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Shot scale matters: The effect of close-up frequency on mental state attribution in film viewers

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ABSTRACT

Mental state attribution, an important aspect of social cognition, refers to the verbalization of mental state references observed in another person. Fictional film narratives can elicit social cognition and mental state attribution specifically, however, little is known about the cinematographic techniques underlying this effect and their link to mental state attribution. The present experiment focuses on the role of close-up shots of the character's face in viewers' mental state attribution, as well as in their cognitive and affective processing more generally. The online experiment ($N = 495$) included thirteen versions of an animated film and employed a 6 (different number of close-up shots) × 2 (facial expressions) factorial between-subject design, with an additional zero close-up control condition. Participants were randomly assigned to one version of the film and subsequently asked to describe the story (with and without a prompt for mental state attribution). In these free responses, the study used a quantitative content analytic method (with independent blind-coders) to identify the proportion of spontaneous and prompted mental state attributions (i.e. explicit mental state references to the character), as well as cognitive and affective processing employed by viewers. Additionally, we tested the moderation effect of character facial expression (in the close-up) and participant gender. Confirming our main hypothesis, close-up frequency significantly influenced spontaneous, but not prompted mental state attribution. Results indicate that increasing the number of close-ups may elicit a higher proportion of spontaneous mental state attribution up to a certain point, beyond which it may decrease the proportion of spontaneous mental state attributions. Results suggest that the effect of close-up frequency is specific to mental state attribution rather than some general effect on cognitive and affective processing of narratives.

"*The close-up in film is the art of emphasis. It is a mute pointing to important and significant detail, while at the same time providing an interpretation of the life depicted. Two films with the same plot, the same acting and the same long shots but with different close-ups will express two different views on life.*" (Balázs & Carter, 2010, p. 39.).

1. Overview

Social cognition – the process of understanding other people's mental content – is a uniquely human skill, and crucial for a well-

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functioning society (Tomasello, 2009). Cultural products, especially, fictional narratives can powerfully activate social cognition processes and schemas, motivating the attribution of thoughts, emotions and intentions to fictional characters (Mar & Oatley, 2008; Wood, Stoltz, Van Ness & Taylor, 2018). Mar's (2018) Social Processes and Content Entrained by Narrative (SpaCEN) framework outlines two potential pathways through which exposure to fiction may lead to increased social cognition: through exposure to social cognitive content and/or by activation of social cognitive processes (Mar, 2018). Despite the growing body of empirical studies investigating the effect of exposure to fictional story content on social cognition processes (Mumper & Gerrig, 2017), surprisingly little research examined the role of non-content related formal features on social cognition, especially in cinematic narratives. Due to this gap, fundamental parts of the media reception process remain undertheorized.

Mental state attribution or mentalizing is defined as the explicit reasoning and verbalization of an inferred mental state (Castelli, Happé, Frith & Frith, 2000; Frith & Frith, 2003; Leslie, Friedman & German, 2004; Premack & Woodruff, 1978). The extent to which individuals attribute mental states to observed others is an important index to the richness of their mental model of that observed person (Abell, Happe & Frith, 2000; Castelli, Frith, Happé & Frith, 2002; Montgomery & Montgomery, 1999). Previous research differentiated *spontaneously occurring mental state attribution*, referring to the individual tendency to use mental state references when describing events or other people, and *prompted mental state attribution,* that is the extent to which events and other people are described in terms of mental states when one is explicitly asked to do so (e.g. Apperly, 2012; Apperly & Butterfill, 2009; Frith, 2004; Klin, 2000; Meins, Fernyhough, Johnson & Lidstone, 2006; Rooney & Bálint, 2018).

The present study investigates the role of close-up frequency as a potentially important factor that influences viewer's mental state attribution to fictional characters. Close-up shots are shots with a certain shot scale that show the character's face from a close distance, making the details of the human face and facial expression visible. The central importance of close-up as a cinematic technique has been recognized already in early film theory, linking close-ups with attention (Münsterberg, Griffith and Münsterberg, 1970), emotion (Balázs & Carter, 2010), and interpretation of context by the famous Kuleshov-effect, recently replicated by Calbi et al., 2019. Contemporary film scholars agree also that when presenting faces and facial expressions, close-ups can effectively communicate the emotional experience of the character and powerfully elicit cognitive and affective responding in viewers (Carroll, 1993; Plantinga, 1999; Tan, 2005). Close-up shots can have powerful effects on viewers because they make the emotional expression of characters visually accessible (Plantinga, 1999). Empirical studies have provided some explanation of the underlying mechanisms. For example, studies have found that close-ups make person- and emotion-recognition faster (Cutting & Armstrong, 2016; Loftus & Harley, 2005) and more accurate (Lampinen, Erickson, Moore & Hittson, 2014). This suggests that close-ups enable viewers to arrive at a better understanding of fictional characters. The present study builds on a line of research that showed that close-ups can affect viewers' mental state attribution (Bálint, Klausch, & Pólya , 2016; Rooney & Bálint, 2018, (Bálint & Rooney, 2018, 2019)).

In this paper, we extend previous work (Rooney & Bálint, , 2018) on close-ups and mental state attribution in three important ways. 1) We improved the ecological validity of the experimental design by employing a fine-grained manipulation of the frequency of close-ups throughout a whole animated fictional narrative. In our previous study (Rooney & Bálint, 2018), we manipulated only one single close up in a sequence that arguably does not reflect the cinematographic design of movies and so is limited in its ability to explore character-viewer proximity. 2) Previous research also neglected to investigate the moderating effect of the emotional expression of the face in the close-ups of whole narratives; however, it might be that positive and negative facial expressions change the effect of close-ups on viewer responses. 3) In our prior study, we exclusively focused on the response of mental state attribution (Rooney & Bálint, 2018), however, it is possible that close-ups have a more general activating effect on emotional and cognitive processes.

Addressing these research gaps, in the current study we conducted an experiment in which we manipulated the frequency and facial expression of close-ups in whole narratives. We measured the level of general cognitive and affective activation, the proportion of spontaneously occurring mental state attribution (from now on MSA-spontaneous) and more purposefully provided mental state attribution (from now on MSA-prompted) in participants' written descriptions of the story and the character. A study on the effect of close-ups on viewers' mental state attribution promises to further our understanding of the mechanisms through which fictional narratives and visual design may elicit social cognition.

1.1. Social cognition and mental state attribution

Social cognition, the umbrella term for all kind of processes related to the recognition, understanding and sharing the mental states of observed other people, is fundamental for a well-functioning society. Previous research has identified two key underlying mechanisms in social cognition processes: one path is responsible for *representing the mental states of others*, the other path is for the *experiencing the mental states of others* (Happ & Pfetsch, 2015; Lieberman, 2007; Zaki & Ochsner, 2012). Representing the mental states of others (also referred as theory of mind, cognitive empathy, mind reading, mentalization, perspective taking) is the awareness and understanding of mental states in real (Baron-Cohen, 2001; Premack & Woodruff, 1978) or mediated others (Black & Barnes, 2015). Experiencing the mental states of others (also referred to as embodied simulation, affective empathy, or emotional contagion) is an involuntary process, not dependant on higher cognitive processes. It occurs when one resonates with matching affective bodily states of the observed person (Decety & Jackson, 2004; Gallese, 2007; Lieberman, 2007; Metzinger & Gallese, 2003), for example directly experiencing a similar intensity of anxiety or pain when seeing someone in stress. This reaction has been linked to the simulation theory and the mirror neuron system (Gallese, 2007). The relative importance of these two pathways in social cognition has been debated and the relationship between the neural network that underlies representing and experiencing mental states of others has been subject to discussion (See Shamay-Tsoory, Aharon-Peretz & Perry, 2009). Nevertheless, previous research has demonstrated that representing and experiencing of others' mental states is triggered by different cues (Raz et al., 2014). For example representing is more sensitive to external situational information, whereas experiencing is more sensitive to signals coming from one's own body, such as the level of arousal or distress (Lieberman, 2007; Raz & Hendler, 2014).

The present study focuses on an important aspect of social cognition: mental state attribution, defined as the use of linguistic expressions to explicitly describe an observed other's mental content (Castelli et al., 2000; Frith & Frith, 2003; Premack & Woodruff, 1978). It has been often referred to as mentalizing (e.g. Frith & Frith, 2003), internal state language (e.g. Siller, Swanson, Serlin & Teachworth, 2014), mental state talk (e.g. Tompkins, Benigno, Kiger Lee & Wright, 2018), mental state inference or mind-mindedness (e.g. Meins, Fernyhough & Harris-Waller, 2014). The importance of the capacity to verbalize mental states in others has been often emphasised in studies of mother-child relationship (e.g. Devine & Hughes, 2014; Meins et al., 2002; Tompkins et al., 2018). These studies show that theory of mind ability develops in the linguistic context of the parent-child relationship, meaning that children internalize the understanding of mental states through being exposed to interpersonal dialogues rich in mental state attributions (Tompkins et al., 2018). Other studies show the important role of cultural products, such as children books (Dyer, Shatz & Wellman, 2000; Peskin & Astington, 2004) and televised narratives (Mar, Tackett & Moore, 2010) in the development of mental state vocabulary.

Importantly, mental state attribution is not a trait like ability. Meins et al. (2014) observed a competence-performance gap between participants' discernible appreciation that people have mental states (the extent to which they verbalized mental states when explicitly asked to do so) and the tendency to spontaneously attribute mental states to others (when not explicitly asked to do so). Their study showed that spontaneous attribution depended on the intimacy of the relationship, and not on the social cognition performance (Meins et al., 2014). Relatedly, in our previous study (Rooney & Bálint, , 2018), we found that close-up shots increased spontaneous mental state attribution, but did not affect mental state attributions when explicitly prompted. This suggests that spontaneously occurring and prompted mental state attribution differ in their relative sensitivity to formal features (Rooney & Bálint, , 2018), and also implies that it is not only the level of intimacy that can modulate people's tendency for mental state attribution, but also cultural practices can influence the extent to which people engage in mental state talk. This point opens the door for the exploration of the ways in which cultural practices can do so.

Regardless of the underlying neural pathways, evidence of social cognition effects has been explored via measures of the behavioural outcomes. Research methods and measures that are based on quantitative analysis of (verbal or written) qualitative data seem to be particularly suited to capturing a wide range of social cognitive responses to narratives and circumvent problems reported in using self-report measures (Dodell-Feder, Lincoln, Coulson & Hooker, 2013). In previous research, verbalized mental state attributions have been captured by measures that require participants to formulate mental state references about a specific other person, such as a significant caregiver (Fonagy & Target, 1997), one's own child (Sharp & Fonagy, 2008), or a famous person (Meins et al., 2014). In these studies, the qualitative data is coded and analysed quantitatively to derive a proportion of mental state references.

1.2. Social cognition, narratives and visual cues

Cultural practices, especially those in literary (Mumper & Gerrig, 2017) and cinematic narratives (Balint & Tan, 2019), have been found to be closely associated with social cognition processes. Two meta-analyses have shown that reading literary fiction compared to non-fiction and non-literary fiction contributes to improving social cognition abilities (Dodell-Feder & Tamir, 2018; Mumper & Gerrig, 2017). Recently, this research has also been extended to audio-visual narratives (Black & Barnes, 2015), showing that viewers of fictional filmic narratives performed better in emotion recognition, measured by the Reading the Mind in the Eyes test (Baron-Cohen & Cross, 1992), than those who watched a documentary TV series episode. Movies, TV series, and animated films are highly popular and provide easy access to fictional narratives; therefore, it is important to understand how they may activate social cognitive responding.

However, it is still not clear what narrative techniques of the fictional story elicit social cognitive processing, especially when it comes to visual narratives. For example, Black and Barnes (2015), following Kidd and Castano's (2013) method, compared effects of different episodes from *Mad Men* and *West Wing* with two documentaries from The Discovery Channel. Their study importantly showed that fiction film can increase viewers' theory of mind (measured by the RMET), most probably because of the presence of human beings on screen. On the other hand, the films used in the different conditions in their study not only differ from each other in their genres (fiction vs. non-fiction), but in various other narrative and visual parameters. Therefore, there is no way to tell what components of a fictional film narrative increase its potential to elicit social cognition activity, establishing the need for evidence from a true experimental design to investigate causal relationships.

In the exploration of social cognition and fictional narrative the role of story *content* has received relatively more attention (for example Mar, 2018; Mar & Oatley, 2008) than the significance of linguistic/ visual *form* (i.e., how content is presented). The latter has been largely neglected, with one notable exception; Van Krieken, Hoeken, & Sanders, 2017 Linguistic Cue Framework gives a systematic overview of linguistic cues (e.g., third person vs. first person narration, optical vs. moral point of view, verb tense, etc.) potentially influencing readers' psychological engagement with fictional characters. The taxonomy implies that the same story content can be written up using different techniques yielding different effects in readers. To the best of our knowledge, there is no such taxonomy of cinematographic features for visual narratives. A good starting point in the search for potential cinematographic features is the large body of neuroscientific study showing that social cognition can be directly triggered by visual cues carried by the human face, such as facial expression, image of the eyes and gaze direction (see Itier & Batty, 2009). The way these visual cues are arranged on the screen through cinematic techniques are likely to have an effect on the extent to which they activate social cognition, yet this remains untested.

Previous research has shown that formal features in audio-visual stimuli affect the way messages are processed (Detenber & Lang, 2010). One explanation for this is that formal attributes elicit attentional and motivational systems, and influence cognitive and emotional reactions as elaborated in the Limited Capacity Model of Information Processing (Detenber & Lang, 2010; Lang, 2000) and the Perceived Message Sensation Theory (Morgan, Palmgreen, Stephenson, Hoyle & Lorch, 2003). In line with these, research showed that audio-visual features of films synchronise viewers' attention (Mital, Smith, Hill & Henderson, 2011) as well as brain activity (Hasson et al., 2008), i.e., when people watch the same professionally composed film scene they look at similar parts of the image for similar amount of time (Smith & Henderson, 2008). This synchronicity indicates that media producers can influence which parts of the image to what depth should get attention and be remembered through the effective usage of formal features (Smith, 2013).

1.3. Social cognition and close-up

Shot scale, defined as the apparent size of the figure and its spatial distance from the camera (Zettl, 2013), is one of the most researched cinematographic device influencing viewers cognitive and emotional processing of messages, and mental state attribution in particular ((Rooney & Bálint, 2018, Bálint & Rooney, 2018, 2019)). Shot scale ranges from extreme close-up to extreme long shot defined by the size of the figure on screen and ratio of the background and figure. Shot scale distribution of a movie seems to carry the distinct fingerprint of the director (Benini, Svanera, Adami, Leonardi & Kovacs, 2016). Close-up shot, a shot with a smaller scale, showing the subject of the shot from a short distance in a relatively larger size (Bowen & Thompson, 2013; Salt, 1992), is one of the most theorized shot scale in the history of film theory, see further details of its history in Bordwell and Bordwell (1997), Bowen & Thompson, 2013 and Thompson (1985). The present paper focuses on the frequency of close-up shots (CU) in a narrative.

Faces carry socially relevant information, therefore, it is reasonable to assume that regulating the apparent distance of faces may influence viewers' mental state references to characters. Supporting theoretical assumptions in film theories, empirical studies have found that close-ups make person- and emotion-recognition faster (Cutting & Armstrong, 2016; Loftus & Harley, 2005) and more precise (Lampinen et al., 2014). Findings indicate that closer shots and shorter distance increase responses closely related to social cognition processes, such as mental state attribution (Bálint, Klausch & Pólya, 2018), empathy and care (Cao, 2013), liking of the character (Bellman, Schweda & Varan, 2009; Hou, Nam, Peng & Lee, 2012; Lombard, 1995; Mutz, 2007), emotion recognition (Cutting & Armstrong, 2016), and the intensity of characters' perceived emotions (Lombard, Ditton, Grabe & Reich, 1997). Most probably, the effect of shot scale on character engagement is mediated by the effect of perceived spatial distance on attention (Franconeri & Simons, 2003) and arousal responses (Canini, Benini & Leonardi, 2013; Mühlberger, Neumann, Wieser & Pauli, 2008).

A growing body of neuroscientific research suggests that processing of faces and facial expressions activate brain areas associated with both the representing theory of mind system and the experiencing embodied simulation system, and also areas that do not belong to either of the two systems (Fusar-Poli et al., 2009). Specifically neuroscientific research have found that images of human faces (Frischen, Bayliss & Tipper, 2007), gazes (Calder et al., 2002), gaze directions (Hood, Macrae, Cole-Davies & Dias, 2003; Mosconi, Mack, McCarthy & Pelphrey, 2005), and gaze dynamics (Pfeiffer et al., 2012) can directly activate brain areas related to mental state representation. People tend to look at eyes for a disproportionate amount of time (Henderson, Williams & Falk, 2005; Itier, Villate & Ryan, 2007), likely because the eye region conveys salient information about emotion (Baron-Cohen, Wheelwright, Hill, Raste & Plumb, 2001), face recognition (Hood et al., 2003) and the target of attention (Frischen et al., 2007). Understanding gaze direction is a developmental precursor of theory of mind (Parsons, Young, Murray, Stein & Kringelbach, 2010), sharing a common region in the brain Mosconi et al. (2005). In addition, close-ups may also activate social cognition processes via the mirror system leading to immediate embodied simulation (Gallese & Guerra, 2019), without having to effortfully infer a mental state, rather directly simulating the emotional state (see also (Daly, 2016)). Regardless of the route by which close ups might activate neural mechanisms associated with social cognition (or mental state attribution in specific) the reviewed research here suggests that they will contribute to a mental model of events that is more rich in social information – in turn, we predict this will lead to a greater proportion of mental state attributions in descriptions based off this model.

1.4. Moderating factors: facial expression and gender

The abovementioned study by Rooney and Bálint (2018) indicates that the facial expression of characters may be an important factor in the effect of close-ups on mental state attribution. According to the Emotions as Social Information Model (Van Kleef, 2009), the social information carried by emotional expressions triggers inferential processes and affective reactions in observers. It seems that formal features can regulate how much information is distributed on emotional expressions. For example, the same emotional expression showed only for a short time from a long distance may have a different effect than when showed for a long time from a short distance. It seems that shot scale interacts with differing content. If so, then manipulating content such as facial expression in shot scale studies allows us to extend the generalisability and examine the extent to which shot scale or the content of the face is driving observed effects.

Individual differences in the viewer, such as gender, seem to be another important moderating factor of the effect of shot scale on social cognition. For example, Cao (2013) compared video documentaries depicting people experiencing hardships, that were shot in close-ups or medium shots, and found that female participants tended to report higher levels of empathy and prosocial behaviour when watching the videos shot with close-ups than male participants. Other studies found no such effect (e.g., Kidd & Castano, 2013; Rooney & Bálint, 2018).

1.5. Hypotheses

Based on these abovementioned previous findings, we predicted that higher close-up frequency will increase the level of MSA-spontaneous (H1) but that close-up frequency will have no effect on MSA-prompted (H2). Additionally, we predicted that close-up frequency will be associated with higher levels of general cognitive processing (H3), as well as affective processing (H4). Furthermore, we investigated the extent to which facial expression of close-up shots (RQ1) and participant gender (RQ2) may moderate the effect of close-up frequency on the dependant variables.

2. Method

2.1. Overview and design

To examine the effect of shot scale (manipulated through close-up frequency) on spontaneous and prompted mental state attribution (MSA) responses, and on more general cognitive and affective processing in viewers, we created several versions of the same animated narrative. We manipulated the frequency of close-up shots of the protagonist (no-close-up vs. 1 vs. 2 vs. 3 vs. 4 vs. 5 vs. 10) and the facial expression of the close-ups (neutral vs. sad). This yielded 13 versions of the film as the zero CU had no manipulation for facial expression. For each version, we controlled for the point in the film when the close-up(s) appeared (narrative sequence position; see Bálint & Rooney, 2019). This design resulted in an uneven distribution of participants in each close-up condition, but was required to meet the minimum cell size for each version of the films (and is naturally controlled for in regression analysis). In this between-subject online experiment, participants were randomly assigned to one of the video versions, and they were asked to fill a questionnaire and describe the story of the presented movie in open-ended questions. We processed the open-ended answers by manual and computer-aided coding. The dependent variables were MSA-spontaneous, MSA-prompted, Cognitive processing, Affective processing.

2.2. Participants

The sample size was based on a priori power analysis using G-Power version 3.1.9.2. z-tests for Poisson regression (two-tailed, Exp $(\beta 1) = 1.1$; power = 0.8; α = 0.05; Base rate($\beta 0$) = 0.02; mean exposure = 130, R2 = 0.3, X distribution normal). With these parameters G-Power recommends a total sample size of 469 participants. Base rate and mean exposure were calculated based on previous results published by Rooney & Bálint (2018).

Participants were native German speakers, recruited via university mailing lists and social media posts. Five-hundred thirty-five people responded to our call. After data cleaning for missing responses, free responses less than 10 words, and familiarity with the film stimuli, the sample consisted of 495 participants (341 females), average age of participants was 27.74 (*SD* = 11.23 year, between 18 and 80 years). Some people did not complete the second open-ended question; therefore, H2 was tested only on 461 (320 females) participants.

2.3. Stimulus material and manipulation

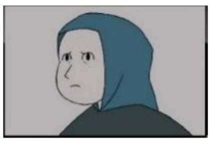
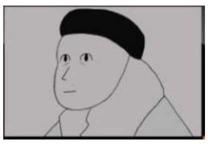
The experiment used the international award-winning animated film entitled *Father and Daughter* (Dudok de Wit, 2001). The global story structure (Cohn, Paczynski, Jackendoff, Holcomb & Kuperberg, 2012) begins by introducing the characters, a father, and daughter, riding their bikes to a point near the water (Setting). The father embraces his daughter and leaves her on the shore as he rows away, setting the story in motion (Initiating Event). This is the source of the daughter's continued grief and longing for her father (Internal Response), and the motivation for her repeated return to the same place by the water (Attempts) to see her father again (Goal). Finally, as an old woman, she is reunited with her father again in a dreamlike embrace (Outcome) (See Suckfull, 2010 for detailed analysis).

The film is a two-dimensional hand-drawn animation created in a simplistic style with a very limited colour palette and simple, clean lines. The film accompanied by instrumental music (the waltz melody of the *Waves of the Danube*), has a linear chronology, and it contains no dialogue or lyrics. The film is comprised of ten narrative sequences (i.e., consecutive shots taking place at the same location and time) that depict the daughter during five different life periods (two sequences in each of the following; childhood, adolescence, young adulthood, adulthood, older adulthood) as she returns to the place where she last saw her father. The original version of the film presents the female protagonist exclusively in long shots, i.e., she is depicted from a long distance without providing details of the face.

We manipulated the film for the present study as follows: There were 10 sequences (1–10) depicting five life periods; the first two represented the daughter in her childhood (Sequence 1, 2), followed by two in her adolescence (3, 4), two in young adulthood (5, 6), two in adulthood (7, 8), and two in older adulthood (9, 10). Two ten-close-ups versions were created, one for each sequence displaying either a sad or a neutral facial expression. Each close-up showed the face in the same size, with the same head/gaze direction (averted gaze), and the same facial identity (facial characteristics). By inserting these close-ups into these sequences, we created versions of the film with different levels of close-up frequency. The story content and inserted close-ups are presented in Table 1.

Placement of the close-ups within each sequence was determined by the visual structure of the sequences. Conventionally, a point of view shot is a shot comprised of a gaze shot depicting a person who is looking at something, and an object shot depicting the object

Table 1
The content of narrative sequences, indicating the location of inserted close-ups, and the inserted close-up frames (sad close-up version only). **[The images in Table 1 may be published in grayscale.]**.

Narrative	Content of Sequence [time stamps]	Sad Close-up
Seq. 1	A man and a little girl are riding bicycles through a landscape. At one point, they arrive at a tree at a lake where the father gets off the bicycle. The little girl stops and gets off the bicycle too. The father walks down to the water to a boat, then returns to the little girl and hugs her. He walks down to the water again and sits into the boat and rows away. The little girl stays there standing and watches [*location of close-up insert*] the man rowing away. [00:00 – 01:30]	
Seq. 2	The girl is a little bit older, on the same road riding the bicycle. She stops at the same tree and looks at the water. [01:31 – 01:51]	
Seq. 3	The girl is a little bit older, she is on the same road riding the bicycle. She stops at the same tree and looks at the water. [01:52 – 02:22]	
Seq. 4	The female protagonist is a teenager; she is on the same road riding the bicycle. She stops at the same tree and looks [*location of close-up insert*] at the water. [02:23 – 02:44]	
Seq. 5	The female protagonist is a young woman. She is coming with her friends; she stops at the same tree and looks at the water. [02:45 – 03:26]	
Seq. 6	The female protagonist is a young woman. She is sitting at the back of her boyfriend's bicycle. She looks [*location of close-up insert*] at the water. [03:27 – 03:53]	
Seq. 7	The female protagonist is a mother. She comes with two kids and her husband. She stops and looks at the water. [03:54 – 04:20]	
Seq. 8	The female protagonist is a middle-aged woman. She comes alone, stops at the same tree, and looks at the water [*location of close-up insert*]. [04:21 – 04:45]	
Seq. 9	The female protagonist as an older woman. She comes alone, stops at the same tree, and looks at the water. [04:46 – 05:14]	
Seq. 10	The female protagonist as a very old woman. She comes alone, stops at the same tree, and looks at the water [*location of close-up insert*]. She walks into the dried-out lake and lies down in a boat. [05:15 – 06:37]	
Seq. 11	The female protagonist wakes up in the boat and reunites with his father. (no close-up) [06:38 – 07:20]	

of the looking (Branigan, 2012). In *Father and Daughter*, each sequence consists of a point of view shot, without the close-up gaze shot. In the manipulated versions, we inserted a close-up gaze shot, preceding the object shot (of the water). Professional animation designers created and edited these shots into the film in a way that they are a perfect fit for the style of the original artwork, and the cadence of the visual sequences. Both the length of the inserted gaze shots (2 s each), and all film durations were kept constant. In a pilot study ($N = 31$) we tested the close-up shots for emotionality to ensure that the faces were perceived as neutral or sad. For the details of this pilot study, see Rooney and Bálint (2018).

2.4. Procedure

The online experiment was designed and presented with Qualtrics survey platform. Participants received a link and were asked to complete all parts of the experiment in one sitting in an undistracted environment. Participants watched a single randomly assigned version of the thirteen video clips and asked to report on their experiences and demographics, and respond to two open-ended questions. The first question asked participants to describe the story and was designed to allow for MSA-spontaneous responses (Question 1: *Please describe the story of the film scene in as much detail as possible using at least 6–10 sentences.*). The second question was designed to capture MSA-prompted using a prompt to describe the story from the target character's perspective (Question 2: *Please describe the story from the perspective of the female character, how would you describe her feelings, thoughts, and intentions? Please write at least 6–10 sentences.*). These questions were carefully designed to allow us to explore various MSA effects while minimizing demands on the participants. Question 1 contains no prompt for MSA therefore it is suitable for measuring spontaneously occurring mental state references, whereas Question 2 prompts MSA directly therefore it is suitable for assessing MSA-prompted. Once participants responded to these, they completed quantitative control measures of their experience and answered questions about their demographics. At the end of the session, participants were debriefed.

2.5. Coding procedure

2.5.1. Manual coding

MSA-spontaneous and MSA-prompted were assessed by a quantitative content-analytic method developed in prior work (Bálint, Klausch, & Pólya , 2016; Rooney & Bálint, 2018). A trained coder, blind to the experimental conditions, coded the participants' answers to the open-ended questions for the frequency of mental state references. Another independent rater coded a randomly selected ten percent of descriptions and agreement was calculated for each variable using Krippendorf's Alpha; these yielded acceptable levels of agreement (Alpha MSA-spontaneous = 0.775; Alpha MSA-prompted = 0.783).).

The manual coding was carried out as follows: In each response, explicit mental state references (i.e., mental states attributed to the female or male protagonists) were identified. Mental states attributed to the male were coded but not included in the present analysis (this character did not feature in the manipulated CU shots). Each utterance that was identified as an explicit mental state reference was placed into one of three exclusive categories: (a) *Affective mental states*: Any reference to the characters' wishes, desires, or feelings (e.g., 'anxious', 'excited', 'feeling lonely'); (b) *Cognitive mental states:* Any reference to the characters' memory function (e.g., 'forget', 'remember', 'was reminded'); knowledge (e.g., 'realize', 'understand', 'assume'); or other cognitive and metacognitive functions (e.g., 'imagine', 'accept', 'pretend'); (c) *Intentions*: Any reference to the characters' intention, aim, goal, expressed by an explicit word (e.g., 'intend', 'determined', 'attempt'), or a preposition (e.g., 'to', 'so that', 'in order to'), or a modal verb (e.g., 'have to', 'must', 'want'). Each participant was given a score for the use of mental state references for each open-ended question separately.

Length of answers was controlled for in the statistical analysis, expressing the proportion (or density) of mental state references in participants' story descriptions. In this way the proportion of mental state references is an index of the perceived relevance of the fictional character's mental states for the participant. (The detailed coding protocol is available from the corresponding author upon request).

2.5.2. Computer-aided coding

To assess cognitive and affective processing, we employed the German version of the Linguistic Inquiry of Word Count software (Tausczik & Pennebaker, 2010; Wolf et al., 2008). Participants' responses for Question 1 and 2 were coded for the Cognitive processing and Affective processing categories (see description below). The software conducts a dictionary based analysis and counts the percentage of a given category in respective of word count. For the purpose of our statistical analysis, we transformed these percentage values to frequency scores, which were then offset in the analysis by the length of the participants' responses (see 2.7 Data analysis section for details).

2.6. Measures

2.6.1. MSA-spontaneous

Individual rate for attributing mental states to the character was assessed in responses to Question 1 (*Please describe the story of the film …)* by the manual coding procedure described above. As mentioned above, Question 1 contained no prompts for MSA. Once coded, each participant's response was given a score for the frequency of mental state references, where higher scores are indicative of higher proportion of MSA-spontaneous.

2.6.2. MSA-prompted

Individual rate of attributing mental states to characters when prompted to do so was assessed through coding mental state references occurring in answers to Question 2, which prompted MSA (*Please describe the story from the perspective of the female character, how would you describe her feelings, thoughts, and intentions?*). Again all utterances were coded for explicit references to character mental states. Higher scores indicate higher proportion of mental state attribution, indicating a higher level of MSA-prompted.

2.6.3. Cognitive processing

Cognitive processing was assessed by the Cognitive mechanisms coding category of the LIWC textual analysis software (Wolf et al., 2008). The Cognitive mechanisms coding category contains the following sub-categories: (a) *cause*: reflecting on the viewers' attempt to explain something in terms of causal relations and logical patterns, or connecting reasons to effects (e.g., therefore, because, motive); (b) *insight*: reflecting on viewers' increased meaning making process, awareness or deeper understanding of a central theme (e.g., face, admit, believe); (c) *tentativeness*: reflecting on viewers' consideration of multiple meanings for certain contents (e.g., maybe, for example, consider); and (d) *certainty*: reflecting on viewers' increased assurance or lack of doubt about something (e.g., never, always, assurance). The higher frequency of cognitive mechanism words in a story description indicates active processing of the described experience as opposed to not processing the experience (Tausczik & Pennebaker, 2010; Wolf et al., 2008). Given that our goal was to explore how CU-frequency affected general cognitive processing and Question 2 prompted social cognition, we limited this measurement to Question 1 (open unprompted question).

2.6.4. Affective processing

The degree to which films elicited affected processing in participants was assessed by the Affecting processing category of the LIWC software (containing words such as "happy", "nervous", "sad", "cry", "grief", and "tense"). This category has two subcategories, positive emotions, and negative emotions. A higher level of language emotionality can indicate a higher degree of emotional engagement with the film (Tausczik & Pennebaker, 2010). Again, this procedure was only conducted on Question 1, the unprompted responses.

2.6.5. Word count

The length (word count) of free responses to open-ended questions was calculated and controlled for in the statistical analysis.

2.6.6. Controls

Gender, age, level of education.

2.7. Data analysis

Open responses were coded and group mean scores were calculated. Data were cleaned, distributions were explored, and descriptive statistics are reported in Table 2. Given the nature of the data (count data) the hypotheses were tested using Poisson regression and Negative binomial regression. Count frequency of mental state references was offset against the log transformed word count in participants' responses to account for individual response length in a way that is required for analysis of count data (Agresti, 2003). LIWC scores, which are typically returned as a proportion of participants' total word count, were transformed to the original count data to allow for the use of Poisson or Negative-binomial regression. By using word count as an offset in this way, the dependant variables were effectively transformed from a count measure of words, to a proportion of text that was characterized by the relevant variable (MSA, cognitive processing etc.).

Goodness of fit was assessed by checking the significance of Pearson Chi Square. The independent (predictor) variables were close-up frequency, facial expression of close-up, participant gender, interaction of close-up and facial expression, interaction of

Table 2
Estimated marginal means (standard deviations) of Key Variables Extracted from Viewers' Story Descriptions According the Number of Close-up Shots in the Film.

	Frequency of Close-up Shots							
	0 CU	1 CU	2 CU	3 CU	4 CU	5 CU	10 CU	Total
MSA-spontaneous (Q1)	13.3 (2.02) *n* = 26	12.90 (0.77) *n* = 177	15.27 (1.39) *n* = 67	17.49 (1.68) *n* = 67	11.46 (1.39) *n* = 56	12.37 (1.32) *n* = 67	11.24 (1.66) *n* = 35	13.3 (0.58) *N* = 495
MSA-prompted (Q2)	47.56 (4.33) *n* = 24	45.42 (1.71) *n* = 166	52.16 (3.01) *n* = 61	48.73 (3.08) *n* = 64	44.15 (3.24) *n* = 53	48.94 (3.24) *n* = 61	42.66 (3.97) *n* = 32	46.9 (1.29) *N* = 461
Cognitive Processing (Q1)	46.71 (0.98) *n* = 26	46.71 (1.51) *n* = 177	47.62 (2.49) *n* = 67	45.94 (2.76) *n* = 67	46.48 (2.86) *n* = 56	47.00 (2.64) *n* = 67	46.88 (3.51) *n* = 35	46.77 (1.10) *N* = 495
Affective Processing (Q1)	15.33 (2.16) *n* = 26	13.07 (0.78) *n* = 177	17.12 (1.50) *n* = 67	15.62 (1.59) *n* = 67	11.80 (1.42) *n* = 56	13.60 (140) *n* = 67	14.30 (1.91) *n* = 35	14.15 (0.60) *N* = 495
Word count Question 1	151.3 (48.42) *n* = 26	163.8 (68.66) *n* = 177	170.5 (95.25) *n* = 67	149.9 (76.55) *n* = 67	149.7 (61.62) *n* = 56	166.6 (75.14) *n* = 67	175.7 (76.01) *n* = 35	161.8 (73.75) *N* = 495
Word count Question 2	127.9 (63.2) *n* = 24	130.9 (77.1) *n* = 166	160.6 (149.4) *n* = 61	130.9 (77.5) *n* = 64	130.7 (138.0) *n* = 53	124.6 (66.8) *n* = 62	160.3 (119.7) *n* = 32	135.8 (99.6) *N* = 461

Note: CU = Close-up; MSA = Mental state attribution; Values are multiplied by 100 for clarity (except word count). Estimated marginal means are derived from the model that included participant age, gender and word count. 0 CU model could not include the variable of facial expression, as no face was presented.

close-up and gender. The contribution of each of these predictor variables (regression coefficients) can be tested against zero using Wald tests. Age was included as covariate.

3. Results

3.1. Preliminary analysis

There were no significant differences in the distribution of gender, $\chi 2$ (6) = 4.06. p = .67, age, F(6, 471) = 0.03, p = 1.00, and education, $\chi 2$ (12) = 14.86, p = .25, across the CU-frequency conditions. Education did not correlate with any of the dependant variables, therefore, we did not include it into the final model.

A one-way ANOVA test showed that the word count of responses to Question 1 (M = 938.66, SD = 434.43) and Question 2 (M = 782.6, SD = 577.73) were not affected by close-up frequency (p = .284, p = .236 respectively).

Descriptive statistics are reported in Table 2.

3.2. MSA-spontaneous (H1)

To answer H1, RQ1 and RQ2, we tested the effect of CU-frequency on MSA-spontaneous, and if this effect is moderated by facial expression of close-ups and gender of participants. Analysis revealed a significant effect of CU-frequency on MSA-spontaneous, Wald $\chi 2$ (5) = 14.092, p = .015. Deviation contrasts demonstrated that MSA-spontaneous positively departed from the mean for the 3 CU condition, Wald $\chi 2$ (1) = 7.31, p = .007. Corrected pairwise contrasts also demonstrated this effect, where 3 CUs significantly increased MSA compared to 1 CU (p = .012), 4 CU (p = .005), 5 CU (p = .017) and to 10 CUs (p = .009). Looking into gender differences, analysis revealed that gender moderated the effect of CU-frequency, Wald $\chi 2$ (5) = 12.02, p = .035, indicating that the effect of CU-frequency was carried by its effect on male participants. Table 2 shows, increasing the number of CUs had a more pronounced effect on male participants' MSA-spontaneous compared to females. There was no main and moderation effect of facial expression, Wald $\chi 2$ (1) = 0.94, p = .33, Wald $\chi 2$ (5) = 1.76, p = .88, respectively.

3.3. MSA-prompted (H2)

To answer H2, RQ1 and RQ2, we tested the effect of CU-frequency on MSA-prompted, and whether this effect is moderated by facial expression and gender. Analysis revealed no significant relationship of CU-frequency on MSA-prompted, Wald $\chi 2$ (5) = 6.58, p = .254, and no main and interaction effect of facial expression, Wald $\chi 2$ (1) = 0.33, p = .566, Wald $\chi 2$ (5) = 3.38, p = .642, respectively, and no interaction effect of gender, Wald $\chi 2$ (5) = 6.47, p = .263. These results support our prediction (H2) that MSA-prompted is not affected by close-up frequency in movies.

3.4. Cognitive processing (H3)

We predicted that CU-frequency would affect cognitive processing (H3), and asked if this effect is moderated by facial expression of close-up and gender of participants (RQ1, RQ2). Results showed no significant effect of CU-frequency on cognitive processing, Wald $\chi 2$ (5) = 0.34, p = .99. Facial expression had no main and moderation effect, Wald $\chi 2$ (1) = 0.55, p = .459, Wald $\chi 2$ (5) = 2.53, p = .772, respectively. Gender showed no direct and interaction effect either, Wald $\chi 2$ (1) = 0.06, p = .937, Wald $\chi 2$ (5) = 0.357, p = .996, respectively.

3.5. Affective processing (H4)

Hypothesis 4 expected that close-up frequency influences participants' affective processing, and in RQ 1 and 2 we asked if this effect is moderated by facial expression of close-ups and gender of participants. Analysis revealed no significant effect of CU-frequency on affective processing, Wald $\chi 2$ (5) = 10.168, p = .071. We have found no main and interaction effect of facial expression in CU, Wald $\chi 2$ (1) = 0.3, p = .86, Wald $\chi 2$ (5) = 2.58, p = .77, respectively, nor participant gender, Wald $\chi 2$ (1) = 0.001, p = .97, Wald $\chi 2$ (5) = 6.95, p = .225, respectively. These results reject our hypothesis predicting that CU-frequency affects affective processing.

4. Discussion

A between-subject online experiment with 13 conditions was conducted to examine the effect of close-up (CU) frequency, facial expression of CUs, and participants' gender on spontaneous and prompted MSA responses, as well as more general cognitive and affective processing in descriptions of the film story participants watched. CU-frequency significantly influenced viewers' MSA-spontaneous (H1), but had no effect on MSA-prompted (H2), and general cognitive (H3) and affective processing (H4) when describing the film story.

4.1. CU-frequency and mental state attribution (MSA)

While we observed that CU-frequency did have an effect on the proportion of spontaneous attributions of mental state to character, the relationship was not linear. Increasing the number of close-ups may not continue to elicit higher and higher tendency to use MSA, rather it suggests there is an optimal number of close-ups associated with MSA-spontaneous and moving beyond this can reduce the effect. This finding suggests that mental state attribution is not entirely a trait, rather the degree to which people attribute mental states to others seems to depend on the cues provided. Specifically, close-ups showing human faces are especially important in facilitating spontaneously occurring MSA responding. From our work, it is not possible to claim a universal optimal number of close-ups (nor do we wish to). Instead, we consider the possibility that mechanisms other than MSA are also activated by close-ups, and it is possible that they are more impactful beyond a certain frequency of close-up shots.

While results of the present study demonstrated that the frequency of CUs influenced MSA-spontaneous in viewers, it showed no effect on viewers' MSA-prompted, that is, their ability to use MSA when explicitly asked to do so. More specifically, when prompted, all groups' mean MSA scores were higher, independently of close-up frequency. This suggest that the shot scale manipulation increased viewers' tendency to spontaneously refer to the mental states of the character in an unprompted open question, but when prompted to describe mental states, all viewers did so to the same extent. Given that participants were not recruited for any specific social cognition deficits or vulnerabilities (e.g., autism), they were presumably adept at calling on these social skills when prompted. As previous research has shown that individuals with autism versus neurotypical individuals differ in the way they view and retell films (e.g., Klin, Jones, Schultz & Volkmar, 2003), future research may explore the way in which shot scale manipulations may prompt MSA within a sample of participants with social cognition deficits.

4.2. The effect of CU-frequency on cognitive and affective processing

So far we have discussed the finding that CU-frequency impacted MSA towards the character. To understand the mechanism of action behind the previously reported narrative effect on MSA, the present study also explored the effect of CU on viewers' general cognitive (H3) and affective processing (H4). Our results suggest that the effect of close-up frequency is not a general effect on cognitive and affective processing of narratives (e.g., describing the film narrative with higher frequency of emotional verbs and adjectives, for example that it was a *sad* movie), rather a specific effect on the level of spontaneously occurring mental state references to protagonists (e.g., the protagonist was *sad*). Our nuanced manual coding elucidates the relative effect of CU-frequency on viewers' MSA processes.

4.3. The effect of facial expression

The present study observed no effect of facial expression on the dependant variables (RQ1), demonstrating that showing the face of the character can be powerful in prompting MSA independently of the facial expression presented. Previous work found that sad close-ups increase MSA compared to neutral close-ups (Authors, 2018), despite using the same research material, we did not replicate these findings when using a whole animation and larger sample. In order to fully understand the effect of facial expression, further studies would benefit from including a larger variety of facial expressions and extending the work to live action films, as it is possible that the limited role of facial expression in MSA activity that was observed in the present study is specific to animated faces.

4.4. The effect of gender

The present study found no main effect of gender on MSA (RQ2), i.e., males and females exhibited similar level of MSA across conditions. Although, the effect of CU-frequency on MSA-spontaneous interacted with gender; specifically, the effects of CU were stronger for males than for females; thus males benefitted more from the visual prompt for social cognition provided from the CU shot. Previous findings on narratives and social cognition (measured by the RMET) are mixed when it comes to gender effects: Kidd and Castano (2013, 2017) found no significant differences in eight independent samples, Black and Barnes (2015) in two studies found that women performed better than men. Also, other studies content analysing verbal reports found no gender differences either (Bálint, Nagy & Csabai, 2014; Rooney & Bálint, 2018). Such mixed results may reflect the ways in which dichotomous gender identities are evolving and future research might benefit from exploring more nuanced individual differences.

4.5. Theoretical implications

These findings have implications to cultural sociology, cognitive social science, and also to the psychology of narrative processing. This study builds on the assumption that cultural practice has cognitive dimensions relevant to social cognition, and these cognitive properties have the potential to affect individuals' cognitive processes. A thought that was extensively elaborated on by Edwin Hutchins (1995) who claimed that cultural cognitive activities need to be investigated in dynamic cultural contexts as an interaction between cultural products and individuals. Cinematic narratives are designed in a cultural practice that can influence audience members' emphatic emotions, beliefs and attitudes toward fictional characters. Fictional characters in movies often represent a certain segment of society (e.g. marginalized groups). Prior research has shown that viewers' emerging reactions to fictional characters can have a transfer effect on their attitudes toward the represented group through identification (Igartua & Frutos, 2017). Our findings suggest that movies can manipulate the extent to which people are motivated to understand the underlying mental reasons of characters. It can be assumed that characters who trigger a lower level of social cognition activity will be perceived as driven by simple motivations (as opposed to complex reasons). We believe that our findings can further the understanding of how cinematographic representation influences audiences' understanding of various characters, and in turn how their attitudes are formed toward social groups.

The role of social cognition is extremely important to everyday functioning (Baron-Cohen, 2001; Baumeister & Leary, 1995; Bouchard et al., 2008; Nichols, 2001), and the prospect of increasing social cognitive abilities through narrative has immense benefits for society. This is the impetus for a growing body of work that has explored how narratives might increase social cognition. Mar's (2018) SpaCEN model proposes that this improvement in social cognition most likely occurs over repeated exposure to narratives and practice (Mar, 2018). In our study, we show effects of CUs on viewers' spontaneous use of mental state references. Here we speculate, in line with the SpaCEN model, that over time the increased tendency to spontaneously use mental state attributions trains the behaviour and generalises to everyday social interactions; we call on future research to test this claim.

Mar and Oatley (2008) and Mar (2018) proposed that readers simulate in their minds the social world and interactions described in narrative events, via an embodied mental representation of the story. If we accept that written description of film stories reflects on the viewers' mental model of a story, then our results suggest that shot scale may modulate the simulation process that occurs during film reception. In line with the Limited Capacity Model of Motivated Mediated Message Processing (LC4MP, Lang, 2000) which states that viewers' attention to visual narratives is driven by their intentions and goals, but is also automatically prompted by formal features of messages (Detenber & Lang, 2010; Lang, 2000), we propose that shot scale has the potential to accentuate characters' mental states while watching a movie, resulting in more mentalized mental representations of the story. In other words, the impact of social content presented in fictional narratives can be boosted by cinematographic design features.

These abovementioned results may help to understand the findings of Black and Barnes (2015), who demonstrated that fictional film narratives compared to documentary film narratives about scientific topics increase performance on the Reading the Mind from the Eyes test. The results of the current study offer the possibility that their experimental conditions not only differed in fictionality or genre, but also the way human figures were visualised (if there were any at all). Like the current study, future research should control for relevant cinematographic features.

This study used a novel method to investigate viewers' mental state attribution. We collected qualitative responses of story descriptions and analysed them quantitatively. The ability to represent other people's mental states has often been assessed by behavioural measures (Turner & Felisberti, 2017), whereas the involuntary mental state experiencing have been most often measured by neuropsychological measures. The majority of previous studies on social cognition and narratives measured theory of mind responses by the Reading the Mind in the Eyes Test (RMET, Baron-Cohen et al., 2001). The RMET measures a very specific ability of emotion recognition: it presents only the eye region of a number of faces and participants are asked to pick one of four emotional labels that best describe what the face is expressing. The forced-choice test, developed for assessing abilities in clinical population, prompts mental reasoning directly; therefore, it is less sensitive at high level of theory-of-mind abilities (Black, 2019). Moreover, it cannot capture spontaneously occurring mental state references, let alone the extent to which mental states are embedded in a mental representation of a narrative.

4.6. Future research and limitations

The film material and its various manipulations combined with the content analysis of free responses may also have some potential for being the bases of an advanced test of social cognition that could serve as an alternative measure for the Reading the Mind in the Eye Test. One of the main advantages of this new test would be that it prevents the problems of ceiling effects as participants can mention as many mental states as they want, furthermore it presents emotional faces in a dynamically evolving narrative as opposed to static pictures without an emotional context.

The use of only a single film as the basis for our manipulation is both a limitation and the key strength of our design. While using a single film limits the generalisability beyond this particular narrative, it allowed for strict control over extraneous variables with no cost to the aesthetic of the stimulus. This way we could use a between groups design to ensure that all participants viewed the exact same film, with only the shot scale manipulated. By using true experimental manipulation, we moved beyond the previously reported correlational studies, and by working with animation designers and filmmakers, we retained the film's artistic value and aesthetic qualities. Here we aimed to move this research beyond the laboratory-controlled studies with relatively artless visual stimuli. Experimental designs are best employed to test hypotheses of what *can* happen, rather than what *does* happen (Levitt & List, 2007). We do not claim that close-ups always increase social cognition activity, but that it can be used to do so in a designed visual narrative. This information is vital if we are to design narratives that can support the development of social skills.

The findings of the current study are in line with previous research and contribute to a body of work exploring the relationship between social cognition and narratives. Nevertheless, the point above raises the need for more work to expand the generalisability of these findings. An important next step for future research is to extend the findings to live action narratives with dialogue and interactive visual narratives, such as those embedded in video gameplay.

In our study participants first answered a non-prompting open question, then a prompting open question. To prevent confounding of the non-prompting question, the design could not allow for randomizing the question order, and so order effects were not controlled and may have influenced the outcome. We recommend that future studies using this data collection method include a control group that is only exposed to the prompting question.

The present study furthers a large body of research that links engagement with narrative and social cognition, by exploring the nature of the underlying mechanisms for such effects (e.g. Mar & Oatley, 2008, Wood et al., 2018). Specifically, we demonstrate that presenting a character in close-up can increase the spontaneous occurrence of mental state attributions towards that character. The question still remains how close-ups and verbalized mental state attributions relate to underlying social cognition processes of representing and experiencing mental states in others. It may be the case that through direct exposure to character faces and expressions, immediate embodied perceptuo-motor effects can explain both spontaneous mental state attributions, and the absence of effects on prompted mental state attributions. In this study, we did not assess the activity of these underlying processes, therefore there is no way to tell if close-ups triggered the theory of mind pathway or the embodied simulation pathway. Future work should address this question through specifically tailored neuropsychological experiments.

This work paves the way for the exploration of other types of formal features and their potential to prompt social cognition. Previously, various studies have shown that the way in which a visual message is processed can be influenced by formal features such as, for example, shot length (Cutting & Armstrong, 2016; Cutting, Brunick, DeLong, Iricinschi & Candan, 2011), camera perspective (Lassiter, Geers, Handley, Weiland & Munhall, 2002), lighting (Zettl, 2013), music (Bullerjahn & Güldenring, 1994; Tan, Spackman & Bezdek, 2007; Vitouch, 2001), sound and image intensity (Morgan et al., 2003). Future research can explore the ways in which such formal features can work in a particular narrative to prompt social cognition.

5. Conclusion

In recent years, a large body of work has demonstrated a link between exposure to fictional narratives and improved social cognition. Yet very little research has explored the mechanisms by which this effect might occur. In line with Mar's (2018) SpaCEN model and Lang's (2000) LC4MP model, the present study tested the hypothesis that formal features of a visual narrative, CU-frequency in particular, would contribute to this effect. Using a true experimental design, we demonstrate that CU-frequency affects viewers' spontaneously occurring mental state attribution towards characters in an open description of the story. When explicitly prompted to describe character mental states, CU effects disappeared, demonstrating that viewers MSA-prompted was unaffected by the frequency of CUs. The results also suggest that the effect of CU-frequency is not a general effect on cognitive or affective processing of narratives, rather a specific effect on the level of spontaneously occurring mental state attributions to protagonists. Based on these findings, previous theory and research, we propose that formal features of narratives direct viewer attention in a way that can increase the level of mental state attribution, and we speculate that multiple exposures can improve social cognition more generally. Future research can more directly test this proposal, exploring the role of formal features beyond CUs and their effect on a range of social cognition domains such as perspective taking, embodied or physiological responses and moral empathy.

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Supplementary materials

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