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Kinetic Memories: An Embodied Form of Remembering the Personal Past

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Despite the popularity that the embodied cognition thesis has gained in recent years, explicit memories of events personally experienced are still conceived as disembodied mental representations. It seems that we can consciously remember our personal past through sensory imagery, through concepts, propositions and language, but not through the body. In this article, I defend the idea that the body constitutes a genuine means of representing past personal experiences. For this purpose, I focus on the analysis of bodily movements associated with the retrieval of a personal memory, which have certain features that make them different from procedural memories, pragmatic actions and common gestures, as well as other forms of embodied memories as examined in recent literature. I refer to these as "kinetic memories" and analyse their representative nature as well as their adaptive functions. Kinetic memories are bodily movements in which some event or action that took place in the past can be seen, because they are an externalisation of the subject's inner intention of representing a past personal experience. Kinetic memories represent a past experience sometimes by imitation of a past movement, and other times through embodied symbols and metaphors. Furthermore, although sometimes they present direct pragmatic benefits, such as communicative benefits, they seem to enhance the whole reexperience of the past event and memory recall, which I argue is one important adaptive value.

Keywords: embodied memory, personal memory, gestures

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"The body knows things about which the mind is ignorant"
Jacques Lecoq (1997/2002)

We are used to expressing past experiences and fictitious stories through narratives. Because everyday narratives are generally linguistic and visual, we attribute only to words and images the capacity of referring to particulars, often forgetting the potentiality of bodily movements to carry specific meanings and to tell stories. But theatre practitioners, and more especially mime artists, do not forget this. An outstandingly rich analysis of the potential expressiveness of the body is found in the writings of Jacques Lecoq, a French actor, mime, and acting instructor, who spent his life studying and exploring the movements of the human body. He considered bodily movements to be a form of knowledge for both actors and spectators. Reality could be better grasped through movement, allowing actors and spectators to discover new meanings that other forms of expression, such as words, could not convey. The discovery and rediscovery of the possibilities of the body was supposed to allow actors to learn how to "write" a play with their own bodies, how to "speak" on stage with full physical awareness. For this purpose, actors needed not only to observe and imitate or "mimic" the richness of human bodily movements, but also to learn to recognize the hidden dynamics of unmoving elements (such as colors or buildings) and "mime" them, that is, express them through gestures and bodily movements (Lecoq, 1987/2006). Lecoq's method aimed to help his students to rid themselves of the conventional forms of behavior imposed by society, in order for them to consciously recover the freedom of movement characteristic of childhood (Lecoq, 1997/2002).

For Lecoq, bodily movements were essential not only to theatre, but also to human life itself. He was probably right: although as we grow up our bodily movements become more rigid and impersonal and in western culture at least, we narrow down (and sometimes we intentionally hide) our bodily expressions, we all carry a potential actor inside that occasionally awakens. As Lecoq himself mentions, it is not uncommon that during a family reunion, the "comedian" of the family stands up and imitates each person present (1987/2006, p. 68). During a conversation between friends, the extrovert member of the group might use her whole body to recount a past personal experience. These sorts of real life "theatrical performances" done offstage to tell a past personal experience have nonetheless received little attention as objects of study.

In philosophy as well as in psychology, explicit memories of past events which were personally experienced by the rememberer are commonly associated with two capacities: the capacity of remembering or recollecting events, which in the literature is known as episodic memory (Tulving, 1972), and the capacity of knowing what was previously experienced, called personal semantic memory or semantic autobiographical memory (Levine, Turner, Tisserand, Hevenor, Graham, and McIntosh, 2004; Tulving, 1985). Episodic memory is associated with

the ability of mental time travel through subjective time, and is generally characterized as a mental representation with rich phenomenological details (Tulving, 1985). Personal semantic memories present fewer phenomenological details and refer to memories of general events or lifetime periods (Conway, 2009; Renoult, Davidson, Palombo, Moscovitch, and Levine, 2012), or to episodic memories that have become semanticized over time (Piolino, Desgranges, and Eustache, 2009). Both ways of recollecting past personal experiences are considered as a kind of mental representation of past events by means of internal visual images (specially for the case of episodic memory), concepts, or language (Rubin and Umanath, 2015). Explicit memories can be externalized through natural language but are nonetheless regarded as being essentially disembodied: besides the neural substrates of personal memories and the vocal apparatus that is necessary for speech production, other parts of the body are not considered to be involved in the recollection of the personal past.

My purpose is thus to challenge this disembodied conception of personal memory and show that some explicit personal memories are highly embodied: facial expressions, tones of voice, arms, legs and other parts of the body are genuine and are common means of representing the personal past. For this purpose, I analyse these forms of "theatrical performance" done in the context of remembrances of past personal experiences. This analysis shows that we can consciously represent our personal past experiences not exclusively through mental images or language but also via bodily movements that can engage the whole body. Just like professional actors use their body along with words to express meaning to spectators in a play, in everyday life we also occasionally become actors while remembering our personal past.

The present article is organized into five sections. The first section presents some conceptual remarks about the terminology used. The second section introduces and analyses the paradigmatic examples found in the literature about this special way of remembering the personal past through the body that I refer to as "kinetic memory." The third section offers a deep analysis of the representative nature of kinetic memories. This allows us to establish the conditions that a bodily movement must meet to be considered a case of kinetic memory as well as the existence of two possible types: mimetic and symbolic kinetic memories. The fourth section contrasts kinetic memory with procedural memory, pragmatic action and gesture in order to analyse the possible adaptive values and functional uses of kinetic memories. The last section highlights the specificity of this kind of embodied memory by comparing it with other forms of embodied memories, all of them implicit, which have been mentioned relatively recently in the literature.

My approach here is mainly semiotic and phenomenological, but also drawing in detail on the small amount of relevant empirical work there currently is on this topic. Because the study of bodily movements during the process of remembering

the personal past is quite underdeveloped in both philosophy and psychology to date, I do not pin down a final definitive theory of kinetic memories: my claims are tentative and provisional at this stage. My main aim in this article is thus to identify a range of fascinating phenomena which have, as of yet, received insufficient attention, and to offer preliminary analyses of their nature and functions.

Preliminary Remarks

The main purpose of this article is to demonstrate that personal memories can have one special kind of embodied content, that I call kinetic content. Therefore, it is necessary to define the main concepts in order to avoid misunderstanding.

On the one hand, "personal memory" is a term I use to broadly refer to all memories of first-hand experiences where the self is implicitly or explicitly represented. This includes not only memories of particular events, but also recurring experiences, periods of my life, persons I met, actions I saw, places I went, odours I smelled, and so on. So, in this sense, the notion of personal memory is not a synonym of episodic memory, which has been conceptualized in terms of the experience the rememberer goes through while recollecting her past (Tulving, 1985) and, more recently, conceptualized in terms of visual and spatial scenes (Rubin and Umanath, 2015) or fragmentary sensory–perceptual–conceptual–affective representations embedded in a framework that contextualizes them (Conway, 2009). Therefore, personal memories can have multiple intentional objects; they can come with a feeling of travelling back in time and re-experiencing something from the past, like episodic memories. However, they can lack this feeling of pastness and present themselves as objective and impersonal memories, that is, as semantic autobiographical memories (Levine et al., 2004).

On the other hand, the notions of embodied and kinetic contents also need some clarification. In general terms, embodied content refers to all bodily aspects related to cognition, such as motor behaviors, motor tendencies, and bodily sensations. Nonetheless, in this paper I will only focus on one particular kind of embodied content that I refer to as "kinetic content." Kinetic content related to memory refers in general terms to bodily movements that are at the same time an act of remembering or part of an act of remembering the past. It is important to highlight that kinetic content differs from any kind of sensitivity originating from inside of the body: temperature, arousal, and other bodily feelings and sensations, including motor tendencies. This interoceptive content is essentially internal (although in some cases, like temperature, it can be exteriorized), unlike kinetic content which is always external and public. Interoceptive sensations seem to be tightly connected with affective states, that is, emotions, feelings, and moods. I have defended elsewhere (Trakas, 2015, 2021) that, while dealing with the relationship between emotions and memory, personal memories can in general present affective content, among other possible contents such as propositional and imagistic

content (both of which are commonly recognized in the literature). In this article I shift my focus to the possibility that personal memories present kinetic content.

Whereas kinetic content is commonly attributed to procedural memories, such as riding a bike (see the next section), it has been almost entirely forgotten from the analysis of personal memories, except for the few examples I mention below. These examples are very enlightening: they help to establish a distinction between kinetic content associated with procedural memory and kinetic content associated with personal memory, and to better define the kind of bodily movements that are of concern in this research.

The Paradigmatic Cases of Kinetic Memories

In their seminal 1966 paper, Martin and Deutscher mentioned the following instance of memory:

> Suppose that someone has never dog-paddled. He is not good at visualization and has never learned any words which would describe swimming. His method of representing the one time at which he saw a man dog-paddle is his actually doing the dog-paddle stroke. We can imagine him trying to remember the curious action that the man went through in the water. He cannot describe it, and cannot form any picture of it. He cannot bring it back. He gets into the water, experimenting a little until suddenly he gets it right and exclaims, "Aha, that's it!" (pp. 161–162)

This is an unquestionable example of kinetic content: the dog-paddling case is a motor behaviour that is at least part of an act of remembering, if not an act of remembering itself. Nonetheless, it is not immediately clear if this example of dog-paddling motor behavior is a case of personal memory or a case of procedural memory. Procedural memory refers in general to motor skills that are the product of a gradual and implicit learning process.[1] The operations of procedural

[1] Whereas "procedural memory was originally intended to cover motor skills, such as tying shoes, riding a bicycle, or typing,… it was broadened to cover mental as well physical procedures" such as "the mental processes involved in multiplying 24 X 16" (Roediger III, Zaromb, and Lin, 2017, pp. 10–11). With time, "the term procedural memory became broader and covered such topics as priming on implicit memory tests, classical conditioning of responses, and habituation" and because of its opposition to memories that could be verbally stated, "the broader term nondeclarative memory came into use" (Ibid). In the literature, the term "kinesthetic memory" and "skill learning" have been used as synonyms of "procedural memory," but they present nonetheless a subtle difference: "kinesthetic (sometimes called motor) memories are those involved in motor skills: the swing of a baseball bat, how to keep a hula hoop going, and so on through hundreds of other examples…. However, many other types of skill learning exist. There is verbal skill learning, such as learning to read distorted or inverted text,… learning of grammars" (Roediger III et al., 2017, p. 15). In this article, I exclusively use the notion of procedural memory to refer to motor skills, and avoid the other notions to not confuse the reader. In fact, the notion of procedural memory is much more common in the empirical literature than "kinesthetic memory" (for a particular use of the latter, see the final section), and it is also broader, as I have already explained. But I omit any reference to cognitive skills because what is at stake here is the difference between bodily movements that are motor skills and those that are personal memories.

memory are expressed solely in behaviour; which is why procedural memory does not imply an explicit recollection of the past (even if it reflects memory of prior episodes) and the traditional memory concepts of encoding–retrieval do not apply (Schacter, Wagner, and Buckner, 2000; Tulving, 2000). As Casey (1987) explains, the habit-based remembering of how to do an action is nothing more than the performance of that action; in this sense, procedural memory presents kinetic content and is thus the enacted form of memory par excellence. Typical examples of procedural memory include learning to ride a bike and to tie one's shoes.

Is, then, Martin and Deutscher's example of dog-paddling a case of procedural memory or not? At first sight, we could say that the action performed, dog-paddling, refers to a motor skill, and this would give evidence for it being a case of procedural memory. But a closer look allows us to corroborate that the concepts of encoding and retrieval do apply here: this particular motor behaviour of dog-paddling constitutes the retrieval of a particular and specific motor behaviour seen previously. The man is explicitly recollecting through bodily movement a similar action observed in the past. There is no implicit learning (although learning may yet occur in the future); there is an explicit and conscious process of retrieval carried out through the body, and there is an explicit causal link between the present bodily movement and a particular past experience, which in this case refers to the past observation of a person dog-paddling. These characteristics are quite different from the distinctive features of procedural memory, so from this it follows that Martin and Deutscher's example is unlikely to be considered as a classical case of procedural memory.

Nonetheless, Martin and Deutscher's example refers to an action in general related to the process of the acquisition of a skill. And that is why at first glance it can be easily mistaken for a case of procedural memory. In order to help dissipate this confusion, another paradigmatic example may help, this time authored by Ryle some years before Martin and Deutscher's classic paper on memory:

> The stock accounts given of reminiscence give the impression that when a person recalls an episode belonging to his own past history, the details of the episode must come back to him in imagery. He must "see" the details "in his mind's eye," or "hear" them "in his head." But there is no "must" about it. If a concert-goer wishes to recollect just how the violinist misplayed a certain piece, he may whistle the bungled tune, or play it on his own fiddle just as the artist had done it; and, if he repeats the mistake faithfully, he is certainly recollecting the artist's error. This might be his only way of recalling how the artist had gone wrong, since he may be poor at going over tunes in his head. Similarly a good mimic might recapture the preacher's gestures and grimaces only by reproducing them with his own hands and on his own face, since he may be poor at seeing things in his mind's eye. … If their mimicries … are good and if, when they go wrong, their authors duly correct them without being prompted, their companions will be satisfied that they have recollected what they had seen, without desiring any additional information about the vividness, copiousness or connectedness of their visual imagery or even about its existence. (Ryle, 1949, p. 260)

Whistling a misplayed piece or mimicking a preacher's gestures are not related to the acquisition of skills, and thus the differences with procedural memory are more salient than in Martin and Deutscher's example. In their example, the action of dog-paddle is certainly related to an explicit and conscious process of retrieval and is causally linked to a specific past event. However, it also constitutes one of the many repeated actions necessary for learning how to dog-paddle. Ryle's examples are exempt from this duality, and that is why both the causal link with a particular past event and its purely representative nature becomes evident. In fact, in this paragraph Ryle makes clear that memory is a way of showing and presenting something that has already been perceived or experienced. This presentation of something from the past not only can take the form of a visual image or a verbal narration, but also of a mimicry or re-performance of some past experience. That is why these examples highlight one characteristic that is essential to this form of embodied memories: their representative nature. These cases refer to bodily movements that present something else than themselves: when these motor behaviors are enacted, they mean and indicate a past "bodily" event, that is, bodily movements that happened in the past. In Ryle's examples, the past bodily movements are observed actions, that is, past actions done by people other than the rememberer, but they could also refer to performances done in the past by the rememberer herself. To make fun of myself, I could re-enact, in front of my friends, the mimicking and gestures I did in a conference. In both forms of re-enactment, their meaning is given by their referent — the past bodily movement — and by presenting them again they represent them. In contrast, procedural memories do not represent something from the past; in fact, they have lost any mark of the past, and present themselves as simple habits that are tied to current practical goals related to the specific environment in which they are performed.[2]

For clarification purposes, I propose to call "kinetic memories" these forms of memories that present kinetic content but are not procedural memories, because they are memories that refer to the personal past. In fact, it seems more appropriate to say that personal memories can have kinetic content than to speak of kinetic memories. Whereas some personal memories are expressed completely through a motor behavior, such as the examples mentioned previously, in other (and maybe more common) cases of personal memory, only one part or aspect is expressed through a kinetic component. As Sutton and Williamson (2014) explain, when remembering a difficult conversation at work, I may partly reinstate a pattern of gestures and reproduce the embodied alignment I displayed during

[2] Although it may be tempting to consider that procedural memories do not represent at all, procedural memories can have a representative nature: they can represent aspects of the culture or of the social position of the individual, such as in Pierre Bourdieu's (1980) analysis of the notion of habitus. For the purposes of this article, it is not necessary to determine in which specific sense procedural memories represent (if they do); it is sufficient to show that they do not represent some past event, and thus that they do not represent as kinetic memories do.

that conversation. Although these cases do not properly deserve the name kinetic memory, I will continue to use this term to refer to both cases (the entirely kinetic personal memory and the personal memory that has a kinetic content among others) in order to simplify the discussion. In this sense, the use of the term kinetic memory is similar to the use of visual memory: in general, this notion is adopted to refer not only to memories that are exclusively visual, but also to the memories that mainly present visual imagery, among other kinds of contents such as propositional or affective content. As Rubin (2006) explains, most of our episodic memories — as well as our personal memories — do not come in one single format or possess only one kind of content, but are constructed via the interaction between different basic systems, "each of which uses fundamentally different structures and processes for fundamentally different kinds of information" (p. 278). A variety of systems including vision, audition, olfaction, spatial imagery, and other senses, as well as language, emotion, narrative, kinesthesis and motor output can all contribute to the construction of personal memories, even if they are not all involved in the construction of every single memory.

The Representative Nature of Kinetic Memories

More needs to be said about what kind of representations these embodied forms of memories are. In order to better understand the representative nature of kinetic memories, two questions must be answered: first, we need to understand the conditions that must be fulfilled for bodily movement to represent something from the past; and second, we need to analyse the way in which kinetic memories represent past bodily movements.

Conditions

To establish the conditions that must be fulfilled for a bodily movement to be a kinetic memory, consider the following examples. Imagine that a concert-goer, instead of trying to remember the violin piece he listened to last night, unwittingly starts to whistle this tune while whistling different songs and tunes at work. Or imagine that after mimicking the preacher's gestures many times in front of her friends to make them laugh, my sister involuntarily replicates these gestures herself while speaking at a conference. These two examples have some similarities with Ryle's examples: the traces involved (at least for the most part) are probably the same, and both re-enactments derive from a specific past experience. The best explanation of what the unwitting and the intentional re-enactor are doing is similar: in both cases, the re-enactor is reproducing what she listened to or saw before. Nonetheless, the unwitting cases also present an important difference: the re-enactor does not *see* some other event through the whistling or mimicking because she perceives it as an occurrent performance, but not as a representation of a past event.

It is true that someone with enough information could recognize the re-enactment and see through the current whistling and gestures a past bodily movement. Even the agent herself might come to see some past event if it is pointed out to her that she is now re-enacting something which she saw in the past. These examples can be considered as *implicit* kinetic memories because they are used unconsciously, have become partially detached from their context of acquisition and are only potentially representative of something past. Nonetheless, they are also potentially part of the process of learning a tune by heart, or acquiring a new habit or skill, that is, they are also potentially part of the process of formation of procedural memories. If my sister involuntarily does the preacher's gestures while giving a speech on two or three occasions, they no longer point to or represent the preacher's past gestures. They have become her own, a habit that characterizes her special way of giving a speech to an audience. This double but dichotomic potentiality makes implicit kinetic memories a sort of *spurious* case of kinetic memories. Implicit kinetic memories are halfway between actual cases of procedural memories and explicit cases of kinetic memories. They could be conceptualized as explicit kinetic memories that are going through a process of *proceduralization*, similar to a certain extent to the process of semantization that affects some episodic memories due to remoteness and aging (Piolino et al., 2009). Because of this ambiguity, the pure explicit cases seem to be the most paradigmatic cases of kinetic memories: the re-enactor (and eventually her potential spectator) can *actually* (and not *potentially*) see some past event through her current bodily movements. In consequence, although implicit kinetic memories are possible, only their explicit version can provide genuine and exemplary cases of kinetic memories that are exempt of all ambiguity, and can thus be useful to better analyse this phenomenon and unravel its characteristics.

An explicit representative nature is then essential to kinetic memory: something else outside the current bodily movements must be actually seen through them. Whereas a minimal causal link through memory traces to a past personal experience is a necessary condition for bodily movement to be a memory, it does not seem to be a sufficient condition for bodily movement to be a representation of something else. Another condition is thus required to reach sufficiency: the rememberer must intend to perform a bodily movement in which some event or action that took place in the past is actually *seen*. This theory of representation in terms of "seeing in" has been suggested by Wollheim (1977) and perfectly explains another of the main conditions of kinetic memories: the representative intention of the rememberer. For actually seeing something in a bodily movement other than the current bodily movement itself, the representative intention of the rememberer seems essential. If the representative intention is absent, the bodily movement loses its mnemonic character; it is not anymore a re-enactment of a past experience but a habit or a skill that is part of the subject's bodily movement repertoire. Even in the case that an implicit kinetic memory — which may be

still part of the process of proceduralization — suddenly becomes explicit for the subject, the possibility of fully *seeing* something other than the current bodily movement itself depends on the subject's representative intention. Following my previous example, as soon as my sister recognizes in her movements the preacher's past gestures, two options are available to her: either she changes the patterns of her bodily movements in order to avoid the consolidation and proceduralization of this kinetic memory, or she decides to continue performing the preacher's gestures by explicitly recalling them.The intention of representing some past bodily movements plays then a crucial role, and it fully expresses itself when the rememberer intentionally re-enacts a past experience through the movement of her body, that is, when she performs some bodily movements as part of an explicit and conscious process of remembering a personal experience. It is important to make clear that I use here a semiotic conception of representation, which simply implies that some elements may signify some other object in different ways. This notion of "representation" should not be confused with the notion of "mental representation" generally used in cognitive science to refer to mental entities, such as neural structures, which have content and correctness conditions (see, for example, Smortchkova, Dolega, and Schlicht, 2020).

We can then summarize the conditions that must be fulfilled for bodily movement to represent a past personal experience in the following terms. For bodily movement to count as a kinetic memory, the following conditions must be met: (a) the bodily movement must be causally linked in a minimal sense to a past personal experience through some memory traces; (b) the bodily movement must be a performance in which the personal experience that took place in the past is actually seen; and (c) the condition (b) can only be satisfied when the subject who performs the bodily movement has a representative intention pointing to the past. In other words, when she performs this bodily movement as part of an explicit and conscious process of remembering the personal experience causally linked to it.

Note that what could be called "implicit kinetic memories" would in principle meet condition (a) and a modified version of condition (b): the bodily movement should be a performance in which the personal experience that took place in the past *could* be seen. The more kinetic memories are implicitly retrieved, the less they are linked to the past personal experience from which they originally derived, and the less this past personal experience can potentially be seen.

Two other remarks need to be made concerning these general conditions of kinetic memories. First, the notion of "past personal experience" mentioned in condition (a) refers not only to first-hand experiences of specific past events, but also to repeated events I have experienced, and even to persons I met, actions I saw, places I went, emotions I felt, and so on. "Experience" is not thus a synonym of "a specific event," or even of "an event." Although all the cases of kinetic memories previously analysed are memories of specific past events, we could easily think

of different examples. I can mimic the particular way my sister used to touch her hair and constantly blink while talking, with the purpose of making the family laugh. In this case, the bodily movements are not causally linked to a specific event, but are linked through memory traces to a series of repeated events I have experienced.[3] Other examples of kinetic memories that are causally linked to experiences that are not specific events will be given in the next section when I analyse the different ways in which kinetic memories can represent the personal past.

The second remark concerns the minimal causality condition and the notion of memory trace. The notion of "cause" is used here in a very broad and indeterminate sense, as it is generally used in causal theories of memory (see Bernecker, 2010; Martin and Deutscher, 1966, for a causal condition in terms of counterfactual dependency). It would certainly be benefited by further specification, but it is beyond the scope of this paper to enter into the discussion of this complicated issue. I only ask the reader to avoid assuming that the causality condition entails identity or a strong similarity between the past representation and the present memory representation, and that it rules out generationism about memory content. In fact, I assume a sort of minimal causal theory of memory: some traces left by the past event are necessary to construct a memory representation of any kind. This nonetheless does not imply that the memory representation cannot include information not originated in the experiential representation of the past event. That is why this minimal causal theory that I assume — and do not intend to discuss here — is compatible with generationism about memory content.

Concerning memory traces, I take them to carry informational content (although I leave the specific nature of this informational content unspecified) and to be distributed. Different basic systems — not only the motor system but also

[3] I do not want to confuse the reader and imply with this sentence that a kinetic memory is simultaneously linked to several past events through different causal chains. In fact, models of autobiographical memory have always integrated repeated and general events and explained the relation between them and more specific events (Barsalou, 1988; Conway 1992, 1995, 2009; Conway and Pleydell–Pearce, 2000; Linton, 1986). Barsalou (1988), inspired by computational theories, proposed a theory of autobiographical memory hierarchically and chronologically organized in three levels: extended-event timelines, summarized events and specific events. According to his model, when an event is experienced, information about each aspect of the event — sister, hair, to touch in a particular way, to blink, to talk — becomes integrated into the representation of the event. But at the same time the generic information of the event that has been activated — sister, hair, to touch in a particular way, to blink, to talk — interrelates among each other and gives rise to a long-term memory of a summarized event. With time, this summarized event may become more accessible than the event memory itself. That is why the encoding of a second similar event may cue and activate the summarization instead of cuing and activating the memory traces of the first similar event. Moreover, the retrieval of a specific event may also activate the respective summarization. In the case of repeated events of everyday trivial events, we could hypothesize that the information of the context of acquisition of each specific memory (information that places a particular event in a specific time and space) becomes more difficult to retrieve and can even be forgotten with time, whereas the long-term memory of the summarized event is on the contrary reinforced each time the subject experiences a particular instance of that event.

the visual system and other sensory systems — may be involved in the formation of kinetic memories. There need not be specific "kinetic memory traces"; kinetic memories may be constructed from relational binding, operated by the hippocampus, among different memory traces. In this respect, the process of kinetic memory construction would not differ significantly from that characteristic of the personal memories more commonly analysed in the literature, such as personal memory expressed through natural language and visual imagery. For example, when I mimic the preacher's gestures and grimaces in front of my friends, diverse memory traces may be reactivated. These include visual traces of the preacher's physical appearance, the church where I heard his speech, the specific way he moved, auditory traces of his speech and his particular intonation, semantic and motor traces of the general movements and attitudes normally performed while giving a speech, as well as other traces of previous encounters with the preacher and previous events in which I participated as an audience member. But these also include motor traces formed during the experience. Motor-related areas of the brain are not only activated when we perform actions but also when we observe actions, as the extensive literature on motor resonance has shown (see for example the interesting study done by Calvo–Merino, Grèzes, Glaser, Passingham, and Haggard, 2006). That is why specific motor traces like the ones induced by practicing movements are also formed when we merely observe actions (Stefan, Cohen, Duque, Mazzocchio, Celnik, Sawaki, Ungerleider, and Classen, 2005), and these motor traces are likely to be reactivated when we remember those actions (see also Galvez–Pol, Forster, and Calvo–Merino, 2020).[4] Nonetheless, unlike procedural memories which are independent of the operations of the medial temporal lobe memory system (Zola and Squire, 2000), it is expected that kinetic memories would recruit the explicit memory system.[5] This specificity would establish another difference between the paradigmatic cases of kinetic memories and procedural memories, as well as with their spurious — and implicit — counterpart.

There is little work linking human bodily movements to memories of past experiences and their neural substrates, but a fairly recent study goes some way in this direction: Hilverman, Cook, and Duff (2016) have provided evidence that patients with hippocampal amnesia produced significantly fewer gestures than healthy participants when remembering different semantic and episodic memories. This suggests that gestures produced in the context of an act of remembering are, at least in part, supported by the hippocampal region. The authors warn us that further

[4] And this is the reason why the "translation problem," that is, the problem of explaining how information encoded in one format (in this case visual) is "translated" into another format (such as a motor format), is a fictitious problem.

[5] For a recent article that argues that evidence for a neat division between the declarative and procedural memory systems is messy and inconclusive, see de Brigard (2019). Christensen, Sutton, and Bicknell (2019) also hold that the declarative system makes a substantial contribution to skilled performance, and this calls for a revision of the standard view of memory systems.

investigation is needed to determine "if the nature of the relationship between gesture and memory is stable across tasks and behaviors, or if there are conditions or contexts in which gesture might engage non-declarative or procedural memory" (Hilverman et al., 2016, p. 11). In fact, another study has shown that the procedural memory system seems to be necessary to learn and remember information and experience expressed through hand gestures (Klooster, Cook, Uc, and Duff, 2015). It is true that these two studies examine gestures which are not necessarily kinetic memories, such as common beat gestures (I will come back to the difference and similarities between kinetic memories and gestures below). It is also true that the studies examine gestures in different contexts. In the first study, the gestures were spontaneously performed by the rememberer (the only instruction was to remember different kinds of events), whereas the second study was essentially focused on implicit learning of gestures and on their explicit voluntary retrieval. But despite these differences, these two studies support the belief that both memory systems, that is, the declarative and the procedural memory systems, are necessary for the production of some gestures, and thus, are necessary for the construction of kinetic memories. In this respect, kinetic memories would partly rely on the anatomical structures that are known as the procedural memory system, without nonetheless being similar to specific occurrences of procedural memories.[6]

Different Ways of Representing the Personal Past Through Kinesis

The second question mentioned at the beginning of this main section concerns the way in which kinetic memories represent past experiences. Until now,

[6] That is why it is extremely unlikely that kinetic memories would rely on a specific memory system. More empirical research is certainly needed to better know the specific brain regions involved in kinetic memories. But as I have suggested, there is a high chance that the anatomical structures normally attributed to the procedural memory system and to the declarative one are both involved in the formation of kinetic memories. In fact, the notion of "process specific alliances" (PSAs) would be probably very suitable to explain the brain network that underlies kinetic memories. This notion has been recently introduced by Cabeza and Moscovitch (2013) to expand and ameliorate the component process framework proposed by Moscovitch in 1992 as an alternative to memory systems and processing modes frameworks. According to Cabeza and Moscovitch (2013), a process specific alliance is "a small group of brain regions working together to achieve a cognitive process. This small 'team' is rapidly assembled in response to task demands and is rapidly disassembled when no longer needed. Thus, we view PSAs as flexible, temporary, and opportunistic. These characteristics distinguish PSAs from large-scale networks that are assumed to be relatively stable across tasks and persist during periods of rest" (p. 52). Therefore, according to this framework, episodic recollection is not the result of a memory system, but of a process specific alliance mainly established between the angular gyrus and the hippocampus (Cabeza, Stanley, and Moscovitch, 2018, p. 6). Although Rubin's (2006) basic memory systems — which has been mentioned and adopted in this article as the theoretical framework to explain memory recollection — explicitly states that episodic memory is the result of the coordination of basic memory systems, his model is not incompatible with the notion of PSAs, and could probably be reformulated in terms of a PSA without losing its essential features.

all cases mentioned, the representation of the misplayed violin piece, the past preacher's gestures and grimaces, and the special way of swimming seen for the first time, are cases of re-enactment and mimicry. The rememberer recreates some movements previously performed or seen. These examples may suggest that kinetic memories represent by the most primitive sense of resemblance: physical resemblance. As O'Brien and Opie (2004) explain, "a representing vehicle and its object resemble each other at first order if they share physical properties, that is, if they are equal in some respects" (p. 6). My representation of the violinist's misplayed piece, or of the past preacher's gestures and grimaces, intends to be faithful to the original bodily movement, and this means that it reproduces some of its physical properties.

But do all forms of kinetic memory represent by reproducing some of the physical properties of what is represented? This question is intrinsically linked to another: must kinetic memories solely represent bodily movements? If not, that is, if kinetic memories can represent something that is not itself essentially "kinetic," the answer to the first question is also negative, so there must be another way in which kinetic memories can represent that is different from physical resemblance with what is represented.

To explore this possibility, I analyse another example which is closely linked to the second mode proposed by Lecoq to actors to use their bodies to "speak" to the audience on stage: by miming aspects of reality that are not themselves essentially bodily movements.[7] Let us imagine that my potential partner, who is a very introverted person and does not overtly express his emotions, was completely disconcerted and felt very embarrassed when I unashamedly told him that I liked him during last night's dinner. As expected, he tried to hide his feelings, but my knowledge of his personality and some minimal facial movements allowed me to recognize his embarrassment and uneasiness. While recounting this episode to a friend, I can tighten my belly, round my back and make myself smaller in the chair to express that he was really embarrassed, that he just wanted *the earth to swallow him up*, but without implying that he actually moved his body in this way. My friend and I both see in my performance the emotion my potential partner experienced, even if originally this emotion was poorly externalized through his body. This case appears to meet all the conditions mentioned before, and is

[7] Lecoq took this distinction between mimicry and miming from the French anthropologist Marcel Jousse (1886–1961) who studied gestures in oral (religious) traditions. Lecoq quotes an interesting paragraph of Jousse's posthumous work *L'Anthropologie du Geste* (1969/2008): "Miming differs from mimicry in this respect: it is not imitation but a way of grasping the real that is played out in our body. A normal human being is 'played' by the reality that reverberates in him. We are the receptacles of interactions that play themselves out spontaneously within us. Human beings think with their whole bodies; they are made up of complexes of gestures and reality is in them, without them, despite them" (Lecoq, 1987/2006, p. 4).

therefore a legitimate case of kinetic memory, yet a similar body movement is not represented; instead a past affection or emotional state is what is shown.[8] Because the representing and the represented have a different nature, i.e., one is a bodily movement and the other one is an emotional state, the kinetic memory does not represent the emotional state by reproducing some of its physical properties. In this case, the concept of representation cannot be understood as physical resemblance. Therefore, in which sense should the notion of "representation" be understood?

Although it is true in very general terms that a kinetic memory covaries with the attitude or emotion represented (I cannot represent a state of joy and a state of anger with the same bodily movements), the idea of a functional or structural resemblance does not seem adequate to account for this example. "A functional resemblance obtains when the pattern of causal relations among a set of representing vehicles preserves at least some of the relations among a set of represented objects," whereas "one system structurally resembles another when the physical relations among the objects that comprise the first preserve some aspects of the relational organisation of the second" (O'Brien and Opie, 2004, pp. 9–10). It is quite evident that neither the pattern of causal relations nor the pattern of physical relations of the bodily movements that represent my potential partner's emotional state preserve some aspects of the relational organization of the emotional state that my potential partner felt during the dinner. The notions of functional and structural resemblance do not account for the representative nature of these particular cases of kinetic memory, because, in fact, these cases of representation cannot be explained in terms of similarity. The notion of symbolic representation is clearly better suited to explain the example mentioned above. Symbolic movements can differ according to their construction (Poggi, 2008). The particular bodily movements in the example given above refer to a metaphor that has a canonical form and a shared meaning in English culture. Because they are paired with a stable meaning, they can be considered to be *codified* symbolic movements. Nonetheless, some symbolic movements are not part of a common ground of meanings in a community, but can be invented on the spot by the performer and are thus new and *creative*. This means that symbolic bodily representations of past

[8] It can be questioned whether emotions are always physically embodied and thus always imply some kind of bodily movement. I agree with this embodied conception of emotions, but as I explained in the "preliminary remarks" section, emotions are generally related to bodily movements that are internal to the body and thus private, such as temperature, arousal, and other interoceptive bodily feelings and sensations. These bodily movements must be distinguished from the external and public bodily movements and motor behaviors that are being discussed here. Emotions are certainly many times externalized through public bodily movements, but I hope the reader will easily agree with me that this embodied externalization is not a necessarily constitutive element of an emotion. It depends on the kind of emotion (more cognitive emotions such as envy, regret, guilt, can probably be less externalized through the body than basic emotions such as anger, fear and sadness), the contextual situation (some public situations often lead a person to hide her emotions), and the culture (some cultures may externalize emotions more than others).

personal experiences can be codified as part of the cultural background, or can be creative as a result of the spontaneity of the individual.

I propose then to distinguish between two main kinds of kinetic memories: *mimetic kinetic memories* and *symbolic kinetic memories*. While the first kind should be broadly compared to cases of mimicry, the second one is more similar to cases of mime. We can thus define the representative nature of these two types of kinetic memories as follows:

Mimetic kinetic memories: they refer to bodily movements that satisfy conditions a–c (above) and represent past experience by physical resemblance, that is, through an occurrent imitative realization of the past experience.

Symbolic kinetic memories: they refer to bodily movements that satisfy conditions a–c (above) and represent past experience by being a symbol of the past experience. The symbol can be codified and culturally shared in a community, or can be the result of the creative and spontaneous performance of the rememberer.

It may be asked why mimetic and symbolic kinetic memories belong to the same kind. First, both of them are bodily movements that meet the conditions mentioned before: (a) they are causally linked in a minimal sense to a past personal experience, and (b) some other event that happened in the past is seen through them, because (c) they are part of an explicit, conscious process of remembering, that is, because the subject performs these movements with a past representative intention, as a re-enactment of the past.

To this similarity, we could add a second one that characterizes the way in which kinetic memories represent the past personal experience. Mimetic and symbolic kinetic memories present some properties that in the literature have been attributed to demonstratives and indexicals (Braun, 2015; Kaplan, 1989a, 1977/1989b). Similarly to indexicals, both kinetic memories are demonstrations, that is, externalisations of the subject's inner intention of representing a past personal experience. These bodily movements not only describe a past personal experience but also point at it, by realizing a demonstration of the same type as the past personal experience. Furthermore, the meaning of both kinetic memories is provided by their referent, and their referent depends on the demonstration itself, the subject's representative intention and the context of remembering. In certain ways, these three elements provide the "rule" that determines the referent of the bodily movements performed. That is why the same movements could have different referents and thus different meanings according to the context and the subject's intentions. I can tighten my belly, round my back and make myself smaller in the chair to express someone else's embarrassment, or my own embarrassment from another past situation, or even to express a different kind of attitude or sensation such as a past feeling of malaise. So the meaning of kinetic memories is not a quality of the mimetic and

symbolic bodily movements themselves but a function of the given bodily movements in their total relation to contextual and intentional elements.[9]

Although the meaning of a kinetic memory is given by its referent, it is not exhausted by its referent. Kinetic memory cannot be considered a pure indexical or a true demonstrative in Kaplan's (1977/1989b) sense, as it is the case for deictic gestures such as pointing. Because kinetic memories *are* memories, they have a reconstructive nature, and even in the imitative cases, a reconstruction of a past bodily movement is hardly ever an impersonal, exact replica. It is formed from different memory traces (as I explained in the last subsection) and, in most cases, includes the perspective of the rememberer. This perspective means that not only does her previous knowledge shape the way she remembers the event but also her present intentions, emotions, interests, and so on. In this case, memory shaping is similar to the particular way in which she performs the bodily movements. This particular way, this embodied perspective, changes from rememberer to rememberer, and from one particular act of recollection to another. A different rememberer could perform the same pattern of bodily movements with a distinct personal touch. Even the same rememberer could perform on two occasions the same pattern of bodily movements differently, according to her current intentions, emotions and interests. This embodied perspective of the rememberer is thus unique to each process of remembering, and is part of the meaning of the bodily movements. That is why the meaning of kinetic memory is not exhausted by their referent.

These semiotic and phenomenological similarities between the representative nature of mimetic and symbolic bodily movements that are performed in the context of remembering the personal past, might lead to the supposition that the two kinds of bodily movements have sufficient commonalities to be subsumed under the unique label of kinetic memory. Nonetheless, further theoretical and empirical research is needed to determine other possible similarities and differences at different levels of analysis, such as the phylogenetic, the ontogenetic, and the implementational ones. Concerning phylogenesis, it is very likely that the ability of reproducing actions generated by others in other places and at other times evolved before the emergence of abstract and symbolic representational systems (Donald, 1991). In any case, I do not pretend here to delve into these aspects. But in the next section, I do develop another similarity between mimetic and symbolic kinetic memories that provides an additional reason to consider both as belonging to the same general kind: a functional similarity. For this purpose, I analyse the possible adaptive functions that kinetic memories seem to perform in present-day Western culture, but I do not deal with the functions that they accomplished in ancestral environments and that led to their natural selection (they do not necessarily need to match: see Smith, 2020).

[9] For a similar functionalist approach to the meaning of certain symbols, such as pictures and music, see Langer (1942).

Functions and Adaptive Value of Kinetic Memories

The functions of episodic and autobiographical memories have been a topic of interest in recent years. It is generally accepted that episodic memories are functionally adaptive because they allow us to simulate future events in order to plan and make decisions in efficient ways (Boyer, 2009; Schacter and Addis, 2007; Suddendorf and Corballis, 2007). Furthermore, individuals use episodic memories for a wider variety of purposes: to preserve the continuity of the self, to develop and maintain social bonds, to reappraise the past in order to regulate emotional states and moods, to teach others and feel a sense of achievement (Bluck, Alea, Habermas, and Rubin, 2005; Harris, Rasmussen, and Berntsen, 2014). But what about kinetic memories? These are generally (but not necessarily) part of larger acts of remembering personal experiences, but seem to neither have the same adaptive function nor the same variety of uses that are characteristic of episodic memories. Kinetic memories are tied to the "here and now," and it is difficult to see how they could play a role in efficient future planning and decision making. Kinetic memories could eventually present a social and conversational function, but they do not seem to have the other general functional uses attributed to episodic memories.

Kinetic memories do, however, seem to serve *present* needs — but which kind? They could respond to demands of the immediate environment, such as a communicative demand, or they could be performed in the service of cognitive activities of the performer. Wilson's (2002) distinction between these two functions proves to be useful for the purposes of this analysis. We can paraphrase and deepen her definitions of on-line and off-line embodied cognition in the following terms:

On-line embodied cognition refers to bodily movements that directly respond to the demands of the physical and/or social environment and thus directly introduce a change in the physical and/or social world that is intended to be efficient for the actor.

Off-line embodied cognition refers to bodily movements that serve intrapersonal functions in that they are put to the service of the higher cognitive processes of the producer. In this sense, they do not directly respond to the demands of the physical and/or social environment and thus can only indirectly introduce a change in the physical and/or social world.

Keeping in mind these two forms of embodied cognition distinguished by their functional role, I analyse below the potential functions and adaptive value of kinetic memories by comparing them with three other cases of embodied cognitions: procedural memories, pragmatic actions related to an act of remembering, and gestures.

Kinetic Memories and Procedural Memories

Probably the best and clearest example of on-line embodied cognition related to memory is procedural memory. Riding a bike and tying one's shoes are cognitive activities that are always embedded in a task-relevant situation and related to the practical needs of the physical environment. In fact, procedural memories are the case par excellence of on-line embodied memory.

Casey (1987) presented an in-depth analysis of the functional value of procedural memories (which he calls "habitual body memories"). He defines them as "an active immanence of the past in the body that informs present bodily actions in an efficacious, orienting, and regular manner" (p. 149). The aspect of this definition that is of most interest here is that procedural memories allow us to embody the past in actions and thus create habitual bodily movements that operate "in an efficacious, orienting, and regular manner." How should we understand the efficacy, orientation, and regularity that pertain to the way that procedural memories respond to environmental demands? To summarize Casey's rich characterization (pp. 151–153), we could say that procedural memories are: (a) efficacious, because they constitute an entire second nature, an effective (and pre-reflective) history within the body that seeks to introduce a difference in the environment that at the same time is effective to the actor herself; (b) deeply orienting, because they form habits that allow us to become familiar with our environment and to establish a base of assurance upon which more complicated and spontaneous actions can arise; and (c) regular, because procedural memories cannot be unpredictable and wayward if they are to be efficacious and orienting, although they need not be restricted to repetition. To sum up, procedural memories "serve as our *familiaris* in dealing with our surroundings — as a constant guide and companion of which we are typically only subliminally aware" (p. 149), but which are indispensable in life so that we can avoid consciously thinking about the right action to take in every occasion.

On the contrary, whistling the violinist's misplayed melody or re-enacting the preacher's gestures and grimaces do not seem to constitute a second nature or exhibit a history as procedural memories do. Although they may allow us in some situations to achieve some goal — as it may happen with some kinetic memories that are embedded in the performance of skilled actions, they neither help us to successfully navigate the world nor to stay oriented and be familiarized with our surroundings. And although procedural memories are flexible, they nonetheless present certain regularity that is absent from kinetic memories, which are generally quite unique performances. We can thus conclude that kinetic memories do not satisfy the conditions enumerated in Casey's characterization of the specific (and essential) functions that procedural memories play in our daily life. Nonetheless, there is still another case of embodied cognition related to memory that may shed some light on the functions of kinetic

memories: instrumental and practical actions performed as part of an act of remembering a personal past experience.

Kinetic Memories and Pragmatic Actions

For a comparative purpose, I begin with an example similar to one proposed by Malcolm (1970, pp. 65–67). Let's imagine that I leave the house with a friend in order to go for a walk and she asks me if I locked the front door. I verbally can reply "yes," "no," or "it was you that locked it." However, I can also reply with an action: go back to my house and lock the door. In principle, Malcolm states that nothing in this example indicates that before doing the action I had a conscious inner representation, like a visual image, of me and my friend leaving the house without locking the front door. He concludes that there is no other occurrence, in addition to the mentioned utterances and actions, which is the remembering itself.[10] Although some readers may reject Malcolm's conclusion, I set this aside since my goal here is not to evaluate the plausibility of Malcolm's statement. Instead I use Malcolm's example to contrast with the previously discussed examples of kinetic memory. Malcolm's example is useful because it refers to an action that, whether or not it is itself a memory, is performed in the context of an act of remembering a past experience.

In this example, the motor behavior is embedded in a task-relevant external situation and only makes sense in that particular environment. The intention behind it is to make a change in the world; in this case, lock the door. This pragmatic action introduces a difference in the environment that is unquestionably effective to the actor herself. Consequently, it is possible to say that in this case, memory is operating to serve the needs of a body interacting with a real-world situation. Because the cognitive-embodied activity — walking back home in order to lock the door — is embedded in a task-relevant situation, it could be considered as a case of on-line embodied cognition. A similar analysis can be applied to the famous case of the Korsakoff's patient studied by Claparède (1911): the patient withdrawing her hand is an action attributable to the retrieval of a past event that

[10] "It is true that neither your saying, 'Yes,' nor your saying, 'You locked the door,' nor your having an image, nor your acting out the locking of the door, was the remembering. But neither was the remembering some other event I failed to mention. It is a bad mistake to think that in those examples of memory, there was, in addition to the mentioned utterances, actions, thoughts and feelings, some other occurrence which was the remembering itself" (Malcolm, 1970, p. 67). And further on: "There is no requirement of an image, copy, picture, pattern or representation in remembering" (Ibid, p. 69). Malcolm's original example is slightly different from the one described in the body of the paper. He mentions two different kinds of memory actions: one corresponds to the re-enactment of the movements made in leaving the house (a case of kinetic memory), and the other to the fact of raising the hand when there is a mistake in the oral description made by a third party of the movements performed in leaving the house. According to him, these two kinds of actions, as well as verbal utterances and visual images, are all cases of memory occurrences.

aims to introduce a difference in her environment: to avoid being picked again. But unlike Malcolm's example, the retrieval of the past event is implicit (or explicit but only *known* and not *remembered*).[11]

These two examples are nonetheless very different from the other examples that I have labelled as kinetic memory. In those examples, the motor behavior is not relevant to any task in the physical environment: it clearly does not pretend to cause a change in the world. It is true that some kinetic memories, especially (but not only) implicit ones, may help us to achieve a goal, as I have mentioned. For example, in a live music performance a skilled musician may replay parts of a particular solo already performed during rehearsal. But this goal-oriented aspect is not necessarily present in kinetic memories, as it happens in pragmatic actions that are attributable to the retrieval of a past event. The explicit cases of kinetic memories that are of concern here do not seem to show this characteristic. Furthermore, there is an additional difference between these pragmatic actions and the examples of explicit kinetic memories under consideration: the latter's meaning is independent from the physical environment where it is performed because it is mainly determined by its referent. I can remember last night's misplayed piece by whistling it at home, while walking on the street, or on the top of a mountain, and in all these occasions the meaning of the whistling is the same. Because many kinetic memories are brought about by a representative intention whose reference bears the mark of the past, they are not cases of on-line embodied cognitions like the pragmatic actions performed in the context of an act of remembering a personal experience.

Nonetheless, there could be a further sense in which kinetic memories allow the producer herself to achieve some goal. First, we might think that they should

[11] Although this case is generally associated with the distinction between explicit and implicit memory, Claparède's commentaries about this patient are also intrinsically related to the problem of recognition and source amnesia, which refer to the problem of conscious recollection (Kihlstrom, 1995; Nicolas, 1996). In fact, the patient did access and retrieve some event information: "she argued that there was, perhaps, a pin hidden in his hand, although she did not remember the episode in which this conditioning procedure was acquired" (Nicolas, 1996, p. 1194). So the patient retained some information of the moment when she was picked, and recovered it, without nonetheless remembering its source. Claparède mentions another similar anecdote: "when the patient is urged to repeat what she has been told, she will sometimes end up answering correctly even though she does not recall ever having had a conversation with you. One day we read a story to the patient about a 64-year-old woman who took her cattle to graze and was bitten by a snake. The next day, we asked her to relate the story we had told her. She could not do so, and could not even recall having seen us the day before. We urged her to answer, saying that it was about a woman and asking her how old the woman was. She then asked us: 'Wasn't the woman 64 years old?' and then she quickly added that it was merely an idea that 'crossed her mind' and that she could have just as easily said something else. In other words, even when these memories arise spontaneously, she does not recognise them as memories that she experienced herself. She believes them to be a passing fancy, and never links them to her past life" (Claparède, 1907/1996, p. 1198).

be better understood as a kind of off-line embodied cognition that may serve some higher-order cognitive process of the producer. In this case, kinetic memories would be similar to epistemic actions: unlike pragmatic ones, epistemic actions are external actions that an agent performs in order to facilitate mental processes (Kirsh and Maglio, 1994). Secondly, we might think that kinetic memories refer in fact to a body responding to environmental and external demands: mimicking the preacher's gestures and bodily demonstrations of someone else's embarrassment could be done for a communicative purpose.[12] In this regard, kinetic memories would be sensitive to physical and social context, always count as bodily movements responding to environmental demands, and be considered as cases of on-line embodied cognitions which mainly serve interpersonal and communicative functions. These two possibilities are explored in the next section.

Kinetic Memories and Gestures

If the adaptive value of kinetic memories is relevant for communication, a comparison with gestures turns out to be necessary. Gestures, like kinetic memories, do not cause a change in the world, but are traditionally considered to have communicative value: they enhance the comprehension of the semantic information of the speaker's message by adding another dimension that makes its own contribution to meaning (Hostetter, 2011; Kendon, 1994; McNeill, 1992, 1998). This is probably why Lecoq thought that mimicry and miming were necessary practices for an actor's performance: because they convey meaning that cannot be transmitted to the audience via other modalities such as spoken words.

Therefore, if kinetic memories are similar to gestures and if gestures accomplish a function that responds to the communicative demands characteristic of the social environment, kinetic memories should be considered as on-line embodied cognitions whose adaptive function is to enhance communication. At first glance, this idea seems quite plausible. Nonetheless, this argument rests on two questionable ideas: first, that kinetic memories are gestures and second, that gestures, and thus kinetic memories, have a primarily communicative function.

Concerning the first supposition, if we define gestures as "movement of the arms and hands in a region of space reserved for symbolic expression, typically in front of the torso" (McNeill, 1998, p. 11), it is evident that kinetic memories cannot be reduced to gestures. Unlike gestures, kinetic memories can suggest the movement of other parts of the body. They can also relate to movements of the

[12] Mahr and Csibra (2018) have recently advocated a communicative function of episodic memory: episodic memories would allow us to represent and communicate the reasons why we hold certain beliefs about the past. Nonetheless, their analysis is very different from the one proposed here: they focus on the epistemic authority that memory confers and its role in communicating about the past. The communicative function explored here refers to the enhancement of communication.

arms and hands conducted in front of the torso which are not generally considered as gestures, such as self-touching actions and object manipulations (McNeill, 1992). In fact they can involve all motor repertoires, including posture and locomotion, such as dancing and walking, and voice modulation.

We could thus say that although kinetic memories cannot be limited to gestures alone, they certainly can take the form of gestures. We may be tempted to believe that kinetic memories, because of their representative nature, can only take the form of iconic gestures, that is, of gestures that bear a physical resemblance to their meaning. But this is not in fact the case.[13] Imitative kinetic memories can take the form of any kind of gesture: iconic, metaphorical, deictic (or pointing) or beat gestures (McNeill, 1992). I can, for example, use deictic gestures to reproduce the way my boss pointed at me in an accusatory tone during our last meeting.[14] I can use beat gestures to imitate the particularly funny way a keynote speaker moved her hands while presenting her paper at a conference. Whereas imitative kinetic memories that take the form of gestures are not necessarily iconic, symbolic kinetic memories that take the form of gestures are mostly metaphoric gestures: they represent an abstract idea or a concept (such as my potential partner's feeling of embarrassment).

Nonetheless, it is important to highlight a main difference between kinetic memories which take the form of gestures and other gestures performed by the speaker. Regarding kinetic memories, the speaker invites the receiver to "see in" her gestures and other bodily movements a representation of something from the past, as if these gestures and bodily movements do not belong to her and should not be interpreted as her own but rather as signs of something or someone else related to the past. By reproducing the preacher's gestures and grimaces, the speaker does not want her audience to believe that she is actually expressing herself; rather she wants her audience to see her current gestures and grimaces as the preacher's past gestures and grimaces. That is why in communicative situations, kinetic memories seem to have more commonalities with theatrical performances than with other gestures performed in everyday life that are directly attributed to the performer. An actor wants her audience to believe that all the gestures and movements that she does, belong to the character she represents and not to

[13] Although it is interesting to notice that in one of the few studies done so far to analyse gestures in the context of remembering past events (Hilverman et al., 2016), the authors observed that deictic gestures were relatively infrequent: participants only occasionally used a pointing gesture, and they did it to refer to themselves or to the experimenter.

[14] Imitative kinetic memories that take the form of deictic gestures may be infrequent, even rare, but are nonetheless possible. It would be interesting to study these special cases when the deictic gesture is produced in the context of remembering the personal past without the intention of directing the recipient's attention to where the finger points.

the person that she is. We can thus conclude that kinetic memories that take the form of gestures can only be a subgroup of gestures and this does not depend on the kind of gestures themselves but on the context, which is determined by the subject's intention of representing a past personal experience.

Furthermore, there is another difference between gestural kinetic memories and gestures that are directly attributed to the performer. Some gestures are thought to communicate nonsemantic information, such as the speaker's internal state, her attitude toward the addressee, and other information that in some situations can be important for the communicative interaction (Krauss, Chen, and Chawla, 1996). Kinetic memories performed in a communicative situation can in certain cases provide information about the speaker's appreciation and perspective of her past personal experience (a memory is always a reconstruction and the remembered event is in general shaped by the rememberer's intentions and emotions), but unlike some gestures, they do not seem to provide any information about the relationship between the speaker and the receiver.

On the other hand, two points can be made concerning the second supposition of the argument mentioned at the beginning of this section regarding the communicative adaptive value of gestures and kinetic memories. First, there are few empirical studies that analyse symbolic gestures and other bodily movements while remembering personal past experiences, so the idea that kinetic memories, as well as gestures, are exclusively performed in conversational situations is more an intuition than an empirically confirmed fact (for a review of the relationship between memory and gesture, see Cook and Fenn, 2017). Ryle's whistling case and Martin and Deutscher's dog-paddling case are clear examples of kinetic memories that are independent of a social context or a communicative situation. We could easily think about similar examples of kinetic memories expressed in solitude: someone can try to imitate a dance movement previously seen at a show when they get home. Alternatively they could simply remember a personal experience in a dialogic conversation with herself (through inner speech), and simultaneously execute some kinetic memories. Here, kinetic memories would not be dissimilar to gestures, which can also be done when the listener is out of sight and there are no visible communicative demands (Alibali, Heath, and Myers, 2001; Pine, Gurney, and Fletcher, 2010). This is so even in inner speech when people dialogically interact with themselves for self-regulation, such as learning a second language (Lee, 2008), or when children perform private pointing gestures as a way of self-organizing and self-regulating their own behavior (Delgado, Gómez, and Sarriá, 2009). Therefore, kinetic memories, like gestures, may present a communicative purpose, but this purpose does not seem to be their sole function.

Secondly, even gestures which are generally considered to be on-line embodied cognitions can in fact be understood as off-line embodied cognitions which serve higher cognitive processes. Gestures seem to play a role not only for the observer, but also for the producer. In fact, gestures serve multiple intrapersonal functions,

that is, they have multiple beneficial effects at the linguistic and cognitive level for the speakers who produce them. They help formulate coherent speech by aiding in the retrieval of words from the mental lexicon (Krauss et al., 1996); they are implicated in the process of integrating nonverbal information into a format that is available for speech and in this way they help with speaking (Kita, 2000); they facilitate working memory capacity in the moment in which they are produced (Cook and Fenn, 2017), and they improve the encoding of information (Cook, Yip, and Goldin–Meadow, 2010) among many other intrapersonal functions (see for example Church and Goldin–Meadow, 2017; Krauss 1998). The importance of their intrapersonal functions has led some researchers to state the controversial idea that gestures add very little to a communicative exchange under ordinary circumstances and that their main functions are intrapersonal (Kita, 2000; Krauss, 1998; Krauss et al., 1996). Although the debate is ongoing (Hostetter, 2011; Pine et al., 2010), Krauss and colleagues consider that gestures may principally serve higher cognitive processes and may not necessarily be related to the communication demands of the physical or social environment. In this case, gestures seem no different from other motor movements such as the "looking at nothing" phenomenon. This refers to oculomotor mechanisms, more specifically eye movements, that are activated in the absence of appropriate external stimuli while remembering a scene or elements of a scene (Richardson, Altmann, Spivey, and Hoover, 2009; Richardson and Spivey, 2000; Spivey and Geng, 2001). It seems that the locations to which eye movements are directed appear to be determined, at least in part, by the mental representation of the scene remembered (Altmann and Kamide, 2004). Because this type of eye movement helps to retrieve information and is thus at the service of memory, it accomplishes an intrapersonal function and is better considered as off-line cases of embodied cognitions.

In sum, we can say that the intuitive argument that considers kinetic memories to have a communicative value based on the identity or similarity between kinetic memories and gestures is not well grounded. Kinetic memories cannot be reduced to gestures, nor can the function of gestures be reduced to the enhancement of communication.

Different Kinds of Functions of Kinetic Memories

The previous analysis leads us to a more plausible hypothesis about the adaptive value of kinetic memories. Some kinetic memories are certainly like pragmatic actions: they are embedded in a task-relevant external situation and aim to introduce a change in the physical and/or social world that benefits the subject. So, they are adaptive because they are useful to achieve the subject's goals, such as communicative goals. But other kinetic memories — especially those whose meaning is independent from the physical environment where they are performed, which are those of interest here — may present pragmatic benefits, such as enhancing

the comprehension of the speaker's message, as a residual effect of the fulfilment of an intrapersonal function: to better cue personal memory. Personal memory can be triggered by different aspects and features of the past personal event it derives from, and kinetic prompts might be particularly effective. They may also be particularly effective to retrieve rich details of the past event as well as aspects of the past subjective experience that may be hard to recover. By doing so, they may even intensify the rememberer's feeling of reexperiencing the past. One great scene of the series *Twin Peaks*, when Donna recounts a memory to the agoraphobic Harold Smith, exemplifies this adaptive value of kinetic memory. In this scene, Donna, in a sitting position, presents the context of her memory: she was 14 years old, at the Bang Bang Bar with her friend Laura Palmer and three boys in their 20s. She then lights a cigarette as she mentions that the boys were older than Laura and her, so they made both girls feel older. At that moment she starts to mentally travel back in time to relive that special night out, when she probably smoked. While recalling what happened, she pronounces an assertive "yes" along with a sensual gaze in her impersonation of Laura's foreseeable response to one invitation to party. When Donna starts to tell what happened in the woods, where they all went to party, she gets up and her remembrance becomes fully embodied. She impersonates Laura again, as she dances with the boys and moves her hips back and forth; she then impersonates Tim — one of the boys — with arms crossed, while he stares at Laura and feels desire for her. She finally embodies her past self, when she was jealous of Laura getting too much attention, and loudly suggested they go skinny-dipping. She continues to remember what happened next with her whole body: she pulls down the neck of her T-shirt while she reveals that they take off their clothes; walks backwards to express that she swam away, stunned, when Laura started to kiss two of the boys. She next walks forwards to show how Tim swam out to her in a resolute manner; touches the hand on her chest with the other hand when she tells how Tim kissed first her hand, and then her lips, and so her hands slowly move towards her mouth, and her fingers roll gently all over her lips. Donna then says: "I still can feel that kiss." This exceptional performance by Lara Flynn Boyle as Donna exemplifies not only how in an act of remembrance, different perspectives of the past event can be expressed through bodily movements, some of them mimetic, others more abstract and symbolic. Also — and more importantly here — these bodily movements do not primarily respond to communicative demands despite being performed in a social context. Donna performs these bodily movements neither to enhance the comprehension of Harold Smith nor to entertain him — she does not even look at him during her act of recollection — but to better remember that cherished moment of her personal past that she wants to communicate. By performing these mimetic and symbolic movements she can truly travel back in time, not only "mentally" but with her full body, reexperience the event and remember it with precise details that would probably not be accessible otherwise. The body, or rather the embodied mind,

finally seems to know things about which the disembodied mind is ignorant, as Lecoq precognized.

Donna's bodily movements can be considered as off-line embodied cognitions and, more particularly, as off-line embodied memories: rather than memory operating to serve real body–world interactions, the body and its control systems are used as part of the process of memory retrieval, and enhance the quality and the quantity of details retrieved. Only a few empirical studies have gone in this direction, but they do seem to support this possibility. These empirical studies have shown that children who gesture (in an iconic and non-iconic manner, even with pointing gestures) when recalling an event report more details than children who are prevented from gesturing (Cameron and Xu, 2011; Delgado, Gómez, and Sarriá, 2011; Stevanoni and Salmon, 2005). Dijkstra, Kaschak, and Zwaan (2007) have shown that people recall faster and more accurately when body positions during retrieval are similar to the body positions that occurred during the original experience. This last result supports, once more, the encoding specificity principle: recollection is facilitated when an overlap occurs between the elements of the retrieval context and those of the encoding context (Tulving and Thomson, 1973). In a study by Casasanto and Dijkstra (2010), participants recalled more positive memories when they moved their arm upwards and more negative memories with a downward arm movement (a similar effect was already demonstrated by Riskind, 1983). The arm movements here could be broadly interpreted as symbolic kinetic memories. These metaphorical representations "arise from a pattern of associations of concrete experiences (cheering, jumping out of joy) with certain body movements (upward movement)" [Dijkstra and Post, 2015, p. 5], so they are not arbitrary symbols, but are abstract symbolic movements after all. It is true that these studies are focused on gestures and do not take into account the difference between gestures and kinetic memory, but they nonetheless implicitly analyse some gestures that could be considered as cases of kinetic memory. More empirical studies should certainly be done in this line of research, taking into consideration the distinctions previously mentioned between kinetic memory and gestures and bodily movements that do not enter into this category, as well as the specific representative nature that is characteristic of kinetic memories. These studies could shed more light on the intrapersonal functions of these embodied kinds of memories.

In conclusion, kinetic memories can be considered neither pure cases of on-line embodied cognitions nor pure cases of off-line embodied cognitions. They sometimes are intentionally performed to achieve a practical goal, and can present a communicative or social intention; but other times, like in Donna's remembrance, they present communicative benefits without being essentially oriented to enhance communication. This is possible because kinetic memories, like gestures, probably fulfill a double adaptive function: they present pragmatic benefits, among which are included the enhancement of communication and other social and

conversational purposes, such as engaging the audience, getting the audience's attention or making the audience laugh; but they also fulfill intrapersonal functions, because they improve the overall process of remembering and reexpericing the past event. Rythmic beat gestures and other gestures that may be performed in an act of recollection may certainly facilitate memory recall too. But they do it by reducing the working memory load, helping to retrieve words from the mental lexicon and to translate nonverbal information into a verbal format. So they may only facilitate the retrieval of perceptual, sensorimotor, and affective components of the past experience in an indirect way. Furthermore, they are not part of the memory itself. On the other hand, kinetic memories improve the overall process of remembering in a direct and contentful way because they are themselves meaningful components in the re-construction of the past experience. They are carriers of mnemic content and at the same time make us relive the past experience with more intensity and, plausibly, produce a richer and more detailed reconstruction of it.

Whereas from the point of view of the finality, kinetic memories may be at the service of memory recollection; from the point of view of the form, they accomplish a specific representative function: kinetic memories are the only kind of bodily movement that points to the past. They always represent a past personal experience (or some aspect of it) and that is why they cannot be directly attributed to the producer. Opening up one's arms and expressing the magnificence of a landscape does not mean the same thing as reproducing the same gesture while remembering that experience, for example, at home. So these bodily movements, despite presenting a physical resemblance, cannot have the same function either. This specific representative function of past personal experiences needs to be highlighted because it establishes a significant difference between kinetic memories on one hand, and common gestures and pragmatic actions on the other.

Kinetic Memories and Other Forms of Embodied Memories

There are only a few relatively recent references in both philosophical and psychological literature concerning the embodied aspect of memories of our personal past experiences. I briefly review them here, showing that none of these studies analyses the phenomenon of kinetic memory.

Traumatic memories are the most common examples of embodied memory related to our personal past that are found in the existing literature. Freud is well known as one of their first theorists: unsconscious repressed memories of a traumatic past event, such as childhood sexual abuse, leave traces in the form of embodied symptoms, such as a painful need to urinate (Freud, 1896/1962). Phenomenologists have also thoroughly analysed how traumatic events leave traces in the body. For example, according to Casey (1987), traumatic memories may sometimes lead to implicit re-actualizations, and sometimes inhibit action (a tooth trauma may inhibit mastication), but in both cases they present certain

characteristics that make them very different from kinetic memories: (a) when they are not explicitly re-experienced, traumatic memories are marginal, part of the ground of our experiences rather than explicit figures, whereas kinetic memories are part of an explicit conscious process of remembering and are thus at the center of our experience; (b) traumatic memories possess an inner opaqueness and that is why they are felt "as a density in depth" (Casey, 1987, p. 166), whereas kinetic memories are voluntary and intentional, and their meaning is transparent for the subject; (c) traumatic memories are characterized by a co-immanence of past and present, because the past is not represented but prolonged and acted in the present, whereas kinetic memories represent the past and, although they bring the past to the present, they also keep a clear distinction between these two temporalities. The characteristics of traumatic memories are also present in their counterpart: "erotic body memories." Erotic body memories refer to the traces that episodes of erotic pleasure implicitly leave in the body, which are also implicitly recalled through the body, for example, when we encounter the one who caused our past pleasure. So erotic body memories are also distinct from kinetic memories. In fact, traumatic and erotic body memories present more similarities with procedural memories than with kinetic memories. These commonalities are rightly reflected in Casey's joint analysis of these three types of body memories (Casey, 1987, pp. 146–180).

More recent analyses of traumatic memories have emphasized, in the similar vein as Freud, long-lasting changes in the posture, gestures and movements produced in the body (Caldwell, 2012), the "inner gesture" or the enduring style of coping that is rooted in a traumatic episode but has forgotten its own situated origins (Behnke, 2012). Once again, this characterization of traumatic memories in terms of structural changes in the body presents more commonalities with procedural memories than with kinetic memories: they are always implicit, and involuntary as certain habits. It is true that, unlike procedural memories, there is still an intrinsic causal link between the present bodily movement and the particular past traumatic experience. But, unlike kinetic memories, this link is blurred, invisible, not represented in the bodily movement. When the causal history is unraveled and the traumatic memory acquires a narrative form, the subject recovers a sense of agency and can unlearn the programmed body memory or re-pattern it (Caldwell, 2012). Therefore, as soon as the posture or bodily movements are *seen* by the subject as a "representation" of a past traumatic event, the subject tries to regain control over them and aims to modify them. This same strategy takes place after a past trauma is explicitly but involuntarily re-experienced as it were happening anew. In PTSD, the recalled traumatic event is processed as happening in the present rather than belonging to the past (Brewin and Holmes, 2003) and might involve the re-enactment of some past behaviour, such as ducking as if to avoid a blow (Holmes and Mathews, 2010). These bodily movements do share some characteristics with kinetic memories — especially

with implicit kinetic memories: someone could recognize the re-enactment and see the past event through the current bodily movements. However, there are essential differences between these explicit forms of embodied traumatic memories and the explicit kinetic memories that are of interest here. Explicit embodied traumatic memories are certainly at the center of the subject's experience, but they are involuntary and their meaning is opaque to the subject. The past is re-enacted in the present and not represented. What is more, because the past trauma is not experienced as past but as a present new threat, explicit embodied traumatic memories are not really explicit. Despite being explicit experiences, they are not explicit memories: they are conscious experiences but not conscious recollections. So, embodied traumatic memories, in their implicit as well as in their explicit form, are very different phenomena from kinetic memories.

A similar kind of distinction can be made between kinetic memory and "kinesthetic memory" (Sheets–Johnstone, 2003, 2012), " Rilkean memory" (Rowlands, 2015, 2017), and Fuch's (2012) taxonomy of embodied forms of memory. Inspired by Luria's work, Sheets–Johnstone (2003, 2012) considers that the notions of "procedural memory" and "implicit knowing" are too mechanical and spatial, and do not do justice to the dynamic, voluntary, and affective aspects of bodily movements. Bodily movements are kinesthetically perceived and kinesthetically encoded. This explains her choice of naming these kinds of memories "kinesthetic memories." Kinesthetic memories refer then to memories of perceptions of spatio–temporal dynamics of our own body in motion. They are inscribed in the body as felt patterns of movements that shape the way we move and allow us to experience it with a sense of familiarity, while at the same time they are flexible enough to adapt themselves to the particularities of each situation. Although Sheets–Johnstone's notion of kinesthetic memory presents a quite different — and innovative — picture of habits and body memory, it still includes the main characteristics attributed to procedural memory. Kinesthetic memories are an effective second nature, the repertoire of "I cans"; they are deeply orienting in our environment and provide us with a sense of familiarity; they present certain regularity despite their flexibility; and they do not represent the past but prolong it in the present. As I have already argued, these characteristics are absent from kinetic memories. Furthermore, kinesthetic memories, like embodied traumatic memories, are at the margins of our experience. And although we can eventually turn our attention to them and bring them to the fore, the level of awareness usually involved is very different from the explicit awareness characteristic of kinetic memories.

More recently, Rowlands (2015, 2017) introduced the poetic term "embodied Rilkean memories" to refer to a sort of context-dependent habits, that is, to patterns of behavioural and bodily dispositions inscribed in the body that are embedded in a particular environmental context and are originated in past events. Embodied Rilkean memories derive from episodic memories, when their content has been forgotten and only the act of remembering persists:

> I open the door in a certain way — one that minimizes its creaking — not because I remember that it creaked. Rather I open the door in this way because a pattern of behavior has been inscribed in my body — and this pattern was inscribed in me precisely because the door creaked. This pattern that has become thus inscribed in my body is my Rilkean memory of the creaking door. If I had no associated episodic or semantic memories, then this Rilkean memory would be my only memory of this door. (Rowlands, 2017, p. 58)

Although embodied Rilkian memories are not considered to be procedural memories in the proper sense of the term, they are efficacious and certainly help us to orientate ourselves in our surroundings. What is more, they are contentless, a pure act of remembrance, so they do not represent the past but they reenact it. And Rowlands also conceives them as involuntary. So once again the similarities with procedural memories are quite salient as well as the dissimilarities with kinetic memories. And despite the fact that Rilkean memories arise from episodic memories and are indirectly linked to past experiences, they do not have intentional content and are never explicit: an explicit episodic memory can accompany a Rilkean memory, but it never transfers its content to a Rilkean memory nor fuses with it.

Finally, Fuchs' (2012) rich taxonomy of the embodied forms of memory does not account for kinetic memories either. Besides procedural and traumatic memories, Fuchs distinguishes other different kinds: (a) painful physical experiences taken into the memory of the body are "pain memory"; (b) "situational memories" refer to memories of sensory and atmospheric perceptions of our body interacting with the world that help us to stay oriented in different spaces; (c) "intercorporeal memories" point to the implicit bodily knowing of how to interact with others which is formed from past encounters and help shape implicit relational styles; and (d) "incorporative memories," that is, bodily habits and attitudes shaped by social roles and culture that have been internalized as a second nature, similar to Bourdieu's (1980) notion of *habitus*. Each type of body memory presents its particularities, but none refers to the ways in which the body explicitly represents the past.

To sum up, none of the relatively recent discussions of embodied forms of memory mentioned in the literature analyses the representative bodily forms that conscious and explicit memories of our personal past experiences can take. Traumatic, erotic, kinesthetic, Rilkean, situational, intercorporeal, incorportive, and pain memories all refer to the traces that different kinds of past events "print" in our body in various ways. If they conserve their singularity and do not become part of the repertoire of our habits and dispositions, they are only implicitly — and many times involuntarily — retrieved. In this article, I have tried to fill this gap by offering an analysis of the way in which the body constitutes a means of representing past personal experiences. Explicit personal memories do not necessarily need to be imagistic or linguistic; explicit personal memories can also take embodied forms, and more specifically, kinetic forms.

The present analysis aims to enrich the already existing inquiry into embodied forms of memory. Contrary to Bergson and Fuchs, for whom "body memory does not represent the past, but re-enacts it" (Fuchs, 2012, p. 19), this article argues that the body can indeed represent the personal past by re-enacting it. In this sense, it should be clear to the reader that the purpose here is not to introduce and add another memory "natural" kind to the already vast taxonomy of memory, but to highlight a particular embodied form that our past experiences can take in everyday recollection.

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