Watching closely: Spatial distance influences theory of mind responding in film viewers

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Abstract

Shot scale in film, that is the apparent spatial distance of characters from the camera, is one of the most important compositional elements in a film shot guiding media audiences' attention. The primary aim of the present study was to investigate the extent to which apparent spatial distance of fictional characters can evoke theory of mind responding in film viewers. Theory of mind, referring to the capacity of attributing mental states to others, is considered fundamental in audiences' character involvement and narrative understanding, and it presumably mediates narrative effects. Four short animated movies were annotated for shot scale distribution and presented to participants (N = 52) in a within-subject design. Participants were asked to retell the story of the films and fill in questionnaires on narrative experience. Skin conductance was also measured during exposure. Story-descriptions were content analysed for theory of mind responses. In a Poisson-regression model average spatial distance predicted theory of mind response indicating that increasing spatial proximity triggered higher occurrence of mental state references in participants' story-descriptions. The findings give insight into how the visual presentation of characters shapes audiences' mental models of the story.

Audiences' involvement with media characters has been identified as a crucial process in narrative effects. Research has shown that involvement with characters facilitates narrative engagement (Busselle and Bilandzic, 2009), narrative persuasion (see Bilandzic and Busselle, 2013; de Graaf, Hoeken, Sanders, and Beentjes, 2012; Igartua, 2010), entertainment-education (Moyer-Gusé, 2008), and social learning (see Bandura, 2004; Mar and Oatley, 2008). Generally, involvement with characters decreases audiences' willingness to counter-argue with the message, thus improving the learning process (Bandura, 2004). Theory of mind, that is the recognition and understanding of feelings, thoughts, and intentions in fictional and real others (Premack and Woodruff, 1978), is a fundamental process in building a situation model of a story (Zwaan, Langston, and Graesser, 1995), and presumably it is an important channel for character engagement and narrative effects (Bilandzic and Busselle, 2013; Busselle and Bilandzic, 2008). Consequently, identifying the features responsible for theory of mind should be beneficial for maximizing narrative impact.

Tying together formal features of visual narratives with audiences' psychological responses is a longstanding challenge to researchers and a key to significant advances in media psychology. Researchers have recognized the significance of message design, namely that non-content formal features modulate media effects. For example, studies have shown the impact of pacing (Chock, Fox, Angelini, Lee, and Lang, 2007), cutting rate (Penn, 1971), camera angles (Kraft, 1987), point of view (Cummins, 2009; Cummins, Keene, andand Nutting, 2012; Krcmar and Farrar, 2009; Lim and Reeves, 2009), color (Detenber, Simons, and Reiss, 2000; Lichtlé, 2007), editing (Lang, Zhou, Schwartz, Bolls, and Potter, 2000), 2D vs 3D (Rooney, Benson, and Hennessy, 2012), image quality (Bracken, 2005, 2006) and motion (Simons, Detenber, Roedema, and Reiss, 1999) on the motivational relevance of a media message. Following Lang's (2000) Limited Capacity for Mediated Processing (LC4MP) model, varying the type and number of structural features in a message influences the extent of motivational activation, the way the message is processed, and people's cognitive and emotional responses (see Detenber and Lang, 2010). In addition, the way story information is formally constructed has been shown to have an influence on audiences` character engagement (Cao, 2013; Mutz, 2007; Oliver, Dillard, Bae, and Tamul, 2012), however our knowledge is still limited in this regard. Addressing this research gap the present study aims to explore how spatial distance (as a function of shot scale) influences theory of mind responding in viewers of animation films. The findings contribute to the understanding of the psychological relevance of message design in higher complexity responses in narrative experiences. The next section will describe the concept of theory of mind and the research on spatial distance.

Theory of Mind

In everyday life people are constantly faced with situations in which they have to take the perspective of the other person in order to react adequately in social situations. The capacity of recognising and understanding mental states in others and explaining the behaviour based on this information is often referred to as theory of mind (TOM, in other terms: mind reading, mentalization) (Premack and Woodruff, 1978). TOM processing is fundamental for navigating interpersonal relationships (Paal and Bereczkei, 2007), as well as for understanding how people feel, think and behave (Baron-Cohen, 2001). This capability is often associated with cognitive empathy (Preston and Hofelich, 2012). Ascribing mental states to or perceiving minds in others have profound consequences for both the observer and the observed (Haslam, 2006; Waytz, Gray, Epley, and Wegner, 2010). TOM deficits are prominent in various psychological disorders impairing subjective quality of life (e.g. autism spectrum disorder (Baron-Cohen, 2001), borderline (Fonagy and Bateman, 2007), schizophrenia (Corcoran, Mercer, and Frith, 1995), etc.).Consequently, understanding the determinants of theory of mind responses is a necessity.

Fictional narratives have a huge potential to activate theory of mind responses (Mar, 2011). Narrative fictions, with some exceptions, are fundamentally concerned with relationships among human or human-like beings and their coping with intra- and interpersonal conflicts (Bruner, 1986). Consequently, fictional stories provide audiences with rich and structured social information about the human world (Fahlenbrach and Bartsch, 2008). In order to understand the complexity of the fictional story world audiences are motivated to recognize, understand, and also to experience fictional characters' desires, intentions, and beliefs (Busselle and Bilandzic, 2008). To put it differently, narrative understanding and theory of mind are closely related to each other (Mar, 2011). Not surprisingly, many of the standardized theory of mind measures are based on fictional stories (Dodell-Feder, Lincoln, Coulson, and Hooker, 2013; Dziobek et al., 2006; Golan, Baron-Cohen, Hill, and Golan, 2006; Happé, 1994). Fictional narratives create an opportunity to simulate complex social interactions and exercise everyday social cognitive skills (Mar and Oatley, 2008), as well as to understand underlying mental processes in social situations (Oatley, 2013). In line with this, recent research suggests that both lifetime (Mar, Oatley, Hirsh, dela Paz, and Peterson, 2006; Mar, Oatley, and Peterson, 2009; Mar, Tackett, and Moore, 2010) and even a single exposure (Djikic, Oatley, and Moldoveanu, 2013; Kidd and Castano, 2013) to literary fictions can enhance TOM capacity. Moreover, TOM responses seem to be sensitive to how the narrative is presented. Studies have shown that literary fiction has a higher potential to trigger TOM processing compared to non-fiction (Djikic et al., 2013; Mar et al., 2006, 2009) and popular fiction (Kidd and Castano, 2013). Yet, insight into which formal features of media messages are effective in enhancing TOM is still insufficient, especially when it comes to visual stimuli.

During the last decades (neuro)psychological research has provided ample support for the assertion that TOM has a strong foundation in visuals (Levin, Hymel, and Baker, 2013). The available findings in evolutionary studies (Zuberbühler, 2008), infant development (Okumura, Kanakogi, Kanda, Ishiguro, and Itakura, 2013; Senju and Csibra, 2008), neuropsychology (Calder et al., 2002; Itier, Villate, & Ryan, 2007; Mosconi, Mack, McCarthy, & Pelphrey, 2005), and cognitive development (Baron-Cohen, 2001) indicate that theory of mind response is strongly associated with visual triggers carried by human faces. These studies have shown that processing facial expressions and gaze direction are salient triggers of TOM (Frischen, Bayliss, and Tipper, 2007). People tend to look at eyes for a disproportionate amount of time (Henderson, Williams, & Falk, 2005; Itier et al., 2007), likely because the eye region conveys salient information about emotion (Simon Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Calder et al., 2002), face recognition (Hood, Macrae, Cole-Davies, and Dias, 2003) and the target of attention (Frischen et al., 2007). Understanding gaze direction is a developmental precursor of TOM (Baron-Cohen, 2001; Parsons, Young, Murray, Stein, and Kringelbach, 2010; Senju and Csibra, 2008). Furthermore, these abilities share a common region of the brain (Mosconi et al., 2005). The presented results demonstrate that images of faces, eyes, and gaze directions have a complex but strong link to theory of mind, and provide an explanation for how spatial distance and shot type in particular may influence theory of mind in viewers.

In line with the results from (neuro)psychological research, the power of actors' faces to engage viewers has been widely discussed in film theory (Balazs and Carter, 2013; Carroll, 1993; Persson, 2003; Plantinga, 1999). While film scholars have argued that close-up shots elicit empathic emotions (Plantinga, 1999) and trigger attribution of mental states to characters (Carroll, 1993; Persson, 2003; Smith, 1995), empirical evidence of this is still limited. The present study thus tests the underlying assumption that spatial distance in visual media regulates the visibility of theory of mind relevant cues, and consequently affects theory of mind responding.

Spatial Distance

Spatial distance, that is the perceived physical distance between an observing and an observed individual, has been shown to have a significant role in our media experience (Lombard, 1995). This is backed up by a considerable body of psychological studies which demonstrated that spatial distance has a strong interpersonal psychological meaning in everyday life, influencing the valence of the interaction by carrying both negative (e.g. invasion) and positive (e.g. attraction) connotations (see for example Hall and Hall, 1969). It is reasonable to assume that the psychological significance of interpersonal distance is similar in non-mediated and mediated environments, namely closer figures trigger more intense reactions (Lombard, 1995; Reeves and Nass, 1996).

In communication studies spatial distance has been mostly manipulated as a presentational feature (e.g. viewing distance, image size, and screen size), and less attention has been paid to its formal characteristics (e.g. shot type, zooming) (see Detenber and Lang, 2010). However, it can be assumed that the psychological responses to both formal and presentational features are reliant on similar perceptual mechanisms (Howard, 2012). Therefore, while the main interest of the present study is in shot scale, it draws on previous research on image and screen size as well.

Spatial distance as a presentational feature has been the subject of investigations of its impact on emotional and cognitive processing. Due to the size-distance law the perceived size of an image changes inversely with the distance of the observer from the object. In other words, the perceived image size shrinks as the object moves farther away (Howard, 2012). According to Detenber and Lang (2010) larger images increase automatic allocation of cognitive capacity, require more visual processing, and consequently, generate larger mental images. The findings of previous studies are in line with this model. For example, it has been shown that decreased apparent distance increased physiological arousal (Codispoti and De Cesarei, 2007; De Cesarei and Codispoti, 2010; Mutz, 2007), self-reported arousal (Detenber and Reeves, 1996), attention (Reeves, Lang, Kim, and Tatar, 1999), memory (Bellman, Schweda, and Varan, 2009), emotions (De Cesarei and Codispoti, 2006, 2008), immersion (Baranowski and Hecht, 2014), and presence (Hou, Nam, Peng, and Lee, 2012; Lombard, Ditton, Grabe, and Reich, 1997; Lombard, Reich, Grabe, Bracken, and Ditton, 2000). Spatial distance also has an impact on character engagement. Shorter apparent distance increases the liking of a character (Bellman et al., 2009; Hou et al., 2012; M. Lombard, 1995), and the intensity of the perceived emotions of a character (Matthew Lombard et al., 1997). Results have also suggested that age (Roring, Hines, and Charness, 2006) and the type of emotion observed (Smith and Schyns, 2009) may modulate the motivational effect of spatial distance.

The same is true for the expansion of the image: looming images make the media message more complex and require increased allocated resources (Lang, Bradley, Park, Shin, and Chung, 2006), as well as attract more attention than receding ones, independently of novelty (Franconeri and Simons, 2003). Mühlberger, Neumann, Wieser, and Pauli (2008) found that approaching (growing in size) unpleasant images evoked increased physiological arousal compared to the same picture moving away (shrinking in size). A similar effect was found when only the mental representation of looming was manipulated (Davis, Gross, and Ochsner, 2011).

The present study focuses on *shot scale*, which is a commonly used term to describe the apparent spatial distance of the camera from the main subject of the shot, as well as the relative proportion of the figure of the character and the background (Bowen and Thompson, 2013; Salt, 1992). Shot scale distribution is one of the most salient stylistic features of audiovisual messages (Kovács, 2014). The family of basic shot scales includes long shot, middle shot and close-up shot. In long shots the human figure is small and surrounded by a large area of the film space. The medium shot depicts the human figure from the waist up corresponding to a distance of 3-5 feet. The close-up shot shows the figure from the upper shoulder, and provides a detailed view of the human face (Bowen and Thompson, 2013). Varying shot scale is an effective tool to arrange film content according to its saliency (Carroll and Seeley, 2013), and regulate the relative size and visibility of characters' faces. However, only a very few empirical studies investigated the role of shot scale in character involvement. Shot type distribution was found to be a key element in the arousal aspect of film experience (Canini et al., 2011). Studies have shown that characters depicted in close-ups compared to middle-shots evoked higher empathy, care (Cao, 2013) and stronger memory (Mutz, 2007). Mutz also found that closer shots intensified the liking of a positive and disliking of a negative character (Mutz, 2007). It is noteworthy that in Cao's (2013) study empathy was measured by items focussing on perspective-taking (e.g. "*I imagined what it was like to be in his situation.*") which has a strong link to theory of mind responses. These results indicate that shot types carry socially important information and shape engagement with media characters.

Some of the limitations of the abovementioned studies have to be addressed. Many studies investigated the impact of spatial distance as a presentational feature, but only a few of them investigated it as a formal aspect. Most commonly, photographs were used as visual stimuli, and narrative moving images were employed only a few times. Therefore, knowledge is still limited about how shot scale functions in narrative experiences. The present study aims to address these research gaps by using complete fictional animated narratives and investigating the impact of spatial distance, as a function of shot scale distribution, on theory of mind responses in viewers.

Hypothesis

The main hypothesis of the present study is that spatial distance affects theory of mind response. Following the LC4MP model we assume that spatial proximity increases the motivational relevance of the image by bringing the character closer to the viewer, increasing the size of the face, thus making the details of facial expression more visible and readily available. The heightened motivational relevance increases the allocation of additional resources that may raise the probability that the characters' mental states become part of the mental representation. As a consequence, we assume that the mental representation of the narrative will be more mentalized, that is, the plot of the narrative will be remembered in terms of mental states of the characters. To put it differently, we hypothesize that decreased spatial distance from the character will be associated with higher occurrence of theory of mind responding.

Method

Overview

Four animated films were annotated for shot type in order to calculate a spatial distance measure. The basic one-factorial within design called for each participant to view three of four animated films (due to time constraints) while skin conductance was recorded. Immediately after viewing each of the films, participants rated their identification with the characters, emotional valence, narrative understanding, perceived reality, and enjoyment.

After watching all films, participants were asked to retell the story of the movies seen. The occurrence of theory of mind references was counted in these film-based narratives. A Poisson-regression analysis was performed to test the influence of spatial distance on the occurrence of theory of mind. The duration of the films, number of coding units, skin conductance, identification, emotional valence, narrative understanding, perceived realism, and enjoyment were included as control variables in the analysis. Having each participant in each spatial distance condition made it possible to separate treatment effects and between subject variance, due to which heterogeneity in theory of mind ability and the ability to verbalize mental states of characters, as well as gender effects could be controlled (Reeves and Geiger, 1994).

Stimulus Material

We selected four films that represent different levels of spatial distance from a large collection of awarded short animation films. Besides spatial distance characteristics, the systematic selection was guided by knowledge of other message features that could influence theory of mind, and it aimed at minimizing potential confounds. Each film 1) featured a self-contained fictional narrative with a linear narrative structure; 2) ran between 4 and 9 minutes; 3) lacked verbal information (e.g. dialogue, voice-over narration, textual inserts); 4) had continuous music along the story without lyrics; 5) had a 2D format of animation; 6) showed anthropomorphic protagonists; 7) contained only two characters (a female focal character and a male character); 8) contained a content about separation from and reunion with a beloved person, a theme that requires a viewer to use theory of mind in order to fully appreciate the content of the film. The following films were used in the present study: *Father and Daughter* (de Wit, 2001); *Invention of Love* (Shuskhov, 2010); *Lavatory – Lovestory* (Bronzit, 2007);

Lettingo (Whitaker, 2008). In a small pilot study (n = 19) no significant differences in perceived quality of the films were found.

Participants

Sixty participants were recruited using university e-mail lists, social media platforms and psychology related public homepages. We excluded five participants because they had already seen one of the films projected, and three participants due to technical problems. The final research sample consisted of 52 participants (42 female) aged between 18 and 60 (M = 25.6 years SD = 6.7 years). University students made up 65 % of the sample, 35 % were in employment. We rewarded participants with a book. All participants gave informed consent for their participation in the experiment.

Procedure

Participants completed the experimental protocol individually. After a welcome, the participant was led into the lab and seated in front of a computer. Viewing distance averaged approximately 50 cm. Participants were initially informed that the purpose of the study was to determine how people process fictional narratives and that it would take 65 min, in which the participant would watch three short animation films. It was explained that skin conductance would be recorded using small sensors while watching. The participant signed a consent form and two finger straps were placed against the inside part of the index and ring finger of the non-dominant hand. Participants were asked to sit quietly and to fully watch each video clip. During the experiment, skin conductance data were collected just prior to the onset of each film for one minute (for the baseline data), as well as for the duration of the film. Participants were shown the first film clip and were asked to fill in questionnaires about the film experience (see Control variables). This process was repeated for three of the film clips, which were presented in a counterbalanced order across participants. To keep response burden manageable, each participant viewed only three of the four movies. All participants viewed a film with high (*Father and Daughter*), and medium level (*Invention of Love*) of spatial distance, and subsequently a film with low spatial distance (either *Lettingo* or *Lavatory-Lovestory*). The latter assignment was also made at random. After having seen all three films, participants were asked to: "*Tell about what happened in the film scenes you just saw.*" Participants were asked to recall the three film scenes in a randomly assigned order. Their verbal responses were recorded. Finally, an open question addressed the participants' awareness of the hypothesis. The result of this showed that they were not aware of the hypothesis. The session was closed with debriefing and rewarding.

Software and Equipment

Films and questionnaires were presented by MediaLab v2010 software (Empirisoft Corporation), which enabled us to systematically vary the successive phases of the study. We used an LCD monitor (HP L1908, 19-inch, 446×59×301mm, 1440×900 pixels) and two 0.6-watt surround-sound speakers for film projection. Verbal data was recorded on a digital voice recorder (Olympus VN-8500PC). Data management and analysis were performed using Matlab and R.

Measures

Independent variables.

Spatial distance.

Based on the shot scale distribution of the films an average spatial distance was calculated for each movie in the following way. 1) Each shot that presented a character was annotated manually by shot scale (Extreme long shot, Very long shot, Long shot, Medium long shot, Medium shot, Medium close up, Close up, Big close up, Extreme close up) and duration of the shot. A weight was assigned to each shot type, where lower weights expressed lower distance (Extreme long shot = 9, Very long shot = 8, Long shot = 7, Medium long shot = 6, Medium shot = 5, Medium close up = 4, Close up = 3, Big close up = 2, Extreme close up = 1). 2) The percentage of the duration of each shot type in the total duration of shots presenting a character was calculated for each shot type. 3) Proportions of shot type duration were multiplied by the weight assigned to shot types expressing the distance. 4) Weighted average spatial distance was calculated by summing the weighted shot type proportions. Table 1 shows the distribution of shot scales in each movie.

> Table 1 is about to here <

Dependent variables

Theory of Mind.

Each participant's set of three film-based narratives was coded for the occurrence of theory of mind response. Theory of mind response was assessed by counting the frequency of mental state references in the coded transcripts of the film-based narratives, i.e., answers to the question to describe the story of the films. The counting procedure was informed by standardized assessments of theory of mind using story-based stimuli and qualitative data collection (Barnes, Lombardo, Wheelwright, & Baron- Cohen, 2009; Dodell-Feder et al., 2013; Dziobek et al., 2006; Golan et al., 2006; Heavey, Phillips, Baron-Cohen, & Rutter, 2000). The procedure was as follows: participants' film-based narratives were transcribed verbatim, then segmented into subject-verb predicate coding units and coded by two independent coders. A coding unit was defined as a word or string of words identified by a pause or grammatical completeness. Units were coded for the presence or absence of an explicit reference to a mental state of the main protagonist (i.e. the female protagonists). The coding was informed by Meins and Fernyhough's (2010) coding manual, in which mental reference is defined as any reference to an individual's mental life, relating to desire, wish, emotion, will, mind, imagination, interest, intellect, or metacognition. Coding was done by two trained independent coders blind to the hypothesis of the study. Inter-rater reliability was assessed in each film separately (Freelon, 2010) and found to be acceptable (Cohen Kappa = .71- .76). Disagreements between coders were resolved by a third coder serving as a tiebreaker (Lombard, Snyder-Duch, and Bracken, 2002). Participants were given a score on each film-based narrative for the count of the coding units containing an explicit mental reference. Higher counts are indicative of increased activity of theory of mind, and a more mentalized mental representation of the film.

Assessing theory of mind responses by non-directive open ended questions enabled us to obtain the spontaneously occurring theory of mind responses. In contrast, Likert-type tests (e.g. Kozak, Marsh, and Wegner, 2006) and other performance tests (e.g. Dziobek et al., 2006; Golan et al., 2006) often rely on forced choices and prompt mental reasoning directly (e.g. "*What does the character feel*?"); consequently, these tests are less sensitive to the absence of mental state references, and are less valid representations of individual differences in adults' spontaneous theory of mind abilities (Meins, Fernyhough, and Harris-Waller, 2014).

Controlled variables

Identification.

Five items measured respondents' felt emotional proximity with characters. The items were taken from Tal-Or and Cohen's (2010) Identification Scale. For example: "*While viewing, I felt like the main character felt."* Respondents indicated the extent to which they agreed or disagreed with each statement on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The ratings for the individual items were averaged, with higher scores indicating higher emotional proximity with the fictional character (α = .82 - .88 for the four films).

Affective valence.

Affective valence of the film experience was measured by one item taken from the Self-Assessment Manikin scale (Bradley and Lang, 1994). Respondents rated the valence of their feelings *("Please describe how you are feeling now.")* caused by the movie on a 7-point Likert-scale, ranging from minus 3 (very negative) to plus 3 (very positive). For the later analysis ranging was recoded to a more conventional 1 to 7 scale. Higher scores indicate more positive affective valence.

Enjoyment.

The enjoyment scale included three items (Tal-Or and Cohen 2010), such as: *"I enjoyed the film segments I watched in the experiment very much."*; *"This is a movie that I can enjoy."; "If this film will be screened on T.V. I will watch it."* Respondents indicated the extent to which they agreed or disagreed with each statement on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The ratings for the individual items were averaged, with higher scores indicating higher enjoyment of the film (α = .90 - .92, for the four films).

Perceived realism.

Perceived realism was assessed by three items based on Tal-Or and Cohen (2010). The items were adjusted to the theme of the films in the present study: *"The events in the scenes resemble ones in real world."*; *"The relationships described in the film resemble relationships between people."*; *"The film reflects problems people encounter in their relationship."* Respondents indicated the extent to which they agreed or disagreed with each statement on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The ratings for the individual items were averaged, with higher scores indicating higher perceived realism of the film (α = .76 - .89, for the four films).

Narrative understanding.

Three items measured respondents' narrative understanding. The items were taken from the narrative understanding subscale of the Narrative Engagement Scale (Busselle and Bilandzic, 2009). The items were the following: *"My understanding of the characters is unclear (reversed item)."*; *"I had a hard time recognizing the thread of the story (reversed item)."*; *"At points, I had a hard time making sense of what was going on in the program."* Respondents indicated the extent to which they agreed or disagreed with each statement on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The ratings for the individual items were averaged, with higher scores indicating better understanding of the narrative (α = .83 - .95, for the four films).

Arousal.

Autonomic arousal was measured by the changes in the tonic level of electrical conductivity of the skin (skin conductance level). Physiological data were collected with a transportable measurement system BioGraph Infiniti (SA7900, Version 5.1.0, Thought Technology Ltd.) and was processed by Ledalab Software, using Adaptive smoothing and Continuous Decomposition Analysis (Benedek and Kaernbach, 2010) that decomposes SC data into continuous tonic and phasic activity. This method is based on Standard

Deconvolution and is comparatively fast and quite robust. Sampling frequency was 256Hz, which was down sampled to 16Hz in Ledalab. Change scores were calculated for each movie by substracting the mean tonic activity for the baseline period prior to the movie from the mean tonic activity for the film viewing period.

Analytic Strategy

To assess the effect of spatial distance on the count amount of TOM occurrences, we used a random intercept Poisson regression model, in which three measurement occasions of TOM were nested in each subject. Including the random intercept allowed controlling for potential heterogeneity in TOM ability across subjects and thus correlated TOM measurements within subjects. In addition, we took into account that the number of coding units varied over subjects and movies depending on the length and level of detail of subjects' responses. Since the number of coding units determined the theoretical 'maximum' of occurrences of TOM, the log of coding units was introduced as an 'offset' into the model (Agresti, 2003). The final model estimates the effect of spatial distance on the *rate of occurrence* of TOM (or, put differently, the 'TOM per coding unit').

Results

Table 2 shows the descriptive statistics for all the variables included in the present study. Theory of mind response was controlled for the number of coding units and ranged between 0.12 and 0.30. Participants scored on high on all the controlled variables (above 4 on a 7-point Likert-scale), which indicates that protagonists triggered high levels of identification, the movies evoked positive affect in general and the storylines were perceived as realistic and clear.

> Table 2 is about to here <

We analysed the data in two steps (Table 3). First, we estimated the effect of spatial distance on TOM count controlling for the duration of the movies (model 1). Second, we introduced the z-standardized subject-level control variables into model 1 (model 2). Note again that spatial distance and duration represented movie-level variables, which were stable across measurement occasions, whereas the subject-level variables represented states that vary across measurement occasions.

The results show that, while controlling for duration, spatial distance has a negative effect on the rate of TOM occurrence in respondents' stories, suggesting that the expected rate of TOM in respondents decreases by factor exp(-.2438)=.7836 with each additional unit of spatial distance ($p<.001$, model 1). In addition, this model revealed that the length of a movie (duration) had a positive effect on the occurrence of TOM ($p<.001$).

> Table 3 is about to here <

In model 2, we controlled for subject-level variables as potential alternative explanations for the TOM count. We found that the effect estimate of spatial distance remained stable. In addition, model fit as assessed by AIC (Akaike Information Criterion) deteriorated slightly when including the additional covariates (726.0 vs. 733.3) suggesting that model 1 produces more precise effect estimates.

Figure 1 gives a visual account of the results by a scatterplot of spatial distance against TOM per coding unit. Each vertical line of points indicates TOM (varying over subjects) for a given level of spatial distance for one of the four movies. In addition, the expected TOM rate based on the fit of model 1 is shown as dashed line for an 'average length movie' (for the current sample of movies this was 7.3 minutes). The functional form illustrates that we may expect a lower rate of TOM as spatial distance increases towards the theoretical scale maximum of 9.

> Figure 1 is about to here <

Discussion

This study examined the effect of shot scale distribution on theory of mind responses in film viewers. Confirming our main hypothesis, average spatial distance significantly predicted the occurrence of theory of mind responses in viewers' film story descriptions. A negative association was found between spatial distance and theory of mind where decreasing spatial distance (increasing proximity) was associated with increasing theory of mind. The results also suggest that film duration influenced theory of mind, with longer duration leading to more theory of mind responses.

The findings of this study provide support for the previous assertion that formal features affect the emotional and cognitive processing of narratives, and it specifically confirms that not only presentational, but formal features of spatial distance, i.e. changes in shot scale distribution, can impact theory of mind in viewers. The findings are in line with the findings of previous researchers, who suggested that image size, viewing distance and shot scale play a role in viewers' involvement with characters. The results were consistent with the argument that spatial proximity increases the motivational relevance of an image. Following the LC4MP model we assumed that increased motivational relevance increases the allocation of additional resources that may raise the probability that the characters' mental states become part of the viewer's mental representation. The higher proportion of theory of mind responses exhibited by viewers associated with decreased spatial distance suggests that spatial proximity can influence the extent to which characters' mental states are stored in the mental representation of the narrative. To put it differently, higher spatial proximity brings the domain of characters' consciousness into the foreground of the narrative experience (Bruner, 1986).

A somewhat unexpected finding was that theory of mind responding is independent from arousal and identification. Both arousal and identification are associated with emotional contagion and the emotional intensity of the experience, yet they appear to be independent processes from recognizing characters' mental states. This finding is in line with theory and prior research claiming that affective empathy and cognitive empathy are independent processes (Lieberman, 2007; Raz and Hendler, 2014; Wallentin, Simonsen, and Nielsen, 2013).

The results also suggest that theory of mind response is not only a trait-like capacity, but rather also dependent on the visualization strategy of a narrative. In other words, directors can regulate the extent to which audiences ascribe mental states to characters regardless of viewers' general tendency to read minds. This is in line with previous findings (Bálint, Nagy, & Csabai, 2014; Meins et al., 2014). The significance of this notion comes from the fact that observed outgroup members, compared to ingroup members, trigger fewer and less complex theory of mind responses from an observer (Adams et al., 2010; Cortes, 2005). This is a crucial element in dehumanization processes and leads to deficits in cross-cultural communication. It is possible that visualisation techniques could circumvent this bias.

The observation that statistical shot scale distribution impacts audiences' perception of characters may extend to a broad range of media effects that involve character engagement (e.g. narrative persuasion, enjoyment). Previous research has already demonstrated the importance of shot scale in charity donation (Cao, 2013) and in evaluations of politicians' credibility (Mutz, 2007). We believe that entertainment-education, a campaign strategy often exploiting narrative effects carried by narrative engagement (Moyer-Gusé, 2008), can benefit from the implication of this study as well. Another important implication of this line of research could be the application of the results into visual tools for the improvement of theory of mind ability. However, in order to do that, we first need a comprehensive model of visual determinants of theory of mind. Determining the visual procedures of mediated messages in delivering theory of mind relevant cues can help to strengthen the theory of mind enhancing potential of mediated messages. This study represents a first step in this direction.

The duration of the films showed an independent main effect on the occurrence of theory of mind responses. It is reasonable to assume that duration is closely linked to average shot length. Consequently, it should determine the average length of shots presenting a character. The longer a character is on screen, the more time the viewer has for understanding his or her mental state. Further research needs to test these assumptions in larger sample of movies.

Limitations

Investigating the impact of formal features on psychological responses in viewers of film narratives is one of the most challenging tasks in media psychology. One of the reasons why this task is often left untouched is the technical and methodological difficulty to create true experiments that explore these connections. Formal features are often difficult to manipulate in an already existing visual narrative, as the quality of the message is easily compromised. On the other hand, creating original visual narratives in different versions is a very costly procedure, and sufficient quality is not guaranteed. Due to these considerations we decided to sample different messages to represent unique treatment levels in spatial distance. However, this decision raises some methodological concerns. One of the biggest challenges of such a quasi-experiment is to control potential confounding variables, and disentangle their potential influences in the statistical model. A systematic selection of the message as in the current study can minimize the specific confounds; however it is inevitable that there are still some unobserved variables that have to be controlled. For the present study those variables that co-vary with spatial distance and also have an influence on theory of mind (Canini, Benini, andand Leonardi, 2013) are of special importance. In order to control the effect of these formal features we observed film related responses (e.g. skin conductance) and introduced them as control variables to the regression model. We also included the duration of movies as a control variable. Future research should attempt to measure further movie characteristics in a larger sample of movies to further strengthen the findings of the present study.

Conclusion

The visualization of fictional characters plays a role in audiences' narrative processing. Our data demonstrated that shot scale distribution of character visualization influences the way participants remember a film's story. Apparent spatial proximity to a character in a movie brings characters' mental states into the foreground resulting in more mentalized mental models of the narrative. This study is a step towards to the understanding of the relationship between formal features and higher complexity film responses. Knowing how to elicit theory of mind through message design holds great promise for gaining valuable insight into the mechanism of narrative effects mediated by character engagement.

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Table 1: Percent distribution of duration of shot scales in the total duration of shots depicting a character (%); total duration of shots depicting a character (seconds), total duration of the movies (seconds); average spatial distance.

	Father and Daughter	Invention of Love	Lettingo	Lavatory Lovestory
Extreme Long Shot	28.24 %	10.55 %	11.36 %	0
Very Long Shot	65.78 %	3.27 %	6.06 %	2.86 %
Long Shot	5.98 %	42.18 %	16.67 %	12.7 %
Medium Long Shot	0	12 %	12.88 %	10.16 %
Medium Shot	0	11.27 %	13.64 %	42.54 %
Medium Close Up	0	4 %	25.76 %	22.22 %
Close Up	0	16.73 %	6.06 %	8.57 %
Big Close Up	0	0	5.3 %	0.95 %
Extreme Close Up	0	0	2.27 %	0
Total duration of shots depicting a character (minutes)	5.02	4.58	2.2	5.25
Total duration (minutes)	7.25	8.43	4.67	8.90
Average spatial distance	8.22	6.10	5.47	5.02

Table 2: Mean statistics (with standard deviation in brackets). Theory of mind (TOM) represented the dependent variable (dV). All other variables represented independent variables, where main effect of average spatial distance on the dV was studied in particular.

	Father and Daughter	Invention of Love	Lettingo	Lavatory Lovestory
Movie characteristics:				
Average spatial distance	8.22	6.10	5.47	5.02
Duration (in minutes)	7.25	8.43	4.67	8.90
Viewers' responses:				
Theory of Mind (dV)	0.12 (0.09)	0.22 (0.14)	0.19 (0.14)	0.30 (0.09)
Identification	5.37 (1.08)	5.13 (1.10)	4.62 (1.35)	4.40 (1.25)
Affective valence	4.08 (1.80)	4.31 (1.96)	4.19 (1.63)	4.81 (1.67)
Enjoyment	5.29 (1.39)	5.41 (1.52)	4.40 (1.92)	5.54 (1.23)
Perceived Realism	5.44 (1.13)	4.97 (1.43)	4.95 (1.41)	5.36 (1.31)
Narrative understanding	5.89 (1.09)	6.24 (1.12)	4.06 (1.37)	6.32 (0.79)
Arousal (skin conductance)	-0.01 (0.72)	0.01 (0.69)	-0.13 (0.57)	-0.09 (0.84)
Sample size (n)	52	52	26	26

Table 3: Random effect Poisson regression models of the effect of average spatial distance on the rate of TOM counts per coding unit (controlled for duration and z-standardized subject-level covariates)

	Model 1	Model 2
Intercept	-0.9037 (.288)**	-0.6088 (.372)
Spatial distance	-0.2438 (.033)***	-0.2529 (.037)***
Duration	0.0998 (.026)***	0.0675 (.035)$^{+}$
Identification	-	-0.0335 (.058)
Affective valence	-	-0.0598 (.055)
Enjoyment	-	-0.0193 (.069)
Perceived Realism	-	-0.0031 (.057)
Narrative understanding	-	0.1027 (.067)
Arousal (skin conductance)	-	0.0032 (.041)
Random effect variance	.0923	.0938
AIC	726.0	733.3

Figure 1: Scatterplot of individual-level TOM per coding unit against the spatial distance of the four movies. Expected average TOM based on model 1 fit is shown as dashed line for an average length movie (7.3 minutes).