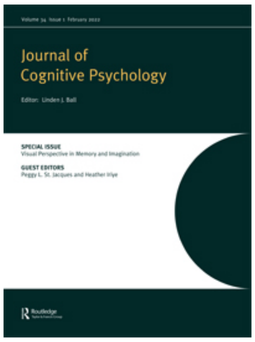

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# Out-of-body memory encoding causes third-person perspective at recall

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**ABSTRACT**
Sigmund Freud famously noted some memories are recalled with a perspective of "an observer from outside the scene". According to Freud—and most memory researchers today—the third-person perspective occurs due to reconstructive processes at recall. An alternative possibility is that the third-person perspective have been adopted when the actual event is experienced and later recalled in its original form. Here we test this hypothesis using a perceptual out-of-body illusion during the encoding of real events. Participants took part in a social interaction while experiencing an out-of-body illusion where they viewed the event and their own body from a third-person perspective. In recall sessions ~1 week later, events encoded in the out-of-body compared to the in-body control condition were significantly less recalled from a first-person perspective. An out-of-body experience leads to more third-person perspective during recollection.

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Dissociative experience; body illusion; screen memory; depersonalisation; episodic memory

## Introduction

When we remember earlier life events, our mental images of these events are envisioned from a specific visuo-spatial perspective (Brewer & Pani, 1996; Conway, 2001; Johnson et al., 1988). More than 100 years ago, Freud noted that in the majority of scenes remembered from childhood, a person recalls seeing himself/herself "as an observer from outside the scene would see him" (Freud, 1899/1953; Henri & Henri, 1897). In this type of third-person perspective at recall, the agent of the life experience becomes a passive viewer of her or his own past experience. Freud suggested that the third-person perspective was a means to distance oneself from difficult emotional life experiences that took place during childhood ("screen" memories, Freud, 1899/1953). In this view, the recall of memories from a third-person perspective was understood to require transformation of the original stored memory during the act of recollection, a view that has prevailed in the literature ever since. However, Nigro and Neisser (1983) discussed the possibility that the third-person perspective may also be adopted during encoding of events and therefore retained at recall (Nigro & Neisser, 1983). However, to the best of our knowledge, this idea has never been experimentally tested. Moreover, Nigro and Neisser referred to cognitive and mnemonic mechanisms of perspective change, such as mental imagery and instantaneous recall, and not changes in actual perception.

Episodic recall can occur from both first- and third-person perspectives, also called field and observer perspectives (Nigro & Neisser, 1983; Frank & Gilovich, 1989; Robinson & Swanson, 1993; Sutin & Robins, 2008, 2010; Siedlecki, 2015). From in a first-person perspective, the participant maintains an agent's view of the event, whereas from a third-person perspective, the participant observes her or his own body and remembered the self taking part in the event from a distance as an external observer. Approximately one-third of spontaneous recalls in adults take on a third-person perspective, with two-thirds taking the first-person perspective (Nigro & Neisser, 1983; but see Rice &

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Rubin, 2011). The fact that events can be recalled from a third-person perspective has been offered as evidence for the reconstructive capacity of our episodic memory system, which can transform events encoded from a first-person perspective. The postulated post-event reconstruction process associated with third-person perspective recall has been related to various attributes of the memory content. More frequent spontaneous third-person perspective- taking is associated with (1) highly stressful and emotionally intense events at encoding (Nigro & Neisser, 1983; Talarico et al., 2004); (2) memories associated with a high level of self-awareness such as situations where humiliation or pride were experienced (D'Argembeau & Van der Linden, 2008); (3) recall with lower vividness and weaker mental imagery (Frank & Gilovich, 1989; Berntsen & Rubin, 2006); (4) longer times between encoding and recall (the older the memory, the more often spontaneous recall takes a third-person perspective) (Nigro & Neisser, 1983; Talarico et al., 2004; Berntsen & Rubin, 2006; Karylowski & Mrozinski, 2017); (5) self-change or a discrepancy between the recalled behaviour and the present self (Libby & Eibach, 2002; Eibach et al. 2003); (6) construal level and processing style (Eibach, Libby, & Gilovich, 2003; Libby, Shaeffer, & Eibach, 2009; Libby & Eibach, 2011).

Increased frequency of recall from a third-person perspective is observed in several psychopathological conditions, making patients, as Freud put it, passive viewers of their own past experiences. Notably, major depression, which entails changes in emotional regulation (Beck, 2008) and increased self-focus (i.e. attention to the self) (Mor & Winquist, 2002) involves not only significant deficits in episodic recall of life experiences but also more frequent third-person perspective recall of past events (Lemogne et al., 2006; see also Kuyken et al., 2006; Kuyken & Moulds, 2009). Interestingly, however, positive events (see also Begovic et al., 2017) are more often remembered from a third-person perspective. In remission of depression, patients no longer show any episodic remembering deficits but still often recall positive life experiences from a third-person perspective (Bergouignan et al., 2008) with no such effect for negative life experiences. Thus, it appears as if the basic ability to recall events within a context (episodic recollection) and the visual perspective adopted at recall are affected in depression, indicating distinct neurocognitive pathological mechanisms. The increased frequency of third-person perspective in the recall of positive events has since been confirmed in dysphoria (Nelis et al., 2013; Hart-Smith & Moulds, 2019) and neurothymic (Lemogne, Bergouignan, Piolino, et al., 2009) personality traits. Anxiety, borderline disorder, schizophrenia, mood disturbances, and psychological distress are also related to the increased spontaneous third-person perspective recall of past life experiences. In these conditions, the increase in third-person perspective is not restricted to positive experiences, but is observed more generally for any type of life-experience recall (Coles et al., 2001; Stopa & Bryant 2004; Lemogne, Bergouignan, Boni, et al., 2009; Potheegadoo et al., 2013; Luchetti et al., 2014; Van den Broeck et al., 2014). The reason for these increases in the third-person perspective among clinical populations is not well understood and may vary across clinical groups according to the symptomatology of the disorder.

Most traumatized patients access their traumatic experiences from a third-person perspective (Dawson & Bryant, 2016; Kenny et al., 2009; Kenny & Bryant, 2007; McIsaak & Eich, 2004; Williams & Moulds, 2007; Williams & Moulds, 2008). This is generally interpreted as a cognitive avoidance mechanism (Kenny & Bryant, 2007; Williams & Moulds, 2007). In a very large sample of PTSD patients, the initial frequency of third-person perspective recall was related to the severity of PTSD symptoms at the time of diagnosis and 12 months later (Kenny et al., 2009). These authors suggested that increased third-person perspective-taking at recall is a vulnerability factor for psychopathology, and that any increase in third-person perspective-taking would represent an explicit transformation process (coping strategy) of shifting from a first- to a third-person perspective at the time of recall. However, these clinical studies did not assess whether encoding during the trauma occurred in a dissociated state where the natural encoding from the first-person perspective was interrupted, such as by the patient undergoing a state of depersonalisation with out-of-body experience during the traumatic event. Depersonalisation is part of the symptomatology of dissociation; an alteration in the perception and experience of the self. It includes the feeling that one is detached from and becomes an outside observer of her or his own body (Hariri et al., 2015; Graham-Schmidt et al., 2016; Cramer et al., 2020; Tuineag et al., 2020). In our view, it is unclear whether the changes in perspective during recall observed in clinical populations emerge specifically during recall (perhaps as part of a coping strategy)—or instead result from dissociative experiences *during encoding* that disrupt and modify memory creation in the first place. However, the current opinion in fundamental psychological science and clinical psychology is that the perspective is shifted at recall in line with emotional and self-regulation strategies (D'Argembeau & Van der Linden, 2006; D'Argembeau et al., 2007; D'Argembeau & Van der Linden, 2008). According to this well-established account, the third-person perspective at recall makes it possible to create *spatial and temporal* subjective distance between the past self (i.e. the bodily-self at encoding) and the current self (i.e. the bodily-self at recall). Out-of-body experiences occur as part of depersonalisation and dissociation symptomatology in various psychopathologies (such as PTSD, schizophrenia, borderline personality disorder, and bipolar disorder), as well as in healthy populations, and could make their own contribution to the perspective adopted at recall. The possible contribution of dissociative experiences during encoding (Lanius et al., 2010) to later changes in visual perspective during recall is difficult to study, both in patients and experimentally therefore, has not been given much attention in the literature (for a discussion on clinical studies, see Lanius, 2015 and Cramer et al., 2020).

Another interesting feature of perspective during recall is that people can shift their perspective even while recalling events (Faul et al., 2020; Libby & Eibach, 2002; Gu & Tse, 2016; Libby et al., 2005, 2007, 2011; Marcotti & St Jacques, 2018; Niese et al., 2019; Sekiguchi & Nonaka, 2014; Shaeffer, Libby, & Eibach, 2015; St Jacques et al., 2017; Vella & Moulds, 2014; Wallace-Hadrill & Kamboj, 2016; Williams & Moulds, 2008). For instance, if a person spontaneously recalls a memory from one perspective (e.g. the first-person perspective), she or he can then voluntarily change to the other perspective (in this example, the third-person perspective). The purpose and functions of such shifts in the healthy mind are not clear. However, this cognitive capacity suggests that mental visual images are flexible at recall and potentially subject to spatial transformation, which in turn could impact other aspects of memory. Robinson and Swanson (1993) first showed that a shift in perspective influences the emotional experience associated with recalling events (Robinson & Swanson, 1993). Interestingly, even though mental images are more vivid and clear when recalled from a first-person perspective (Frank & Gilovich, 1989; Berntsen & Rubin, 2006), a shift from a third-person perspective to a first-person perspective does not increase the emotional charge of a memory. However, the shift from a first-person to a third-person perspective does decrease the emotional intensity of a memory (Robinson & Swanson, 1993; Vella & Moulds, 2014; Sekiguchi & Nonaka, 2014; Gu & Tse, 2016; St Jacques et al., 2017). The possible link between dissociative experiences during encoding and the ease or difficulty of shifting perspective during recall has not been investigated.

For the present study, we analysed how in-body versus out-of-body perceptual experiences during event encoding influence spontaneous visual perspective at recall, and the ease or difficulty with which the perspective initially adopted can be voluntarily shifted. To experimentally manipulate the encoding perspective, we used the out-of-body illusion experimental protocol (Ehrsson, 2007; Guterstam & Ehrsson, 2012; Bergouignan et al., 2014). The out-of-body illusion is elicited by congruent visual and tactile stimulation, similar to the classic rubber hand illusion (Botvinick & Cohen, 1998; Ehrsson et al., 2004), in combination with manipulation of visual perspective by head-mounted display (HMD), that shows the live video feed from cameras placed in different locations relative to the participant's body. The illusion is thus based on multisensory integration (Stein & Stanford, 2008; Ehrsson & Chancel, 2019) and involves profound, automatic changes in the perception of the bodily self that do not depend on conscious reflection or higher cognition (Ehrsson, 2012). The bodily self is a multisensory perceptual construct of one's own body as an object distinct from the external environment (Blanke et al., 2015; Ehrsson, 2020). The bodily self represents the most fundamental aspect of self-consciousness (de Vignemont, 2018); this essential bodily experience can influence other higher cognitive aspects of self-representation (Banakou et al., 2013; Tacikowski et al., 2020), including episodic remembering (Bergouignan et al., 2014; Tacikowski et al., 2020).

In the current experiment, we used the out-of-body illusion to move the centre of bodily and spatial awareness (i.e. the bodily self) from the location of the real body to another location in the testing room, such that the participant experienced a real-life social interaction as if from outside her or his body (Ehrsson, 2007). In this condition, the participant thus observed herself or himself, the testing room, and another person in the testing room, from a third-person perspective. Importantly, she or he perceived not only her or his own body, but *also* her or his mind to be located in this extra corporeal location in direct contradiction to conceptual knowledge of the physical self (Ehrsson, 2007; Guterstam & Ehrsson, 2012; Bergouignan et al., 2014; Guterstam, Björnsdotter, Bergouignan, et al., 2015). We compared this out-of-body condition to a well-matched in-body condition, also using a HMD, where the bodily self was experienced to be in a very similar location to the real body, such that the test individual experienced the social interaction, the testing room, and the other person in the testing room from within the body in a first-person perspective (see Supplementary Figure 1). We have previously shown this out-of-body condition impairs the episodic hippocampal system, presumably by disrupting hippocampal binding mechanisms during encoding (Bergouignan et al., 2014). More precisely, ~1 week after encoding, we observed an episodic recollection deficit for events encoded out-of-body compared with those encoded in-body. Functional magnetic resonance imaging further indicated that this impairment is associated with characteristic activity in the posterior hippocampus in line with perturbation of binding mechanisms involved in encoding (Bergouignan et al., 2014). We aimed to investigate how in-body and out-of-body encoding influences visual perspective during spontaneous recall one week after the original event. We thus hypothesised that compared to events encoded in the in-body condition, events encoded during the out-of-body illusion would elicit more frequent occurrences of third-person perspective in recall. We also explored possible differences between the two encoding perspectives in terms of the difficulty of shifting perspective from the spontaneous perspective adopted at recall. In addition, we sought to investigate how the hypothesised changes in visual perspective during recall were related to the previously described episodic remembering deficit associated with the out-of-body condition (Bergouignan et al., 2014). To answer the earlier questions, we analysed behavioural data collected as part of our previous study, but never analysed. We did not include these results in our previous publication (Bergouignan et al., 2014), nor have they been presented in any other format until now.

## Method

In a previous study (Bergouignan et al., 2014), we introduced an out-of-body illusion paradigm to simulate a bodily and spatial dissociative experience during encoding of a real-life event. With the previous study, to examine the disrupting effects of the out-of-body illusion on episodic recall and hippocampal activation. Given the length of Bergouignan et al. (2014) and journal space restrictions, the behavioural data on spontaneous perspective-taking during recall, or an analysis of the difficulty of shifting that perspective were not included in the original publication.

For a more detailed description of the general methods, see Bergouignan et al., 2014, including the Supplementary material. Here, we briefly describe the experimental setup, illusion induction procedures, real-life encoding events, and episodic memory assessment. Next, we focus in greater detail on the procedures and analyses used to assess visual perspective at recall, and the difficulty the participant experiences in shifting that perspective. The behavioural experiment investigated here consisted of three phases: (1) preparation: the participants studied general knowledge documents on four different topics before the illusion manipulation; (2) the encoding of real-life events: we tested the participants on this content in a real social interaction (an oral exam) during illusion manipulation; and (3) event recall: one week later, the participants recalled the events, and we assessed the perspective adopted during recall, as well as the difficulty of shifting this perspective.

### *Participants*

We pooled data from the 64 healthy participants who participated in Experiments 1 (out-of-body 180°; mean age ± SD, 26 ± 5 years; 13 women and 19 men) and 2 (out-of-body 30°; mean age ± SD, 27 ± 6 years; 16 women and 16 men) in the original study (Bergouignan et al., 2014) to conduct a single analysis (see further details later). The perspectives associated with these two versions of the out-of-body condition are common in third-person perspective recall (Rice & Rubin, 2011). All of the volunteers provided written informed consent before participation. The Regional Ethical Review Board of Stockholm approved this study, and the experiments were conducted according to the principles expressed in the Declaration of Helsinki. The participants were students recruited from universities in Stockholm. Because episodic retrieval and visual perspective at recall can be influenced by depression, the participants were prescreened for DSM-IV Axis I disorders, using the Mini-International Neuropsychiatric Interview and the Beck Depression Inventory (BDI). The inclusion criteria were based on a BDI score of ≤ 8. None of the individuals exhibited a history of psychiatric or neurological disorders. The participants were all fluent English speakers who could communicate easily with the experimenter responsible for data collection (LB), who did not speak Swedish.

### Basic experimental setup

The encoding of sessions with life events experienced in-body or out-of-body was conducted in a specially designed testing room (3.5 m × 6 m). The participants were briefly familiarised with the room and the objects before the experiment began.

During the encoding session, the participants were seated in a chair in a relaxed position and were instructed not to move. Each participant wore a HMD (Cybermind Visette Pro PAL; Cybermind Interactive; display resolution, 640 Å∼ 480 pixels; colour displays) with a wide field of view (diagonal field of view, 71.5°). The HMD was connected to two synchronised CCTV cameras (Protos IV; Vista) placed side by side (adjusted to match the distance between the participant's eyes; 8–10 cm) and mounted on a tripod. Two pairs of cameras were mounted on tripods placed at two different locations in the room. The participants also wore a set of studio quality earphones. The earphones were connected to a pair of microphones placed inside the ear canals of an advanced dummy head microphone, which provided a rich 3D sound space of the room from the perspective of the dummy head (KU 100 dummy head audio system; Neumann artificial head stereo microphone system). This advanced microphone was placed below the tripod with mounted CCTV cameras. With this arrangement, the participant could see and hear the room and the individuals within it from two different locations, (i.e. from "within the body", the in-body condition, and from "outside of the body", the out-of-body condition). There were no noticeable delays in the video or auditory systems. All participants experienced two life events in the in-body condition and two life events in the out-of-body condition.

We controlled which pair of cameras fed video signals to the HMD worn by the participant. One set of cameras was placed just behind and slightly above the participant's head so that she or he could see the actor facing her or him from a first-person point of view from her or his actual body position (i.e. from the same perspective as if looking at the room directly without the HMD: the in-body condition, see Supplementary Figure 1A). Because of the restricted field of view with the HMD and the placement of the cameras, the participant could not see her or his real body, just the room and the actor. In Experiment 1, the other set of cameras was placed 2 m in front of the participants and was rotated 180° to face the participant directly (the 180° version of the out-of-body condition) or 1 m to the right of the participant and rotated 30°, offering a perspective of the participant from the side and the actor from the front and slightly to the side (30° version out-of-body condition) (see Bergouignan et al., 2014). In the first out-of-body perspective (180°), the participant's illusory body was placed directly behind the actor so that she or he saw the back of the actor talking to her or him; the participant's real body faced the cameras and the illusory bodily self induced by the HMD setup (Supplementary Figure 1B). In the second out-of-body perspective (30°), the participants perceived their real body from the side and the actor from the front and a little to the side (Supplementary Figure 1C). For the purpose of the present study, we considered these two versions of the out-of-body condition to be equivalent since they both involved taking a third-person perspective, produced a similarly strong illusion, and had similar effects on episodic remembering (Bergouignan et al., 2014). In the in-body condition and the two versions of the out-of-body condition, the participants always saw a clearly visible face, and the room's interior was designed to match in terms of the number and types of objects visible (e.g. the poster and the plant) (see Supplementary Figures 1A, 1B, and 1C).

### Illusion induction

Before each life event encoding session started (see next section), we elicited a multisensory illusion of being located in the place of the displaying cameras and sensing an "illusory body" at this location (Ehrsson, 2007). To this end, we delivered repetitive, synchronous, visuotactile stimulation using two small plastic rods with a rhythm of 80 bpm for 70s. One experimenter stood directly in front of the displaying cameras and moved a rod toward a point below the camera's field of view. When the rod reached this point, it corresponded visually to where the participant's chest would have been if they were sitting right behind the cameras. A second experimenter simultaneously touched the participant's actual chest, which was outside the participant's view, at the corresponding location as synchronously as possible, following audio instructions presented over earphones. Thus, the participant viewed the experimenter's arm approaching the cameras and then disappearing below the field of view; at this point, they felt a touch on their chest with a rod-like object. As in previous full-body illusion experiments (Ehrsson, 2007; Petkova & Ehrsson, 2008; Petkova, Björnsdotter, et al., 2011; Petkova, Khoshnevis, et al., 2011), this type of synchronised visuotactile stimulation produced a multisensory illusion that the approaching rod was directly touching the participant's chest and that the participant's body was located directly behind and below the cameras; this was accompanied by a reduced sense of ownership of their real physical body, which was now observed from a distance (Ehrsson, 2007; Petkova et al., 2008; Guterstam & Ehrsson, 2012; Guterstam, Björnsdotter, Bergouignan, et al., 2015; Guterstam, Björnsdotter, Gentile, et al., 2015) (see Statements 1 and 2 in the Illusion Questionnaire in Supplementary Table 1). The out-of-body illusion thus comprises a bodily illusion, a spatial illusion (place illusion), and disembodiment from the real body. The illusory experience of self-location and body ownership was maintained for the 5-min life events (Figure S1 and Paradigm Development Exp. 2) since our audiovisual experimental setup provided spatially and temporally congruent visual (HMDs) and auditory information (earphones and dummy head microphone), from the perspective of the illusory location (Bergouignan et al., 2014).

The strength of the illusory self-location and the illusory sense of body were registered at the very end of the encoding session (as described later), just after all four life events had been experienced. To this end, we repeated the induction of the out-of-body and in-body illusion conditions once more. Immediately after 70s of repeated visuotactile stimulation, the participants were asked to complete a questionnaire in which they had to record six possible perceptual effects using a 7 point visual analog scale (based on Ehrsson, 2007). Two of the questions were designed to capture the experience of illusory self-location and ownership of the illusory body, whereas the other four questions served as controls for suggestibility and task compliance (see Supplementary Figure 2 for details on statements; Ehrsson, 2007). As previously reported in Bergouignan et al. (2014), the results showed that the illusion successfully induced the out-of-body condition(s) with affirmative ratings for the illusion-related statements (Statements 1 and 2 in the Questionnaire; see Supplementary Table 1). The participants felt that the rod approaching the camera had touched their chest; they perceived their eyes and body as being in the position of the active camera in both the in-body and out-of-body conditions (see Supplementary Figure 2). In sum, the participants felt out-of-body during the out-of-body condition and in-body during the in-body condition. There was no significant difference in the intensity of their illusory bodily location and bodily experience in the in-body and the out-of-body illusion conditions; this is strong evidence for the alternative hypothesis that there was no difference in basic illusion between the in-body and out-of-body conditions (*t*-test Bayesian analysis BF10 = 12.451) (Figure 1A), allowing for comparison of otherwise equivalent conditions.

### *Encoding session with real-life events*

To create realistic, ecologically valid life events for encoding in long-term episodic memory, we worked with a professional actor to develop emotionally engaging, natural social interactions with a high degree of self-relevance (for a detailed description, see Bergouignan et al., 2014). Actors are experts in producing systematic verbal material and social interactions in a believable, consistent manner while respecting the contents of their scripts across multiple performances; they are also well trained to respond to participant behaviour in a natural way.

With the actor's assistance, we developed four separate episodes, which we here refer to as "life events". The participants were informed that they would take part in a memory experiment, and were given written material to study for 10 minutes directly prior to the start of the experiment. They were then led into the testing room, seated, and equipped with the HMD and earphones. After illusion induction (see above), the "professor" (the actor) entered the testing room and initiated the knowledge evaluation procedure. The actor, playing the professor, did not know which of the two pairs of cameras was actively connected to the participants' HMD and was thus unaware of the current experimental condition. Each life event had a mean duration of 5 min. Before the four life events commenced, an initial "introductory event" was enacted that allowed participants to become used to the HMD and to become acquainted with the professor. This introductory task, also gave the actor an opportunity to ask the participants personal questions, information that we included in the subsequent scripted episodes to enhance the self-relevance of the material.

Each episode took the form of a "performance theater" with the "professor" (the actor) giving the student (the participant) an oral exam. In these four separate episodes, the professor evaluated the four different areas of knowledge the participant had briefly studied. These episodes corresponded to the four life events of the encoding session: an oral examination on geopolitics (Life event 1); an oral examination on mechanics (Life event 2); an oral examination on neuroscience (Life event 3); and an oral examination on poetry (Life event 4). These episodes were mildly emotional with a negative valence, as the "professor" was sometimes eccentric, and the students wanted to perform well on the oral exams. We included participants' person information in the life events, such as, information about their relationship to a close friend, to enhance the self-relevance of the material. The actor (professor) used a semi-structured script that allowed for some improvisation related to the student's verbal responses, personal information, and knowledge. The students were not informed that the "professor" was played by an actor. During the "knowledge test", as the "professor" examined the student's knowledge in each specific areas related to the study materials, the student could speak with the "professor" and respond to his questions. After each event, the "professor" left the room, while the experimenter entered the room to ask questions about the participants' experience of the oral exam (assessing performance and emotion at encoding, see Bergouignan et al., 2014).

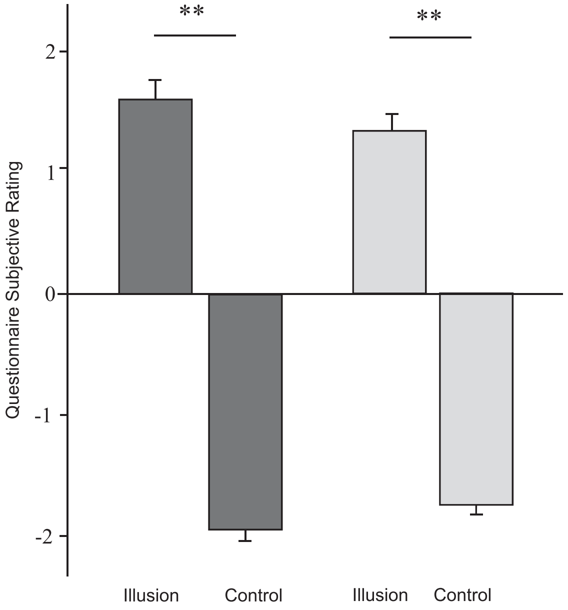

**Figure 1.** Body illusion strength as assessment with the questionnaire ratings.

### *Retrieval session*

The retrieval session occurred 1 week (Conway, 2009) after the life event encoding sessions to ensure long-term memory storage. The retrieval session took place in a different room from that used for the memory encoding experiments. This testing room was a small, soundproof testing room without any of the furniture, HMD, cameras, or other research equipment used in the encoding sessions. The "professor" was not present. The participant sat in front of a table next to the experimenter. The four main events were assessed in a randomised order. The average total duration of the retrieval session was 60 minutes.

Long-term episodic retrieval of life events has been tested with a semi-structured interview, based on a widely used memory task (Piolino et al., 2004, 2006; Lemogne et al., 2006; Noulhiane et al., 2007; Piolino, Chetelat, et al. 2007; Bergouignan et al. 2008). This task (see, e.g. Bergouignan et al., 2014) assesses episodic recall ability for specific life events. The participants were not informed or cued regarding the out-of-body or in-body conditions, the experimenter was also unaware of these conditions. The participants were only cued about which of the four topics covered on the oral exam they should address, and were asked to recall that life event as vividly as possible, reporting every detail until they could remember no further details. After full retrieval of each life event, the participants were requested to provide a subjective report of their state of consciousness during retrieval (see Bergouignan et al., 2014). More precisely, we assessed their episodic recall in terms of four main dimensions—"emotion", "what", "where", and "when"—using the remember/know paradigm (Tulving, 1983; Gardiner et al., 1998). The participants had to justify each "remember" response by providing a specific detail (see Piolino, Desgranges, et al., 2007; Piolino et al., 2004, 2006; Lemogne et al., 2006; Noulhiane et al., 2007; Bergouignan et al., 2008). The remember/know paradigm requires subjects to provide a "remember" response if retrieval is accompanied by the recollection of specific experiences present at encoding, or a "know" response if retrieval is achieved without access to information from the initial encoding context. The participants also had to indicate whether they simply guessed the recalled event. The remember score was defined as the number of "remember" responses divided by the number of "remember" or "know" responses (we discarded "remember" responses without associated details from the analysis). We computed separate remember scores for each domain of the episode: emotional remembering factual remembering, spatial remembering, and temporal remembering. We computed the global remember score as the average score of the four domain-specific remember scores (See Bergouignan et al., 2014 for more details).

Next, we assessed participant's perspective at recall in three stages. First, after each event recall, participants had to indicate, on a continuous scale, the visual perspective they had adopted at recall (Rice & Rubin, 2009). The scale ranged from 0 to 100, with 0 corresponding to a completely third-person perspective, and 100 corresponding to a completely first-person perspective. We chose a dimensional scale for two main reasons. Previous studies have shown some limitations with categorical assessment since memories are often not recalled from either 100% first-person or 100% third-person perspectives (see Rice & Rubin, 2009). Additionally, this approach gave participants the option to respond in a way that would reveal if they experienced more than one perspective in a particular memory (Huebner & Fredrickson, 1999; Piolino et al., 2004, 2006; Piolino, Desgranges, et al., 2007; Lemogne et al., 2006; Noulhiane et al., 2007; Bergouignan et al., 2008). Second, we asked the participants to make a categorical choice, defining the recall of each event as taking either a first- or third-person perspective. In this case, we instructed the participants to choose the dominant perspective in cases where memories actually contained a mix of different perspectives.

Third, for each event, they then had to shift perspective from the spontaneous categorical perspective they had reported taking to the other perspective. Therefore, if a participant had spontaneously viewed the remembered scene from a first-person perspective she or he then had to switch to the third-person perspective, and vice versa. They were then asked to rate the difficulty of making that perspective shift using a continuous scale from 0 to 100 (0: not difficult at all; 100: extremely difficult). We examined the difference in this difficulty and its link with the episodic score. We did not further scrutinise the possible effects of the direction of this perspective shift across the four possible scenarios due to power issues [i.e. (i) in-body encoding, initial recall from third-person perspective; the shift from third to first-person perspective; (ii) in-body encoding, initial recall from the first-person perspective, the shift from first to third-person perspective; (iii) out-of-body encoding, initial recall from the third-person perspective, the shift from third to the first-person perspective; (iv) out-of-body encoding, initial recall from the first-person perspective, the shift from first to the third-person perspective.]

Before commencing with testing recall of real-life events, the assessments were first performed with a practice cue to ensure full understanding of the process.

## Results

### Encoding condition

We hypothesised that life events encoded from a third-person perspective in the out-of-body condition would elicit more third-person perspective responses during recall than events encoded from the first-person perspective during the in-body condition. The in-body data were not normally distributed, with responses highly skewed towards a first-person perspective (above 0.9). We thus applied a Mann–Whitney $U$ test to the dimensional first-person perspective scale. This revealed a significant difference between the in-body and out-of-body conditions ($Z = -2.960$; $p = .003$, effect size $r = .37$). Out-of-body experiences were significantly less often spontaneously recalled from a first-person perspective, that is, significantly more often recalled from a third-person perspective. A dimensional first-person perspective was taken in 72.44% (error type: 2.19) of in-body event recalls and 56.67% (error type: 1.72) of out-of-body event recalls (see Figure 2(A), see also supplementary Figure S3).

The results from the categorical assessment corroborated those from the dimensional assessment. The distribution of the categorical data for the two conditions did not follow a normal distribution. Descriptively, we observed scores of either 0, 0.5, or 1 in the out-of-body condition, but only scores of 0.5 or, more frequently, 1 in the in-body condition. We computed a Mann–Whitney *U* test on the categorical response of a first-person perspective. The out-of-body condition was associated with significantly less recall in the first-person perspective than the in-body condition ($Z = -2.77$, $p = .006$; effect size $r = .12$). Categorical assessment showed participants adopted a first-person perspective in 80.16% (error type: 3.4) of in-body experiences and 64.29% (error type: 4.7) of out-of-body experiences (see Figure 2(B)).

### *Encoding condition and difficulty of shifting perspective*

We found a normal distribution in difficulty ratings for shifting perspective in the in-body (but not the out-of-body) condition. We observed no significant differences in the difficulty of shifting perspective from a spontaneous perspective during recall across the two conditions (Mann–Whitney *U* test on difficulty of shifting perspective, $Z = -0.360$, $p = .719$, effect size $r = .002$) (see Figure 3).

### *Remembering and first-person perspective*

The literature on perspective taking at recall predicts that decreases in remember scores would be associated with decreased adoption of first-person perspective for all events in both conditions. However, we did not find a significant relationship between how well a participant remembered events (remember score during recall) and spontaneous perspective at recall (dimensional perspective scores). Both the remember score and the dimensional perspective scores were normally distributed (Shapiro: $p > .29$). The dimensional perspective score did not correlate with the remember score ($r = .044$, $p = .735$, effect size $r^2 = .0019$) (see Figure 4(A)). Bayesian factor analysis (BF10 = 0.248) supported this evidence for the null hypothesis. We derived similar results for the categorical first-person perspective (the scores were not normally distributed, Spearman correlation with remember score = 0.046; $p = .721$, effect size $r^2 = .0021$; see Figure 4(B)). A Bayesian factor robustness check confirmed the null hypothesis (BF10 = 0.155). We can therefore conclude that the differential effects of in-body and out-of-body encoding on spontaneous visual perspective during recall cannot simply be explained by hypothesising that the out-of-body condition disrupts the episodic system (Bergouignan et al., 2014). To check this with a supplementary analysis, we assessed the correlation between the difference in remember scores for in-body and out-of-body encoding, and the difference in the dimensional perspective scores between these two conditions. There was no correlation between condition-specific changes in remember

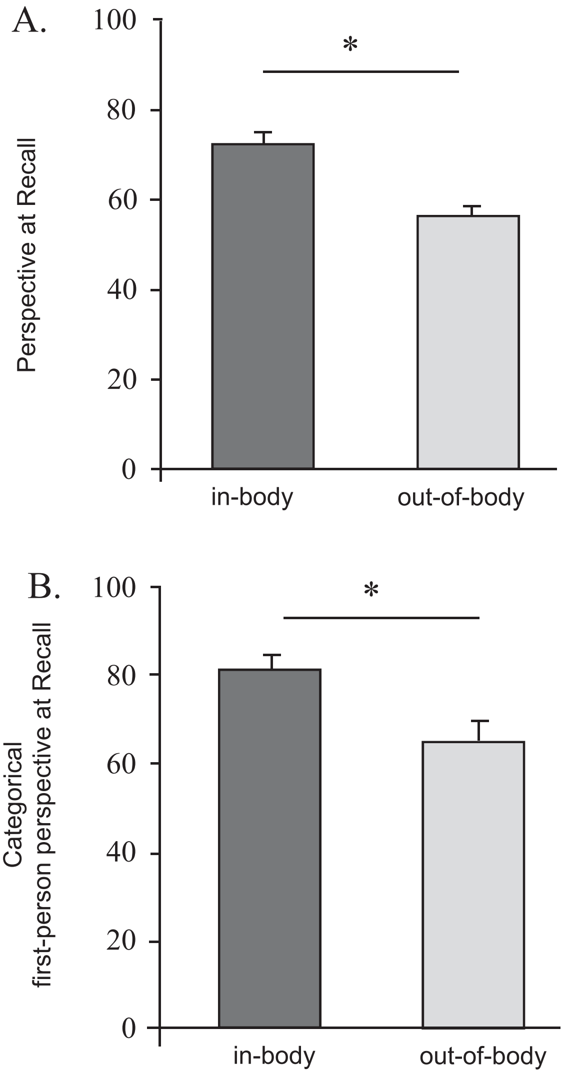

**Figure 2.** Effect of out-of-body encoding on first-person perspective at recall: (A) Visual perspective at Recall on the dimensional scale; (B) Visual perspective at Recall on categorical assessment.

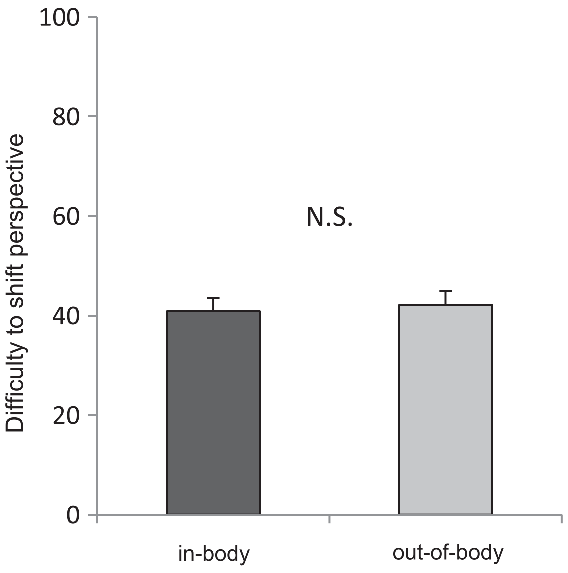

**Figure 3.** No effect of body condition on the difficulty in shifting perspective.

scores and condition-specific changes in the dimensional perspective ($r = .117$, $p = .351$, effect size $r^2 = .0137$; Bayesian factor analysis BF10 = 0.235; see Figure 4(C)).

However, the difficulty of shifting perspective was significantly correlated with the remember score. The better participants recollected an event, the less difficult they found it to shift their perspective (both conditions: $r = -.595$, $p < .001$, effect size $r^2 = .354$; out-of-body: $r = -=.618$, $p < .001$, effect size $r^2 = .382$; in-body: $r = -.507$, $p < .001$, effect size $r^2 = .257$) (see Figure 5(A,B); see also supplementary Figure S4 for details). In other words, the better an episodic memory was recollected, and the more vividly it was relived, the easier it was to shift perspective for events encoded both in-body and out-of-body.

Similarly, when assessing correlations between the difference in the remember scores for the in-body (versus the out-of-body) condition, and the difference in the difficulty of shifting perspective in the in-body (versus the out-of-body) condition, we found that the greater the remembering difference between the two conditions, the smaller the difference in the difficulty of shifting perspective; this relationship explained 62% of the variance in the difficulty difference ($r = -.62$; $p < .001$, effect size $r^2 = .38$; see Figure 5(C)).

## Discussion

For the present study, we used a perceptual illusion in healthy individuals during a real-life social event to simulate an out-of-body dissociative experience. This approach allowed us to test the hypothesis that adopting a third-person perspective at recall can also depend directly on the perspective experienced at encoding. Our main finding supported this hypothesis. At recall, events encoded during the out-of-body illusion showed significantly less spontaneous first-person perspective than events encoded in the in-body condition. This condition-specific effect on visual perspective was not related to episodic recollection (as verified by remember scores), suggesting that the increase in third-person perspective at recall for out-of-body events was not due to lower remember scores or less vivid memories. Instead, our results imply that the perspective from which the self and world are perceived during the encoding of events directly influences the perspective spontaneously adopted at recall. This outcome advances our knowledge on the relationship between the sense of bodily self and memory, and offers a plausible new hypothesis for why individuals suffering from dissociative experiences (such as depersonalisation) often exhibit a reduction in first-person perspective at recall for these memories.

Under normal conditions, an individual experiences the world from the perspective of her or his physical body; her or his centre of awareness, or self, is located inside that physical body (Blanke et al., 2015; de Vignemont, 2018; Ehrsson, 2007; Petkova & Ehrsson, 2008; Petkova, Björnsdotter, et al., 2011). This sense of owning a body in space defines the egocentric reference frames used to generate spatial representations of the external environment (Burgess, 2006; Vogeley & Fink, 2003; Ehrsson et al., 2004; Vogeley et al. 2004; Holmes & Spense, 2005; Burgess, 2006; Van der Hoort & Ehrsson, 2014; Guterstam, Björnsdotter, Bergouignan, et al., 2015, Guterstam, Björnsdotter, Gentile, et al., 2015). For the present study, we used a multisensory perceptual illusion to relocate this basic sense of bodily self to a location outside the physical body. Thus, our results provide insight into the link between spatial body perception and the visual perspective of the recalled event. The multisensory body representation that underpins the core bodily self is produced through the continuous integration of information from multimodal sensory inputs at the level of cortical multisensory association areas (Blanke et al., 2015; Guterstam, Björnsdotter, Bergouignan, et al., 2015; Petkova et al., 2011; Preston & Ehrsson, 2016). This represents

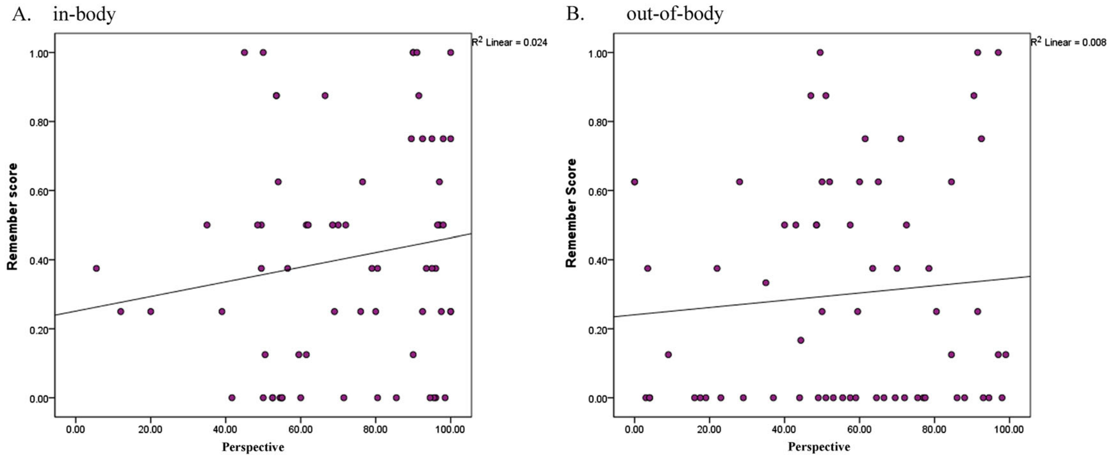

**Figure 4.** Remember score and first-person perspective at recall: (A) No significant correlation for in-body; (B) No significant correlation for out-of-body.

a major advantage over virtual reality experiments conducted using avatars, where the sense of bodily self and its location in space is not explicitly controlled and manipulated, and illusory out-body experiences are not elicited as in the current study (Bréchet et al., 2020; Iriye & St. Jacques, 2020; Mooren et al., 2016). Our experimental manipulation consisted of spatially and temporally correlated visual, auditory, and somatosensory signals (Bergouignan et al., 2014; Bergstrom et al., 2017; Ehrsson, 2007; Guterstam & Ehrsson, 2012), which caused changes in the central perceptual construct of the participant's own body in space. In a recent experiment, Iriye and St. Jacques (2020) assessed the effect of visual perspective when encoding two types of virtual reality designs. In the first case, the observed agent, seen from the third-person perspective, did not look like the participant; in the second experiment, the observed agent visually resembled the participant. The first case did not induce any visual perspective effect at recall, but a trend towards an effect emerged when the virtual agent looked like the participant. However, the interpretation of this effect with respect to perspective at encoding is not so straightforward, and these conditions are quite different from the ones used in the present study when participants experienced a full-body illusion, with the associated shifts in self-location, body ownership, and visual perspective to the out-of-body location (Bergouignan et al., 2014; Bourdin et al., 2017; Ehrsson, 2007; Guterstam & Ehrsson, 2011; Guterstam, Björnsdotter, Bergouignan, et al., 2015; Guterstam, Björnsdotter, Gentile, et al., 2015). Critically, the out-of-body illusion used here is a perceptual illusion that simulates critical aspects of a dissociative experience: it creates a spatial dissociation between the location of the subjective self and the location of the physical body. In the current memory study, this fundamental change in subjectively experienced perspective affected the spontaneously adopted perspective when events were recalled a week later. We suggest the out-of-body dissociative experience in our setting influenced the perspective adopted at recall because the memory was created from the multimodal perspective of the illusory self-location (where the body was seen and sensed to be). Even though the illusion led to inconsistencies in egocentric information processing among the various multisensory, emotional, social, conceptual representations of the self—and this could impact hippocampal binding mechanisms and lead to the kind of episodic memory impairment reported in our previous paper—the current analysis revealed more spontaneous recalls from the third-person perspective, probably because the actual events were experienced and encoded from this perspective in the out-of-body condition.

Traditionally, studies on visual perspective have tended to see memories as taking either a first-person or third-person perspective. However, more recent work has repeatedly validated the finding that memories tend to include a graded mix of views from different perspectives. We found a robust out-of-body effect on visual perspective when participants assessed perspective both categorically and on a dimensional scale. Future studies on out-of-body encoding should collect data on

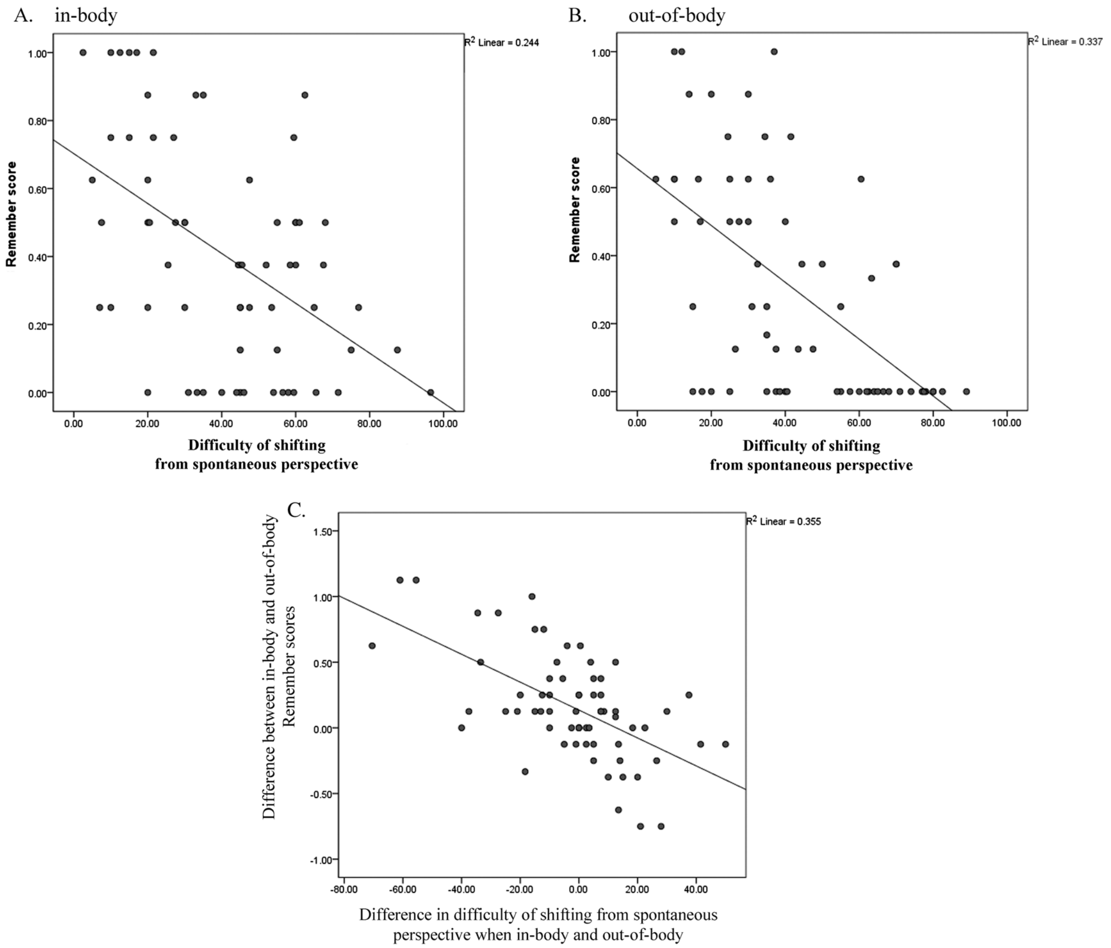

**Figure 5.** Remember score and Difficulty of shifting from spontaneous perspective at recall: (A) in-body; (B) out-of-body. (C) Correlation between the difference in the Remember scores for the in-body minus out-of-body conditions, and the difference in the Difficulty of shifting perspective scores for the in-body minus out-of-body conditions.

the precise spatial origin of the third-person perspective during recall. Does it correspond to the precise location of the illusory self during the out-body illusion or take on another third-person perspective within the scene? If from another vantage point, do participants always only see the veridical physical self during third-person recollection or perhaps also sometimes see two selves: the disembodied physical self and the embodied "invisible self" at the illusory out-of-body location?

Previous memory literature on healthy participants reports that one-third of memories are spontaneously recollected from a third-person perspective (Nigro & Neisser, 1983). Our data corroborate these findings with approximately two-thirds of in-body memories recall in a first-person perspective. This number dropped to about half in the out-of-body condition. Thus, the in-body condition, which also entailed wearing the HMD, did not seem to affect perspective at retrieval. This is helpful in interpreting our results because it suggests that the condition-specific difference we observed was only due to body encoding and did not reflect general experimental procedures related to the use of VR technology. Later, we outline three possible explanations for the specific effects of out-of-body encoding on visual perspective at recall that we have reported.

First, the effect could be an indirect consequence of a general impairment of episodic memory caused by the out-of-body illusion during encoding, as reported in Bergouignan et al., 2014. Indeed, we know that less vivid memories are more often retrieved from a third-person perspective (Berntsen & Rubin, 2006; Frank & Gilovich, 1989), because such memories are less vivid, contain fewer details, and are more spatiotemporally disorganised (as described in Bergouignan et al., 2014). However, we did not find any significant relationship between the degree of impairment in episodic recall (Remember score) and reductions in first-person perspective in the out-of-body compared to the in-body condition. This is noteworthy because if memory deficits mediated increased recall from a third-person perspective, then we should have found a significant correlation between Remember scores and the visual perspective adopted at recall. We found no such relationship; in fact, our Bayesian analysis provided evidence in favour of the null hypothesis of a lack of relationship (see Results). This was also true for the Remember subscores (see Supplementary Results). In sum, the out-of-body effect on visual perspective at recall is unlikely to be explained by a deficit in remembering.

Our results are instead coherent with a second possible explanation: the condition-specific effect on perspective at recall is due to a natural tendency to remember events from the perspective that such events were originally perceived and the associated memories first created. Because encoding typically occurs in-body, providing perception from the first-person perspective from the real body, this results in more first-person perspective recall of a situation in healthy individuals. However, in the out-of-body illusion condition, the real body was perceived from a third-person point of view, so participants reported more third-person perspectives on their real body during recall. Thus, our results provide empirical support for the conclusion that there is a natural tendency to recall memories from the same perspective in which they were originally experienced and perceived during encoding.

Finally, we should mention a third more speculative explanation: that the *similarity* or *difference* in perspective at encoding and recall matters, and not only the original perspective taken during encoding per se. According to this view, if the perspective taken at recall and encoding are the same, there will be more first-person perspective during recall. If the perspectives taken are different, there will be less first-person perspective. Because participants were "in their body" during the recall session, and this perspective was different from the visual third-person perspective adopted during the out-of-body encoding condition, this difference could lead to a reduction in first-person perspective recall. This last view is more speculative and would predict that if both encoding and recall took a third-person perspective, this would lead to a more first-person perspective recall, which is unlikely to happen. Future studies could test this hypothesis by replicating the current study but having participants recall events while experiencing both the in-body and out-of-body conditions. A $2 \times 2$ design of this kind would also help establish whether it is only *perspective at encoding* that determines perspective at recall or if recall is also influenced by dissociation from the body at recall.

A second intriguing finding is the independence of the effects of the out-of-body condition on remembering and on perspective. This independence has been seen in clinical populations (see Introduction, also see Bergouignan et al., 2008) and was also observed when assessing the Remember subscores: Remember emotion, Remember facts, Remember space, and Remember time (see supplementary Results). The link between episodic memory decrease and third-person perspective in the literature could be part of the semantisation process of the memory. This commonly happens with the repetition of episodic recall or passage of time. This effect could be present for the in-body encoded experiences but out-of-body encoded events retrieved from a third-person perspective can be predicted to stay locked into a third-person perspective with repetition or passage of time, without being part of a semantisation process.

A third important finding from the current data relates to the difficulty or ease with which participants were able to voluntarily change perspective during recall when instructed to do so by the experimenter. In both conditions, we found that the weaker the episodic quality of the recall, i.e. the lower the Remember score, the more difficult it was for a participant to shift their first spontaneously adopted perspective in the recall session. In other words, the better the event was remembered, the easier it was to shift perspective at recall. However, this was true for both in-body and out-of-body conditions with no significant difference between the conditions. It is possible that the ease of shifting perspective is closely related to episodic recall due to the involvement of cortical areas in the episodic hippocampal system. Recent research has determined that perspective shifts are carried out in the posterior parietal cortex and precuneus (St Jacques et al., 2017). The mechanism behind the finding that higher Remember scores correlate with facilitation of perspective shift could come from a boost in hippocampal activity leading to greater hippocampo-precuneus connectivity. Although a previous imaging study has linked changes in hippocampal and right posterior parietal activation (Guterstam, Björnsdotter, Bergouignan, et al., 2015) as well as hippocampo-retrosplenial cortex connectivity (Guterstam, Björnsdotter, Gentile, et al., 2015) to the integration of body ownership and illusory self-location in the out-of-body illusion, we found no evidence that this illusory experience had a direct impact on the difficulty of shifting perspective during recall.

Our study can provide a new way of thinking about how a person going through a trauma experiences dissociation, including out-of-body experiences and depersonalisation, and why they subsequently exhibit less first-person perspective recall of the traumatic event (Williams & Moulds, 2007). Cooper et al. (2002) found that prostitutes who reported dissociating during a traumatic experience were more likely to retrieve memories of that trauma from a third-person perspective; however, there were no effects of trait dissociation. Other studies have found that, among individuals with strong depressive affect, high dissociators tended to retrieve intrusive memories from the third-person perspective (Williams & Moulds, 2007). There has been no direct assessment of the contribution that depersonalisation or out-of-body experiences make to such memory disturbances. A recent study by Cramer et al. (2020) showed the centrality of depersonalisation in the symptomatology network of PTSD. It is essential that future studies investigate links between dissociative symptoms at encoding and the quality of memories for traumatic experiences at recall, including whether recalls are characterised by a third-person perspective.

Using an experimental manipulation which simulated the perceptual and perspective changes that occur in dissociative states and depersonalisation, we showed a causal relationship between an out-of-body experience during encoding and increased third-person perspective at recall. It has been suggested that dissociation is a major vulnerability factor for psychopathology (Bryant, 2003; Kenny & Bryant, 2007; Punamäki et al., 2005) so this aspect of dissociation deserves to be more considered in future studies. This patho-neurocognitive mechanism could also be the target of future research into treatment strategies for individuals suffering from dissociative symptoms and depersonalisation across a wide range of psychiatric conditions and disorders. We here suggest that dissociative out-of-body encoding during traumatic experiences drives, at least in part, an increase in third-person perspective recall in clinical populations (Begovic et al., 2017; Bergouignan et al., 2008; Butler & Rice, 2016; Coles et al., 2001; Dawson & Bryant, 2016; Hart-Smith & Moulds, 2019; Heyes et al., 2017; Kenny & Bryant, 2007; Kenny et al., 2009; Kuyken & Howell, 2006; Kuyken & Moulds, 2009; Kuyken et al., 2006; Lemogne et al., 2006, 2009; Luchetti et al., 2014; McCarroll, 2017; McIsaak & Eich, 2004; Nelis et al., 2013; Pearson et al., 2013; Potheegadoo et al., 2013; Travers-Hill et al., 2017; Stopa & Bryant, 2004; Van den Broeck et al., 2014; Williams & Moulds, 2007, 2008). Based on our results we speculate that providing in-body re-exposure could help ensure proper re-encoding of past traumatic experiences (Frewen et al., 2015; Lanius, 2015).

The influence of the in-body versus out-of-body conditions on the visual perspectives taken at recall we established here suggests a strong link between ongoing perceptual experiences of the spatial relationship between one’s own body and the world during encoding and the perspectives on visual imagery adopted at recall. This empirical observation may explain “screen memories”, with their detached view of traumatic experiences. In this interpretation, spatial dissociation from the physical self would take place at the very moment of encoding and then cause third-person perspective at recall. This appears to be a viable alternative to the classical explanation that cognitive transformation only takes place later in the act of recollection. Our findings could be further extrapolated in the case of real-life traumatic memories: out-of-body experiences may be a means to distance oneself from unpleasant life experiences as they unfold, leading to the increased passive viewing of the self in third-person perspective at later recall.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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## References

Banakou, D., Groten, R., & Slater, M. (2013). Illusory ownership of a virtual child body causes overestimation of object sizes and implicit attitude changes. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(31), 12846–12851. https://doi.org/10.1073/pnas.1306779110

Beck, A. T. (2008). The evolution of the cognitive model of depression and its neurobiological correlates. *American Journal of Psychiatry*, *165*(8), 969–977. https://doi.org/10.1176/appi.ajp.2008.08050721

Begovic, E., Panaite, V., Bylsma, L. M., George, C., Kovacs, M., Yaroslavsky, I., Baji, I., Benák, I., Dochnal, R., Kiss, E., Vetró, Á, Kapornai, K., & Rottenberg, J. (2017). Positive autobiographical memory deficits in youth with depression histories and their never-depressed siblings. *The British Journal of Clinical Psychology*, *56*(3), 329–346. https://doi.org/10.1111/bjc.12141

Bergouignan, L., Lemogne, C., Foucher, A., Longin, E., Vistoli, D., Allilaire, J. F., & Fossati, P. (2008). Field perspective deficit for positive memories characterizes autobiographical memory in euthymic depressed patients. *Behaviour Research and Therapy*, *46*(3), 322–333. https://doi.org/10.1016/j.brat.2007.12.007

Bergouignan, L., Nyberg, L., & Ehrsson, H. H. (2014). Out-of-body-induced hippocampal amnesia. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(12), 4421–4426. https://doi.org/10.1073/pnas.1318801111

Bergstrom, I., Azevedo, S., Papiotis, P., Saldanha, N., & Slater, M. (2017). The plausibility of a string quartet performance in virtual reality. *IEEE Transactions on Visualization and Computer Graphics*, *23*(4), 1352–1359. https://doi.org/10.1109/TVCG.2017.2657138

Berntsen, D., & Rubin, D. (2006). Emotion and vantage point in autobiographical memory. *Cognition and Emotion*, *20*(8), 1193–1215. https://doi.org/10.1080/02699930500371190

Blanke, O., Slater, M., & Serino, A. (2015). Behavioral, neural, and computational principles of bodily self-consciousness. *Neuron*, *88*(1), 145–166. https://doi.org/10.1016/j.neuron.2015.09.029

Botvinick, M., & Cohen, J. (1998). Rubber hand's `feel´ touch that eyes see. *Nature*, *391*(6669), 756. https://doi.org/10.1038/35784

Bourdin, P., Barberia, I., Oliva, R., & Slater, M. (2017). A virtual out-of-body experience reduces fear of death. *PLoS One*, *12*(1), e0169343. https://doi.org/10.1371/journal.pone.0169343

Brewer, W. F., & Pani, J. R. (1996 September). Reports of mental imagery in retrieval from long-term memory. *Consciousness and Cognition*, *5*(3), 265–287. https://doi.org/10.1006/ccog.1996.0019

Bréchet, L., Hausmann, S. B., Mange, R., Herbelin, B., Blanke, O., & Serino, A. (2020). Subjective feeling of re-experiencing past events using immersive virtual reality prevents a loss of episodic memory. *Brain and Behavior*, *10*(6), e01571. https://doi.org/10.1002/brb3.1571

Bryant, R. A. (2003). Early predictors of posttraumatic stress disorder. *Biological Psychiatry*, *53*(9), 789–795. https://doi.org/10.1016/S0006-3223(02)01895-4

Burgess, N. (2006). Spatial memory: How egocentric and allocentric combine. *Trends in Cognitive Sciences*, *10*(12), 551–557. https://doi.org/10.1016/j.tics.2006.10.005

Butler, A. C., & Rice, H. J. (2016 May). Visual imagery in autobiographical memory: The role of repeated retrieval in shifting perspective. *Consciousness and Cognition*, *42*, 237–253. https://doi.org/10.1016/j.concog.2016.03.018

Coles, M. E., Turk, C. L., Heimberg, R. G., & Fresco, D. M. (2001). Effects of varying levels of anxiety within social situations: Relationship to memory perspective and attributions in social phobia. *Behaviour Research and Therapy*, *39*(6), 651–665. https://doi.org/10.1016/S0005-7967(00)00035-8

Conway, M. A. (2001). Sensory-perceptual episodic memory and its context: Autobiographical memory. *Philosophical Transactions of the Royal Society of London B Biological Sciences*, *356*(1413), 1375–1384. https://doi.org/10.1098/rstb.2001.0940

Conway, M. A. (2009). Episodic memories. *Neuropsychologia*, *47*(11), 2305–2313. https://doi.org/10.1016/j.neuropsychologia.2009.02.003

Cooper, B. S., Yuille, J. C., & Kennedy, M. A. (2002). Divergent perspectives in prostitutes' autobiographical memories: Trauma and dissociation. *Journal of Trauma & Dissociation*, *3*(3), 75–95. https://doi.org/10.1300/J229v03n03_05

Cramer, A. O. J., Leertouwer, I., Lanius, R., & Frewen, P. (2020). A network approach to studying the associations between post-traumatic stress disorder symptoms and dissociative experiences. *Journal of Traumatic Stress*, *33*(1), 19–28. https://doi.org/10.1002/jts.22488

D'Argembeau, A., Ruby, P., Collette, F., Degueldre, C., Balteau, E., Luxen, A., Maquet, P., & Salmon, E. (2007). Distinct regions of the medial prefrontal cortex are associated with self-referential processing and perspective taking. *Journal of Cognitive Neuroscience*, *19*(6), 935–944. https://doi.org/10.1162/jocn.2007.19.6.935

D'Argembeau, A., & Van der Linden, M. (2006 June). Individual differences in the phenomenology of mental time travel: The effect of vivid visual imagery and emotion regulation strategies. *Consciousness and Cognition*, *15*(2), 342–350. https://doi.org/10.1016/j.concog.2005.09.001

D'Argembeau, A., & Van der Linden, M. (2008). Remembering pride and shame: Self-enhancement and the phenomenology of autobiographical memory. *Memory (Hove, England)*, *16*(5), 538–547. https://doi.org/10.1080/09658210802010463

Dawson, K. S., & Bryant, R. A. (2016). Children's vantage point of recalling traumatic events. *PLoS One*, *11*(9), e0162030. https://doi.org/10.1371/journal.pone.0162030 de Vignemont, F. (2018). *Mind the body: An exploration of bodily self-awareness*. Oxford University Press.

Ehrsson, H. H. (2007). The experimental induction of out-of-body experiences. *Science*, *317*(5841), 1048. https://doi.org/10.1126/science.1142175

Ehrsson, H. H. (2012). The concept of body ownership and its relation to multisensory integration. In B. E. Stein (Ed.), *The new handbook of multisensory processes* (pp. 775–792). MIT Press.

Ehrsson, H. H. (2020). Multisensory processes in body ownership. In K. Sathian & V. S. Ramachandran (Eds.), *Multisensory perception: From laboratory to clinic* (pp. 179–200). Academic Press.

Ehrsson, H. H., & Chancel, M. (2019). Premotor cortex implements causal inference in multisensory own-body perception. *Proceedings of the National Academy of Sciences of the United States of America*, *16*(40), 19771–19773. https://doi.org/10.1073/pnas.1914000116

Ehrsson, H. H., Spence, C., & Passingham, R. E. (2004). That's my hand! activity in premotor cortex reflects feeling of ownership of a limb. *Science*, *305*(5685), 875–877. https://doi.org/10.1126/science.1097011

Eibach, R., Libby, L., & Gilovich, T. (2003). When change in the self is mistaken for change in the world. *Journal of Personality and Social Psychology*, *84*(5), 917–931. https://doi.org/10.1037/0022-3514.84.5.917

Faul, L., St Jacques, P. L., DeRosa, J. T., Parikh, N., & De Brigard, F. (2020). Differential contribution of anterior and posterior midline regions during mental simulation of counterfactual and perspective shifts in autobiographical memories. *Neuroimage*, *215*, 116843. https://doi.org/10.1016/j.neuroimage.2020.116843

Frank, M. G., & Gilovich, T. (1989). Effect of memory perspective on retrospective causal attributions. *Journal of Personality and Social Psychology*, *57*(3), 399–403. https://doi.org/10.1037/0022-3514.57.3.399

Freud, S. (1899/1953).Screen memories. In J. Strachey (Ed.), *Sigmung Freud: Collected papers* (vol. VI, pp. 43–63). The Hogarth Press.

Frewen, P., Hegadoren, K., Coupland, N. J., Rowe, B. H., Neufeld, R. W., & Lanius, R. (2015). Trauma-related altered states of consciousness (TRASC) and functional impairment I: Prospective study in acutely traumatized persons. *Journal of Trauma & Dissociation*, *16*(5), 500–519. https://doi.org/10.1080/15299732.2015.1022925

Gardiner, J. M., Ramponi, C., & Richardson-Klavehn, A. (1998). Experiences of remembering, knowing, and guessing. *Consciousness and Cognition*, *7*(1), 1–26. https://doi.org/10.1006/ccog.1997.0321

Graham-Schmidt, K. T., Martin-Iverson, M. T., Holmes, N. P., & Walters, F. (2016). Body representations in schizophrenia: An alteration of body structural description is common to people with schizophrenia while alterations of body image worsen with passivity symptoms. *Cognitive Neuropsychiatry*, *21*(4), 354–368. https://doi.org/10.1080/13546805.2016.1231111

Gu, X., & Tse, C. S. (2016). Narrative perspective shift at retrieval: The psychological-distance-mediated-effect on emotional intensity of positive and negative autobiographical memory. *Consciousness and Cognition*, *45*, 159–173. https://doi.org/10.1016/j.concog.2016.09.001

Guterstam, A., Björnsdotter, M., Bergouignan, L., Gentile, G., Li, T. Q., & Ehrsson, H. H. (2015). Decoding illusory self-location from activity in the human hippocampus. *Frontiers in Human Neuroscience*, *15*(9), 412. https://doi.org/10.3389/fnhum.2015.00412

Guterstam, A., Björnsdotter, M., Gentile, G., & Ehrsson, H. H. (2015). Posterior cingulate cortex integrates the senses of self-location and body ownership. *Current Biology*, *25* (11), 1416–1425. https://doi.org/10.1016/j.cub.2015.03.059

Guterstam, A., & Ehrsson, H. H. (2012). Disowning one's seen real body during an out of- body illusion. *Consciousness and Cognition*, *21*(2), 1037–1042. https://doi.org/10.1016/j.concog.2012.01.018

Hariri, A. G., Gulec, M. Y., Orengul, F. F., Sumbul, E. A., Elbay, R. Y., & Gulec, H. (2015). Dissociation in bipolar disorder: Relationships between clinical variables and childhood trauma. *Journal of Affective Disorders*, *184*, 104–110. https://doi.org/10.1016/j.jad.2015.05.023

Hart-Smith, L., & Moulds, M. L. (2019 June). Abstract processing and observer vantage perspective in dysphoria. *Applied Journal of Experimental Psychology*, *25*(2), 177–191. https://doi.org/10.1037/xap0000172

Henri, V., & Henri, C. (1897). A survey on the earliest memories of childhood. *L'Année Psychologique*, *3*(1), 184–198. English translation by Paul Reeve. https://doi.org/10.3406/psy.1896.1831

Heyes, B., Pictet, A., Mitchell, H., Raeder, S. M., Lau, J. Y. F., Holmes, E. A., & Blackwell, S. E. (2017). Mental imagery-based training to modify mood and cognitive bias in adolescents: Effects of valence and perspective. *Cognitive Therapy and Research*, *41*(1), 73–88. https://doi.org/10.1007/s10608-016-9795-8

Holmes, N. P., & Spence, C. (2005). Multisensory integration: Space, time and superadditivity. *Current Biology*, *15*(18), R762–R764. https://doi.org/10.1016/j.cub.2005.08.058

Huebner, D. M., & Fredrickson, B. L. (1999). Gender differences in memory perspectives: Evidence for self-objectification in women. *Sex Roles*, *41*(5–6), 459–467. https://doi.org/10.1023/A:1018831001880

Iriye, H., & St. Jacques, P. L. (2020). How third-person experiences in immersive virtual reality influence memory. PsyArXiv. https://doi.org/10.31234/osf.io/4z9we.

Johnson, M. K., Foley, M. A., Suengas, A. G., & Raye, C. L. (1988). Phenomenal characteristics of memories for perceived and imagined autobiographical events. *Journal of Experimental Psychology General*, *117*(4), 371–376. https://doi.org/10.1037/0096-3445.117.4.371

Karylowski, J. J., & Mrozinski, B. (2017). Time frame affects vantage point in episodic and semantic autobiographical memory: Evidence from response latencies. *Frontiers in Psychology*, *8*, 615. https://doi.org/10.3389/fpsyg.2017.00615

Kenny, L. M., & Bryant, R. A. (2007). Keeping memories at an arm's length: Vantage point of trauma memories. *Behaviour Research and Therapy*, *45*(8), 1915–1920. https://doi.org/10.1016/j.brat.2006.09.004

Kenny, L. M., Bryant, R. A., Silove, D., Creamer, M., O'Donnell, M., & McFarlane, A. C. (2009). Distant memories: A prospective study of vantage point of trauma memories. *Psychological Science*, *20*(9), 1049–1052. https://doi.org/10.1111/j.1467-9280.2009.02393.x

Kuyken, W., & Howell, R. (2006). Facets of autobiographical memory in adolescents with major depressive disorder and never-depressed controls. *Cognition & Emotion*, *20* (3-4), 466–487. https://doi.org/10.1080/02699930500342639

Kuyken, W., Howell, R., & Dalgleish, T. (2006). Overgeneral autobiographical memory in depressed adolescents with, versus without, a reported history of trauma. *Journal of Abnormal Psychology*, *115*(3), 387–396. https://doi.org/10.1037/0021-843X.115.3.387

Kuyken, W., & Moulds, M. L. (2009). Remembering as an observer: How is autobiographical memory retrieval vantage perspective linked to depression? *Memory (Hove, England)*, *17*(6), 624–634. https://doi.org/10.1080/09658210902984526

Lanius, R. A. (2015). Trauma-related dissociation and altered of consciousness: A call for clinical, treatment, and neuroscience research. *European Journal of Psychotraumatology*, *6*(1), 27905. https://doi.org/10.3402/ejpt.v6.27905

Lanius, R. A., Vermetten, E., Loewenstein, R. J., Brand, B., Schmahl, C., Bremner, J. D., & Spiegel, D. (2010). Emotion modulation in PTSD: Clinical and neurobiological evidence for a dissociative subtype. *American Journal of Psychiatry*, *167*(6), 640–647. https://doi.org/10.1176/appi.ajp.2009.09081168

Lemogne, C., Bergouignan, L., Boni, C., Gorwood, P., Pélissolo, A., & Fossati, P. (2009). Genetics and personality affect visual perspective in autobiographical memory. *Consciousness and Cognition*, *18*(3), 823–830. https://doi.org/10.1016/j.concog.2009.04.002

Lemogne, C., Bergouignan, L., Piolino, P., Jouvent, R., Allilaire, J. F., & Fossati, P. (2009). Cognitive avoidance of intrusive memories and autobiographical memory: Specificity, autonoetic consciousness, and self-perspective. *Memory (Hove, England)*, *17*(1), 1–7. https://doi.org/10.1080/09658210802438466

Lemogne, C., Piolino, P., Friszer, S., Claret, A., Girault, N., Jouvent, R., Allilaire, J. F., & Fossati, P. (2006). Episodic autobiographical memory in depression: Specificity, autonoetic consciousness, and self-perspective. *Consciousness and Cognition*, *15*(2), 258–268. https://doi.org/10.1016/j.concog.2005.07.005

Libby, L. K., & Eibach, R. P. (2002). Looking back in time: Self-concept change affects visual perspective in autobiographical memory. *Journal of Personality and Social Psychology*, *82*(2), 167–179. https://doi.org/10.1037/0022-3514.82.2.167

Libby, L. K., & Eibach, R. P. (2011). Self-enhancement or self-coherence? Why people shift visual perspective in mental images of the personal past and future. *Personality and Social Psychology Bulletin*, *37*(5), 714–726. https://doi.org/10.1177/0146167211400207

Libby, L. K., Eibach, R. P., & Gilovich, T. (2005). Here's looking at me: The effect of memory perspective on assessments of personal change. *Journal of Personality and Social Psychology*, *88*(1), 50–62. https://doi.org/10.1037/0022-3514.88.1.50

Libby, L. K., Shaeffer, E. M., Eibach, R. P., & Slemmer, J. A. (2007). Picture yourself at the polls: Visual perspective in mental imagery affects self-perception and behavior. *Psychological Science*, *18*(3), 199–203. https://doi.org/10.1111/j.1467-9280.2007.01872.x

Libby, L. K., Shaeffer, E. M., & Eibach, R. P. (2009). Seeing meaning in action: A bidirectional link between visual perspective and action identification level. *Journal of Experimental Psychology: General*, 138(4), 503–516. https://doi.org/10.1037/a0016795

Libby, L. K., Valenti, G., Pfent, A., & Eibach, R. P. (2011). Seeing failure in your life: Imagery perspective determines whether self-esteem shapes reactions to recalled and imagined failure. *Journal of Personality and Social Psychology*, *101*(6), 1157–1173. https://doi.org/10.1037/a0026105

Luchetti, M., Montebarocci, O., Rossi, N., Cutti, A. G., & Sutin, A. R. (2014). Autobiographical memory and psychological distress in a sample of upper-limb amputees. *PLoS One*. https://doi.org/10.1371/journal.pone.0099803

Marcotti, P., & St Jacques, P. L. (2018). Shifting visual perspective during memory retrieval reduces the accuracy of subsequent memories. *Memory (Hove, England)*, *26* (3), 330–341. https://doi.org/10.1080/09658211.2017.1329441

McCarroll, C. J. (2017). Looking the past in the eye: Distortion in memory and the costs and benefits of recalling from an observer perspective. *Consciousness and Cognition*, *49*, 322–332. https://doi.org/10.1016/j.concog.2017.01.014

McIsaak, H. K., & Eich, E. (2004). Vantage point in traumatic memory. *Psychological Science*, *15*(4), 248–253. https://doi.org/10.1111/j.0956-7976.2004.00660.x

Mooren, N., Krans, J., Näring, G. W. B., Moulds, M. L., & van Minnen, A. (2016). Vantage perspective during encoding: The effects on phenomenological memory characteristics. *Consciousness and Cognition*, *42*, 142–149. https://doi.org/10.1016/j.concog.2016.03.009

Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, *128*(4), 638–662. https://doi.org/10.1037/0033-2909.128.4.638

Nelis, S., Debeer, E., Holmes, E. A., & Raes, F. (2013). Dysphoric students show higher use of the observer perspective in their retrieval of positive versus negative autobiographical memories. *Memory (Hove, England)*, *21*(4), 423–430. https://doi.org/10.1080/09658211.2012.730530

Niese, Z. A., Libby, L. K., Eibach, R. P., & Carlisle, C. (2019). I can see myself enjoying that: Using imagery perspective to circumvent bias in self-perceptions of interest. *Journal of Experimental Psychology General*, *148*(12), 2258–2276. https://doi.org/10.1037/xge0000612

Nigro, G., & Neisser, U. (1983). Point of view in personal memories. *Cognitive Psychology*, *15*(4), 467–482. https://doi.org/10.1016/0010-0285(83)90016-6

Noulhiane, M., Piolino, P., Hasboun, D., Clemenceau, S., Baulac, M., Samson, S. (2007). Autobiographical memory after temporal lobe resection: Neuropsychological and MRI volumetric findings. *Brain*, *130*(Pt 12), 3184–3199. https://doi.org/10.1093/brain/awm258

Pearson, D. G., Deeprose, C., Wallace-Hadrill, S. M., Burnett Heyes, S., & Holmes, E. A. (2013). Assessing mental imagery in clinical psychology: A review of imagery measures and a guiding framework. *Clinical Psychology Review*, *33*(1), 1–23. https://doi.org/10.1016/j.cpr.2012.09.001

Petkova, V. I., Björnsdotter, M., Gentile, G., Jonsson, T., Li, T.- Q., & Ehrsson, H. H. (2011). From part- to whole-body ownership in the multisensory brain. *Current Biology*, *21*(13), 1118–1122. https://doi.org/10.1016/j.cub.2011.05.022

Petkova, V. I., & Ehrsson, H. H. (2008). If I were you: Perceptual illusion of body swapping. *PLoS One*, *3*(12), e3832. https://doi.org/10.1371/journal.pone.0003832

Petkova, V. I., Khoshnevis, M., & Ehrsson, H. H. (2011). The perspective matters! Multisensory. Integration in ego-centric reference frames determines full-body ownership. *Frontiers in Psychology*, *2*, 35. https://doi.org/10.3389/fpsyg.2011.00035

Piolino, P., Chetelat, G., Matuszewski, V., Landeau, B., Mezenge, F., Viader, F., de la Sayette, V., Eustache, F., & Desgranges, B. (2007). In search of autobiographical memories: A PET study in the frontal variant of frontotemporal dementia. *Neuropsychologia*, *45*(12), 2730–2743. https://doi.org/10.1016/j.neuropsychologia.2007.04.013

Piolino, P., Desgranges, B., Clarys, D., Guillery-Girard, B., Taconnat, L., Isingrini, M., & Eustache, F. (2006). Autobiographical memory, autonoetic consciousness, and self-perspective in aging. *Psychology & Aging*, *21*(3), 510–525. https://doi.org/10.1037/0882-7974.21.3.510

Piolino, P., Desgranges, B., Manning, L., North, P., Jokic, C., & Eustache, F. (2007). Autobiographical memory, the sense of recollection and executive functions after severe traumatic brain injury. *Cortex*, *43*(2), 176–195. https://doi.org/10.1016/S0010-9452(08)70474-X

Piolino, P., Giffard-Quillon, G., Desgranges, B., Chetelat, G., Baron, J. C., & Eustache, F. (2004). Re-experiencing old memories via hippocampus: A PET study of autobiographical memory. *Neuroimage*, *22*(3), 1371–1383. https://doi.org/10.1016/j.neuroimage.2004.02.025

Potheegadoo, J., Berna, F., Cuervo-Lombard, C., & Danion, J. M. (2013). Field visual perspective during autobiographical memory recall is less frequent among patients with schizophrenia. *Schizophrenia Research*, *150*(1), 88–92. https://doi.org/10.1016/j.schres.2013.07.035

Preston, C., & Ehrsson, H. H. (2016). Illusory obesity triggers body dissatisfaction responses in the insula and anterior cingulate cortex. *Cerebral Cortex*, *26*(12), 4450–4460. https://doi.org/10.1093/cercor/bhw313

Punamäki, R.-L., Komproe, I. H., Qouta, S., Elmasri, M., & de Jong, J. T. (2005). The role of peritraumatic dissociation and gender in the association between trauma and mental health in a Palestinian community sample. *American Journal of Psychiatry*, *162*(3), 545–551. https://doi.org/10.1176/appi.ajp.162.3.545

Rice, H. J., & Rubin, D, C. (2009). I can see it both ways: First- and third-person visual perspectives at retrieval. *Consciousness and Cognition*, *18*(4), 877–890. https://doi.org/10.1016/j.concog.2009.07.004

Rice, H. J., & Rubin, D. C. (2011). Remembering from any angle: The flexibility of visual perspective during retrieval. *Consciousness and cognition*, *20*(3), 568–577. https://doi.org/10.1016/j.concog.2010.10.013

Robinson, J. A., & Swanson, K. L. (1993). Field and observer modes of remembering. *Memory (Hove, England)*, *1*(3), 169–184. https://doi.org/10.1080/09658219308258230

Sekiguchi, T., & Nonaka, S. (2014). The long-term effect of perspective change on the emotional intensity of autobiographical memories. *Cognition & Emotion*, *28*(2), 375–383. https://doi.org/10.1080/02699931.2013.825233

Shaeffer, E. M., Libby, L. K., & Eibach, R. P. (2015). Changing visual perspective changes processing style: A distinct pathway by which imagery guides cognition. *Journal of Experimental Psychology General*, *144*(3), 534–538. https://doi.org/10.1037/xge0000073

Siedlecki, K. L. (2015). Visual perspective in autobiographical memories: Reliability, consistency, and relationship to objective memory performance. *Memory (Hove, England)*, *23*(2), 306–316. https://doi.org/10.1080/09658211.2014.885054

St Jacques, P. L., Szpunar, K. K., & Schacter, D. L. (2017). Shifting visual perspective during retrieval shapes autobiographical memories. *Neuroimage*, *148*, 103–114. https://doi.org/10.1016/j.neuroimage.2016.12.028

Stein, B. E., & Stanford, T. R. (2008). Multisensory integration: Current issues from the perspective of the single neuron. *Nature Reviews Neuroscience*, *9*(4), 255–266. https://doi.org/10.1038/nrn2331

Stopa, L., & Bryant, T. (2004). Memory perspective and self-concept in social anxiety: An exploratory study. *Memory (Hove, England)*, *12*(4), 489–495. https://doi.org/10.1080/09658210444000098

Sutin, A. R., & Robins, R. W. (2008 December). When the "I" looks at the "Me": Autobiographical memory, visual perspective, and the self. *Consciousness and Cognition*, *17*(4), 1386–1397. https://doi.org/10.1016/j.concog.2008.09.001

Sutin, A. R., & Robins, R. W. (2010). Correlates and phenomenology of first and third person memories. *Memory (Hove, England)*, *18*(6), 625–637. https://doi.org/10.1080/09658211.2010.497765

Tacikowski, P., Weijs, M., & Ehrsson, H. H. (2020). Perception of our own body influences self-concept and self-incoherence impairs episodic memory. *iScience*, 101429. https://doi.org/10.1016/j.isci.2020.101429

Talarico, J. M., LaBar, K. S., & Rubin, D. C. (2004). Emotional intensity predicts autobiographical memory experience. *Memory & Cognition*, *32*(7), 1118–1132. https://doi.org/10.3758/BF03196886

Travers-Hill, E., Dunn, B. D., Hoppitt, L., Hitchcock, C., & Dalgleish, T. (2017). Beneficial effects of training in self-distancing and perspective broadening for people with a history of recurrent depression. *Behaviour Research and Therapy*, *95*, 19–28. https://doi.org/10.1016/j.brat.2017.05.008

Tuineag, M., Therman, S., Lindgren, M., Rouanet, M., Nahon, S., Bertrand, L., Saury, S., Renaud, S., Beaulieu, S., & Linnaranta, O. (2020). Dissociative symptoms as measured by the Cambridge depersonalization scale in patients with a bipolar disorder. *Journal of Affective Disorders*, *263*, 187–192. https://doi.org/10.1016/j.jad.2019.11.137

Tulving, E. (1983). *Elements of episodic memory*. Clarendon.

Van den Broeck, K., Reza, J., Nelis, S., Claes, L., Pieters, G., & Raes, F. (2014). The relationship between borderline symptoms and vantage perspective during autobiographical memory retrieval in a community sample. *Borderline Personality Disorder and Emotion Dysregulation*, *1*(1), 8. https://doi.org/10.1186/2051-6673-1-8

Van der Hoort, B., & Ehrsson, H. H. (2014). Body ownership affects visual perception of object size by rescaling the visual representation of external space. *Attention, Perception & Psychophysics*, *76*(5), 1414–1428. https://doi.org/10.3758/s13414-014-0664-9

Vella, N. C., & Moulds, M. L. (2014). The impact of shifting vantage perspective when recalling and imagining positive events. *Memory (Hove, England)*, *22*(3), 256–264. https://doi.org/10.1080/09658211.2013.778292

Vogeley, K., & Fink, G. R. (2003). Neural correlates of the first-person-perspective. *Trends in Cognitive Sciences*, *7*(1), 38–42. https://doi.org/10.1016/S1364-6613(02)00003-7

Vogeley K., May M., Ritzl A., Falkai P., Zilles K., & Fink G. R.. (2004). Neural correlates of first-person perspective as one constituent of human self-consciousness. *Journal of Cognitive Neuroscience*, *16*(5), 817–827. https://doi.org/10.1162/089892904970799

Williams, A. D., & Moulds, M. (2008). Manipulating recall vantage perspective of intrusive memories in dysphoria. *Memory (Hove, England)*, *16*(7), 742–750. https://doi.org/10.1080/09658210802290453

Williams, A. D., & Moulds, M. L. (2007). Cognitive avoidance of intrusive memories: Recall vantage perspective and associations with depression. *Behaviour Research and Therapy*, *45*(6), 1141–1153. https://doi.org/10.1016/j.brat.2006.09.005