an index of 31 items with a Cronbach's Alpha reliability score of 0.95. The three items removed from analysis due to loadings of less than 0.4 were: (1) "Did the experience seem more like looking at the events/people on a movie screen or more like looking at the events/people through a window?" (Spatial Presence), (2) "During the media experience how well were you able to observe the style of dress of the people you saw/heard?" (Social Presence – Passive Interpersonal), and (3) "How often did you make a sound out loud (e.g. laugh or speak) in response to someone you saw/heard in the media environment?" (Social Presence – Active Interpersonal).

4.2. University College London Questionnaire Confirmatory Factor Analysis

A confirmatory factor analysis was performed for the three-item UCL questionnaire, which intends to measure a general "presence" factor. Principle component extraction with no rotation revealed a single factor with an eigenvalue of 2.447 and the lowest factor loading was .888. A reliability score of .8870 was obtained using Cronbach's Alpha.

4.3. Omnibus Test

Because the experiment performed encompasses four conditions and makes use of treatment stimulus sampling, an overall 4 X 6 ANOVA was performed to seek out general trends in the data. The first variable was "condition" and it had four levels based on the type of treatment each group of participants was exposed to (1 = comic book only, 2 = film adaptation only, 3 = comic book prime followed by its thematic film adaptation, 4 = comic book prime followed by its structural film adaptation). The second variable was "treatment story" and had six levels based on the different comics and film adaptations used as treatments (1 = *Superman*, 2 = *Catwoman*, 3 = *Art School Confidential*, 4 = *Sin City*, 5 = *A History of Violence*, 6 = *American Splendor*). Because the goal for this

omnibus test was only to gain a rough overall perspective on the data, both dependent measures (TPI and UCL) were combined. To maintain the integrity of the TPI dimensions, separate reports of TPI and UCL measures along with a combined measure are used for subsequent tests, although it should be noted that these scales have extremely strong correlation ($r(142) = .788, p < .001$).

The overall test uncovered a significant main effect for treatment story ($F(5,126) = 3.123, p = .011$) and a significant interaction between condition and treatment story ($F(9,126) = 2.305, p = .02$), however no significant main effect for condition was found. A closer look at the interaction effect will provide some insight into the reason why condition produces no initial statistical significance.

The interaction reveals that the mean scores of 4 of the 6 treatment stories move in the direction predicted by the priming hypothesis (H1: *Viewers of film adaptations of comic art will experience higher levels of telepresence if they have prior experience reading the comic art source material than if they do not*). The mean scores of *Superman* and *Art School Confidential*, however, move in the opposite direction, indicating that participants reported higher levels of telepresence without priming (condition 2) than with priming (condition 3 or 4). In particular, differences between conditions for *Superman* were highly significant ($F(2,14) = 10.766, p = .001$) in the opposite direction. An LSD post-hoc test further revealed that levels of telepresence reported in Condition 2 (film with no prime) were significantly higher than both Condition 1 (comic art only) ($p = .007$) and Condition 3 (film with thematic prime) ($p < .001$). Such a finding may indicate a “negative priming” phenomenon in which low telepresence resulting from exposure to the priming material (the comic book) influences the experience of the film to also produce low telepresence responses. Placing this possibility aside for the time being, there are additional findings that may explain the counterintuitive responses elicited by *Superman*.

In order to control for the differences among treatment stories that may exist as a result of the level of popularity of a given comic book or film, a question on the personal experience questionnaire asked: “Have you ever been exposed to other media based on this comic title/series [or film] before?” A crosstabulation between each treatment story and previous exposure to other media revealed that *Superman* alone was exposed in some form to all participants. A chi-square test confirms that this imbalance between observed and expected cell counts is significant ($X^2(5, N = 141) = 46.9, p < .001$). A second crosstabulation comparing treatment stories based on previous experience reading the comic title/series revealed that *Superman* was the only story for which more participants had previous experience reading the comic than not (by a margin of 11 to 6). A chi-square test demonstrates that this difference is also significant ($X^2(5, N = 142) = 15.64, p = .008$). Finally, a third crosstabulation comparing treatment stories based on previous experience with other film adaptations revealed that *Superman* was the only story in which the majority of participants had also seen a different film adaptation previously

(by a margin of 11 to 1). The chi-square test demonstrates strong significance for this difference as well ($X^2(5, N = 106) = 35.62, p < .001$).

Given the disproportionate amount of familiarity and experience that participants reported with regard to *Superman*, there may be a “saturation effect” occurring which renders additional priming previous to exposure to the film adaptation useless or even detrimental to the experience of telepresence. Considering this from a cognitive perspective, easily accessible schemata will not benefit from further activation and may actually be desensitized through exposure to a repetitive stimulus.

A second omnibus test was conducted excluding *Superman* and this revealed a significant main effect for condition ($F(3,112) = 2.62, p = .05$). As a result of these exceptional issues with regard to *Superman*, the following hypothesis tests were conducted both including and excluding this treatment story.

4.4. Hypothesis Testing

Hypothesis 1: Viewers of film adaptations of comic art will experience higher levels of telepresence if they have prior experience reading the comic art source material than if they do not.

Using the combined TPI/UCL measure, a comparison of Condition 2 (film with no prime) with Condition 3 (film with thematic prime) revealed that thematic priming generates higher levels of telepresence than no priming ($F(1,33) = 4.70, p = .04$). Surprisingly, however, this was not the case for structural priming because scores generated in Condition 4 (film with structural prime) were not significantly different from scores generated in Condition 2 (film with no prime) ($F(1,53) = .75, p = 0.39$). Upon further examination of the interaction effect ($F(2,53) = 3.6, p = .03$) it becomes clear that this is the result of responses to the *American Splendor* treatment story which produced a reverse priming trend similar to *Superman*, although not statistically significant. Conversely, responses to *A History of Violence* yielded strong evidence for the structural priming effect with mean scores in the priming condition significantly higher than the control condition on the TPI ($t(18.91) = 3.43, p = .003$), the UCL ($t(17) = 2.72, p = .01$), and both measures combined ($t(19) = 3.5, p = .003$). Additionally, it should be noted that in the structural priming ANOVA, there was a main effect based on treatment story alone ($F(2,53) = 5, p = .01$) and a post-hoc test reveals a significant difference between *American Splendor* and *A History of Violence* ($p = .001$). The fact that *American Splendor* produced the lowest mean score (significantly lower than *A History of Violence*) may also be used as evidence pointing toward the “negative priming” effect referred to earlier in conjunction with *Superman*.

Examined separately, the TPI and UCL generally produce the same patterns of significance as the combined measure except that the UCL alone measures no thematic priming effect ($F(1,33) = 3.32, p = .08$). This discrepancy is evidence that the

three-item UCL is a less sensitive measure than the six dimensions of the TPI used in this study. Interestingly, even when examining only the 7-item “spatial presence” dimension of the TPI (the most closely related dimension to the UCL) significance is still found for thematic priming versus no priming ($F(1,33) = 4.46, p < .05$).

Finally, combining thematic and structural priming conditions and comparing them to the film-only control condition produces a significant main effect for priming when using the combined scale as the dependent measure ($F(1,86) = 4.39, p = .04$). When the scales are separated, the TPI yields significance ($F(1,86) = 4.24, p = .04$) while, once again, the UCL is not sensitive to this priming effect ($F(1,86) = 1.77, p = .186$). Despite this, the UCL does show a significant interaction ($F(4,86) = 2.51, p = .048$) in the direction of the priming hypothesis for *Catwoman* and *A History of Violence*.

All factors taken into consideration, these results present evidence consistent with the first hypothesis, and provide room for further theorizing with regard to the “saturation” and “negative priming” effects discussed earlier.

Hypothesis 2: Viewers of film adaptations of comic art will experience higher levels of telepresence if the film is adapted structurally from the comic art than if the film is adapted thematically.

Testing the results of thematic versus structural priming on the experience of telepresence yields a very subtle effect. It is one thing to compare the effects of priming versus non-priming on levels of telepresence experienced in response to a film adaptation, but something wholly different to compare two levels of priming since the latitude in variance for the effect to be expressed and yield statistical significance is vastly reduced. Despite this, an LSD post-hoc test based on the results of the TPI (excluding *Superman*) uncovered a nearly significant mean difference (13.5), using an additive index ranging from 34 to 187, between levels of telepresence resulting from the structural priming condition and levels of telepresence resulting from the non-priming control condition ($p = .06$) in the direction of the hypothesis. This degree of difference was not found for the thematic priming condition ($p = .18$). Thus, if there is a difference that approaches significance between the level of telepresence experienced as a result of structural priming versus non-priming, but clearly no significant difference between thematic priming and non-priming, one might tentatively conclude, in line with the hypothesis, that structural priming is more effective than thematic priming at cognitively preparing viewers to experience a telepresence response. Of course, this evidence is tenuous at best because a direct comparison of the difference between the structural and thematic priming conditions was not found to be significant ($p = .78$).

Complicating matters further, a separate LSD test (also excluding *Superman*) shows that the UCL measured the opposite effect: participants who were thematically primed report significantly higher levels of telepresence than those who were not primed ($p < .05$) whereas participants who were

structurally primed do not ($p = .73$). Insofar as the TPI is the more sensitive measure, an argument may still be maintained that there is marginal evidence that structural priming yields higher levels of telepresence, but this is very weak indeed. In fact, it is just as reasonable to conclude the opposite based on the results gathered from the UCL: thematic priming yields higher levels of telepresence than structural priming. This opposing conclusion would even find previous theoretical and empirical support based on Nunez and Blake’s [2] study of flight simulator hobbyists discussed earlier.

Hypothesis 3: Participants with a preexisting interest in the priming stimulus (comic art source material) will report higher telepresence scores in response to viewing the film adaptation than participants who have no preexisting interest.

Testing this hypothesis has implications for what Nunez and Blake [2] refer to as the effect of “thematic inertia” on telepresence. It is logical that individuals who have previously sought out the priming stimulus or related materials for their own personal enjoyment would stand a greater chance of experiencing telepresence in response to the treatment materials presented in this experiment than those who have not. This is suggestive of the role “user factors” play in telepresence experiences since preexisting interest is a characteristic of the individual user.

One way to test this is to examine participant responses to the following personal experience item: “Have you ever seen this particular film before?” and see if there is any significant difference in telepresence responses between those who have versus have not seen the film previously. A mean comparison between these two groups resulted in no significant difference for either the TPI ($t(36.04) = .603, p = 0.55$) or the UCL ($t(43.97) = 1.68, p = 0.1$). The null hypothesis also stands if *Superman* is filtered out of the analysis.

A second variable that gauges previous interest is whether or not the participant has read any of the issues from the comic title/series upon which the film adaptation was based. A mean comparison between these groups also resulted in no significant differences for either measure. But when *Superman* was excluded from analysis, the UCL results are significant in the direction predicted by the hypothesis ($t(30.26) = -2.08, p < .05$).

What this means is that, according to responses to the UCL, participants who had previously read issues of the comic title/series upon which the film adaptation was based reported significantly higher telepresence scores than those who had not. In addition, there is a relatively weak but significant positive correlation between number of issues read and scores on UCL ($r(92) = .21, p < .05$) These findings provide some support for the thematic inertia hypothesis, although it is curious as to why differences went undetected by the more thorough measurement of the spatial presence dimension of the TPI ($t(33.15) = 1.61, p = .12$) or the entire TPI as a single factor ($t(27.39) = .993, p = .33$).

A third variable that is indicative of previous interest is whether or not the participant has seen any other film

adaptations based on the comic title/series before. Not surprisingly, no effects were found because *Superman* was the only film adaptation that had numerous alternative adaptations.

The last personal experience item that attempts to determine previous interest is: "Have you ever been exposed to other media based on this film before?" No significant differences were found between groups of individuals who had versus had not been exposed to other media based on the film for either the TPI ($t(93.23) = .439, p = .662$) or the UCL ($t(89.61) = .460, p = .647$). The null hypothesis also stands if *Superman* is filtered out of the analysis.

An index of preexisting interest was also constructed based on a factor analysis of these four items. Although the last three grouped together as a single factor, each with loadings of 0.63 or higher, reliability assessment revealed a Chronbach's alpha of only 0.36. Therefore, the best evidence in favor of the hypothesis is reported above based on whether the participant has read any of the issues from the comic title/series upon which the film was based.

Overall, there is some marginal support here for the thematic inertia hypothesis insofar as previous experience reading issues from the comic title/series is concerned, although, this must be tempered by the fact that this finding is upheld only by the UCL measure.

Hypothesis 4: The medium of film will produce a stronger sense of telepresence than the medium of comics when content is held constant across media forms.

Because this study focuses on film adaptations, a unique opportunity exists to control content variables while testing the impact of media form on the experience of telepresence, in other words: "the book problem." Especially in the context of the structural adaptation (Condition 4), in which distributional functions are held constant, it should be expected that content is extremely similar across the media forms of comic art and film.

An initial comparison of means through an independent samples t-test between Condition 1 (comic art) and Condition 2 (film) revealed no significant differences based on the TPI ($t(65.1) = 1.34, p = 0.19$), but the UCL shows marginal significance in the opposite direction of the hypothesis ($t(74.19) = 1.93, p = .057$), meaning that, according to results gathered through the UCL, readers of comic art experience higher levels of telepresence than viewers of film when content is held constant. Of course, when *Superman* is removed from the analysis, the UCL shows decisively significant results ($t(63.13) = 2.27, p = .03$) while results from the TPI shows marginal significance ($t(55.3) = 1.96, p = .055$).

A more detailed set of 2 X 6 ANOVAs accounting for "medium" (comic art vs. film) and "treatment story" (*Superman, Catwoman, Art School Confidential, Sin City, A History of Violence, American Splendor*) present a much clearer picture. With the exception of *Superman*, mean scores for all treatment stories on both the TPI and UCL were universally in the direction opposite of the hypothesis. With *Superman* removed from the analysis, significant main effects

for "medium" (comic art vs. film) are found on both the TPI ($F(1,73) = 6.05, p = .02$) and the UCL ($F(1, 73) = 6.9, p = .01$) in the direction opposite of the hypothesis.

No main effects for treatment story or interactions between treatment story and medium were found for either measure. This indicates that, according to both measures, significantly higher mean scores were reported in response to the comic art condition than the film condition. It should also be pointed out that, under the circumstances, there is an especially valid reason to exclude *Superman* from this analysis. In addition to the reasons related to popularity and familiarity described at the beginning of this section, *Superman* is a highly thematic adaptation, meaning that only characters, settings and conflicts are adapted instead of actual events (i.e. plot material). And, as previously noted in the omnibus test section above, when *Superman* is analyzed alone across all conditions there is a significant main effect ($F(2,14) = 10.77, p = .001$) for condition and post-hoc analysis reveals that Condition 2 (film only) provokes significantly higher reports of telepresence than both Condition 1 (comic art only) and Condition 3 (film with thematic prime). Thus, it seems less likely that *Superman* shows this pattern because of the reasons asserted in the argument leading up to the fourth hypothesis, and more likely that there was something about the particular treatment story that inhibited telepresence in the comic art condition. Otherwise, why would the priming condition yield lower scores than the film-only condition for *Superman* when the established trend is in the opposite direction?

Overall, tests for this hypothesis present puzzling results. How is it possible for a less immersive and perceptually realistic medium such as comic art to reap higher telepresence scores than the comparatively convincing virtual world of a film (even if it is presented on a 24 inch television screen)? At the very least, this outcome should perpetuate the debate over "the book problem." One potential answer rests in the way we interact with the medium. Bracken and Pettey [32] report similar counterintuitive findings in a study in which a 2.5-inch iPod screen produced higher levels of immersion than a 32-inch television screen. What both comic books and the iPod have in common is that they are hand-held media. Perhaps there is something related to the control gained over hand-held media that causes an increased sense of telepresence.

Summary and Additional Findings

To briefly summarize, an omnibus ANOVA testing all conditions and all treatment stories revealed that responses to conditions in which *Superman* served as the treatment story consistently resulted in findings that were in the opposite direction of the other treatment stories. Further analysis of personal experience responses to *Superman* showed large differences based on familiarity between it and the other stories, therefore hypothesis testing was performed both with and without the inclusion of participants who were exposed to *Superman*.

Of the four main hypotheses tested, evidence was found to support the first one: the general priming hypothesis that individuals who are primed by comic art source material before exposure to the film adaptation experience higher levels of telepresence than those who are not. Contradictory findings were reported for Hypothesis 2, that structural priming produces more telepresence than thematic priming, so any conclusions should be interpreted critically while taking into account the opposing reports of the dependent measures (i.e. TPI and UCL). Similarly, results supporting the third hypothesis, that individuals with a preexisting interest in the comic art priming stimulus will report higher telepresence scores in response to the film adaptation, should be interpreted with caution because they are upheld only by the UCL measure. Finally, results obtained from testing Hypothesis 4, that film viewers would report higher telepresence than readers of comic art, went in the opposite direction expected. Interestingly, these findings were the most decisive in terms of statistical significance.

There were two additional unpredicted findings that lend strong support to the contention that content plays a determining role in the experience of telepresence, a notion previously espoused by Nunez and Blake [2]. First, the use of stimulus sampling for this project functions not only to allow generalization of findings, but also the opportunity to compare responses across stimuli (i.e. treatment stories). A one-way ANOVA testing all six levels of the “treatment story” variable (*Superman*, *Catwoman*, *Art School Confidential*, *Sin City*, *A History of Violence*, *American Splendor*) revealed significant differences among stories according to both telepresence measures: TPI ($F(5,143) = 3.41, p = .006$), UCL ($F(5,143) = 3.34, p = .007$). For the TPI, post-hoc analysis revealed *A History of Violence* to have the highest overall mean score, significantly higher than *Superman* ($p = .001$), *Catwoman* ($p = .04$), and *American Splendor* ($p = .001$). The lowest mean score was in response to *Superman*, which was also significantly lower than *Art School Confidential* ($p = .03$), *Sin City* ($p = .04$), and *A History of Violence* ($p = .001$). The UCL post-hoc test also maintained this general trend, but no significance was found for differences between *Superman* and *Sin City* or *A History of Violence* and *Catwoman*.

A second unpredicted (although not unexpected) finding was that levels of enjoyment have some predictive power for both the TPI and the UCL. Although presence and related concepts are generally seen as the cause of enjoyment [33, 34, 35], it is considered here as the result of the enjoyment of content in line with Denham [36] who maintains that enjoyment is the result of a combination of factors including social norms, viewing situations and program content.

Several questions on the personal experience measures sought to gauge enjoyment. The personal experience measure for Condition 1 (comics only) asked three questions: (1) “How would you rate your level of enjoyment of this issue?,” (2) “How would you rate your level of enjoyment of this comic title/series?,” and (3) “How would you rate your level of enjoyment of comics generally?” Using the TPI, the overall

regression model is significant ($F(3,33) = 16.68, p < .001$), and Table 1 below summarizes the predictive power of each item.

Items	Error	Beta (Standardized)	t- score	Significance
Level of enjoyment of this issue?	4.455	.490	1.989	.056
Level of enjoyment of comic title/series?	4.333	.209	.858	.398
Level of enjoyment of comics generally?	2.228	.278	2.424	.022

Table 1 Condition 1 Enjoyment Regression. Items that predict telepresence level for Condition 1 (comic art)

Because all three of these items failed to load on a single factor, an index was not constructed, although a look at the individual items provides interesting results since enjoyment of both the particular issue and the medium of comics generally are significant predictors of telepresence scores according to the TPI. The combination of predictors for the UCL is similarly significant ($F(3,33) = 7.53, p = .001$), but none of the items themselves are found to be significant.

Items	Error	Beta (Standardized)	t- score	Significance
Level of enjoyment of this film?	2.210	.686	6.271	.001
Level of enjoyment of comic title/series?	2.543	.271	2.458	.019
Level of enjoyment of comics generally?	1.934	.035	.358	.722
Level of enjoyment of films generally?	3.121	-.127	-1.261	.215

Table 2 Conditions 2-4 Enjoyment Regression. Items that predict telepresence level for Conditions 2-4 (film)

The personal experience measure for the film conditions (2-4) asked similar questions: (1) “How would you rate your level of enjoyment of this film based on what you have seen?,”

(2) “How would you rate your level of enjoyment of the comic title/series upon which this film is based?,” (3) “How would you rate your level of enjoyment of comics generally?,” and (4) “How would you rate your level of enjoyment of films generally?” This model for the TPI is also significant ($F(4,43) = 20.25, p < .001$) and Table 2 below summarizes the predictive power of each item.

Once again, the model for the UCL is also significant ($F(4,43) = 9.54, p < .001$), however, interestingly, the only significant predictor is enjoyment of the film ($\beta = .632, t(101) = 4.63, p < .001$).

Comparing these regression models, it seems that for both readers of comics and viewers of film, enjoyment of the specific stimulus is the strongest predictor of telepresence. In addition, though, enjoyment of the comic title/series upon which the film is based has some predictive power for level of telepresence experienced in response to the film. This unpredicted finding could also be used to lend support to the third hypothesis (individuals with a preexisting interest in the comic art priming stimulus will report higher telepresence scores in response to the film adaptation) since enjoyment of the comic title/series implies user factors such as preexisting interest.

Finally, in addition to testing the individual items, an enjoyment index was created based on a factor analysis of the four-item model above. All items were found to load on a single factor above 0.5 and Chronbach’s Alpha yielded a reliability score of 0.64. This index predicts telepresence as a singular construct ($\beta = .531, t(104) = 6.4, p < .001$) as well as the variance among scores ($R^2 = .282, F(1, 105) = 40.92, p < .001$).

Overall, differences in telepresence scores as reported on the TPI and UCL resulting from differing treatment stories and levels of enjoyment strongly imply that, in addition to form factors, content and user factors play a definitive role in the experience of telepresence.

References

- [1] M. McLuhan. *Understanding Media: The Extensions of Man*. Cambridge, MA: The MIT press. 1996.
- [2] D. Nunez, E. Blake. Content expectation and thematic inertia predict virtual presence. In: *Proceedings of The 9th International Workshop on Presence*, 39-50. Cleveland. 2006.
- [3] I. Ladeira, D. Nunez, E. Blake. The role of content preference on thematic priming in virtual presence. In: *Proceedings of The 8th International Workshop on Presence*, 227-230. London. 2005.
- [4] G. McKoon, R. Radcliff. Priming in item recognition: The organization of propositions in memory for text. *Journal of Verbal Learning and Verbal Behavior*, 19, 369-386. 1980.
- [5] L. W. Barsalou. Context-independent and context-dependent information in concepts. *Memory and Cognition*, 10, 82-93. 1982.
- [6] R. J. Gerrig. *Experiencing Narrative Worlds: On the Psychological Activities of Reading*. New Haven: Westview Press. 1993.
- [7] W. Iser. *Prospecting: From Reader Response to Literary Anthropology*. Baltimore: Johns Hopkins University Press. 1989.
- [8] V. Nell. *Lost in a Book*. New Haven: Yale University Press. 1988.
- [9] M.-L. Ryan. *Narrative as Virtual Reality: Immersion and Interactivity in Literature and Electronic Media*. Baltimore: The Johns Hopkins University Press. 2001.
- [10] D. Nunez, E. Blake. Cognitive presence as a unified concept of virtual reality effectiveness. In: *Proceedings of AFRIGRAPH 2001*, 115-118. November. 2001.
- [11] D. Nunez, E. Blake. Conceptual priming as a determinant of presence in virtual environments. In: *Proceedings of the 2nd International Conference on Computer Graphics, Virtual Reality, Visualization and Interaction in Africa (AFRIGRAPH 2003)*, 101-108. February. 2003.
- [12] J. G. Boyum. *Double Exposure: Fiction into Film*. New York, NY: Universe Books. 1985.
- [13] A. Burgess. On the Hopelessness of Turning Good Books into Films. *New York Times*. April 20 1975. pp. 14-15.
- [14] I. Whelehan. “Adaptations: The Contemporary Dilemmas.” In D. Cartmell, I. Whelehan (Eds.) *Adaptations: From Text to Screen, Screen to Text*. New York: Routledge. pp. 4-16. 1999.
- [15] Glenberg, A. M. What is memory for? *Behavioral and Brain Sciences*, 20, 1-55. 1997.
- [16] F. Miller, R. Rodriguez, Q. Tarantino (Directors). (2005). *Sin City*. [Motion Picture]. United States: Dimension Films.
- [17] F. Biocca. Can we resolve the book, the physical reality, and the dream state problems? From the two-pole to a three-pole model of shifts in presence. Presented at the *EU Future and Emerging Technologies Presence Initiative Meeting*, Venice. 2003.
URL: <http://www.mindlab.org/images/d/DOC705.pdf>
- [18] R. M. Banos, C. Botella, B. Guerrero, V. Liano, M. Alcaniz, B. Rey. The third pole of the sense of presence: Comparing virtual and imagery spaces. *PsychNology Journal*, 3, 90-100. 2005.
- [19] A. Gysbers, C. Klimmt, T. Hartmann, A. Nosper, P. Vorderer. Exploring the book problem: Text design, mental representations of space, and spatial presence in readers. In: M. A. Raya, B. R. Solaz (Eds.) *Seventh Annual International Workshop: Presence 2004*. Valencia. 2004.
- [20] S. O’Neill, D. Benyon. A semiotic approach to investigating presence. Paper presented to the *COSIGN-2003*, 1-7. September . 2003.
URL: <http://www.cosignconference.org/cosign2003/papers/Oneill.pdf>

- [21] D. Pinchbeck, B. Stevens. Schemata, narrative, and presence. In: *Proceedings of The 8th International Workshop on Presence*, 227-230. London. 2005.
- [22] T. Schubert, J. Crusius. Five theses on the book problem: Presence in books, film and VR. Paper presented at *Presence 2002–5th Annual International Workshop on Presence*. Porto, Portugal. 2002.
- [23] F. Biocca. The cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, 3, 1-29. 1997. URL: <http://www.ascusc.org/jcmc/vol3/issue2/>.
- [24] M. Phillips. The sadeian interface: Computers and catharsis. *Digital Creativity*, 11, 75-87. 2000.
- [25] E. Julien, R. Over. Male sexual arousal across five modes of erotic stimulation. *Archives of Sexual Behavior*, 17, 131-143. 1988.
- [26] E. Waterworth, J. Waterworth, J. Holmgren, T. Rimbark, R. Lauria. The illusion of being present: Using the interactive tent to create immersive experiences. In: *Proceedings of Presence 2001, 4th International Workshop on Presence*, 1-13. Philadelphia. 2001.
- [27] M. Lombard, T. B. Ditton. At the heart of it all II: Measuring presence. 2007. URL: http://astro.temple.edu/~lombard/research/P2scales_11-04.doc
- [28] M. Slater, A. Steed, M. Usoh. The virtual treadmill: A naturalistic method for navigation in immersive virtual environments. In: *Proceedings of the First Eurographics Workshop on Virtual Environments*, 71-83. September. 1993.
- [29] M. Lombard. Direct responses to people on the screen: Television and personal space. *Communication Research*, 22, 288-324. 1995.
- [30] M. Lombard, R. D. Reich, M. E. Grabe, C. C. Bracken, T. B. Ditton. Presence and television: The role of screen size. *Human Communication Research*, 26, 75-98. 2000.
- [31] M. Lombard, T. B. Ditton, M. E. Grabe, R. D. Reich. The role of screen size in viewer responses to television fare. *Communication Reports*, 10, 95-106. 1997.
- [32] C. C. Bracken, G. Pettey. It is REALLY a smaller (and smaller) world: Presence and Small Screens. In: *Proceedings of The 10th International Workshop on Presence*, 283-290. Barcelona, Spain. 2007.
- [33] M. C. Green, T. C. Brock, G. F. Kaufman. Understanding media enjoyment: The role of transportation into narrative worlds. *Communication Theory*, 14, 328-347. 2004.
- [34] J. L. Sherry. Flow and media enjoyment. *Communication Theory*, 14, 328-347. 2004.
- [35] P. Vorderer, C. Klimmt, U. Ritterfeld. Enjoyment: At the heart of media entertainment. *Communication Theory*, 14, 388-408. 2004.
- [36] B. E. Denham. Toward an explication of media enjoyment: The synergy of social norms, viewing situations, and program content. *Communication Theory*, 14, 370-387. 2004.