IDEO-MOTOR ACTIONS: AN EMBODIED ACCOUNT

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Abstract. The ideo-motor theory of actions, which has been strongly criticized during the last century, is currently receiving new interest in both cognitive psychology and philosophy. In this paper I will describe the principal theoretical reasons of this renewed attention. More particularly, here I will propose that the functioning of the mirror neurons’ system is a very useful tool to describe how the classic concept of ideo-motor action is close to the contemporary concept of simulated action.

Keywords: Ideomotor actions, Embodied Cognition, Motor Intentionality, Mirror Neurons

1. Ideo-motor actions and simulated actions.

In a very famous and quoted passage of the Principles of Psychology, James (1890)\(^1\) has provided one of the most relevant descriptions of what an ideo-motor action is.\(^2\) Suppose – James imagined – that you are in your bed in a freezing winter morning, and suppose that your bedroom is not stocked with heating. Unfortunately, it’s time for you to get up but you delay doing that. You have the idea of doing something, but the relative motor outcome is thus somehow stopped. Understanding better the reasons of such an inhibition is the easiest way to comprehend what an ideo-motor action is. The important point, in order to describe ideomotor actions, is to understand how this inhibition works. According to James’s theory, such an inhibition is due to a kind of competition between different ideas like, for example, the one concerning the very unpleasant cold of the room or the comfortable sensation of warmth felt under the blankets. Importantly, such a conflict goes on until when, in a fortunate moment of lapse of consciousness, the subject forgets all the corollary conditions and brings the act of getting up to an end without hesitation. In other words the previously paralyzing antagonist ideas have now ceased, thus permitting to the original – i.e. principal – idea to fully exert its

\(^1\) James, W. (1890) Principles of Psychology, Dover Publications.

\(^2\) Even if William James is very often quoted with regard to the ideo-motor theory of action – as it is in this paper – in fact he was not its proper author. Indeed, as remarked by James himself, the term “ideo-motor” was introduced by carpenter in the second half of the 19th century. The history of this concept is thus very long. Too long, to say the truth, to be summarized here. As a consequence, in this paper it is assumed as a starting point the synthesis worked out by William James in his Principles of Psychology. For further discussion see Stock A, Stock C. (2004) “A short history of ideo-motor action” Psychological research 68: 176-188
open effects. Notably, this is not the result of a decision-making process, since there are no fixed rules that permit to settle the abovementioned competition between opposite ideas. This drives to the suggestion that ideomotor actions are not generated in agreement with a decision, weather conscious or unconscious. On the contrary, the breaking of this paralyzing antagonism seems to be governed only by the raw dynamic of weakening – as well as strengthening – of internal urges and internal pulses.

Here, the terminology used by James could drive to some dangerous conceptual misinterpretation, so that a preventive clarification is strongly required. More properly, I’m here referring to the James’s usage of the term “idea”. Normally, in both cognitive theories and in folk-philosophical judgments, such a term is inserted in a mentalistic context. An idea is thus usually supposed to be a mental representation of some precisely identifiable object. However, motor ideas are not items of that kind. Indeed, it is not necessary for them to denote something. Rather, it is logically possible that they present the occurrence of an action, as it is the case in the abovementioned example. Crucially, if these ideas could – at least virtually – do not denote anything, then there is no need of considering them mental representations at all. As a consequence, there is no need to trace a radical distinction between contemplating a motor idea and experiencing its proper content. But let me return, now, to the topic of defining the content of motor ideas. It is not, as claimed, something that we can look at as if it was in front of us or, eventually, introspectively placed somewhere inside us.

On the contrary, it is something that we actively do. Namely, in other – and contemporary – terms such content can be identified with what nowadays we can name motor program. This drives to the assumption that when James speaks about motor ideas, he uses a mentalistic term – idea – by presumably putting it in a non mentalistic conceptual framework. Motor ideas, thus, are not literally ideas, since they are not abstract representations of something – in this case of a motor behaviour. On the contrary, here I propose that the notion of ideo-motor idea is a kind of forerunner of what could be nowadays defined as an embodied simulation of a motor experience (Gallese 2005). What is, then, an embodied simulated action? Of course, a simulated action has not an open counterpart, since it is simulated and then implicit. However, a great wealth of data is consistent with the idea that simulated actions are proper actions, in the sense that they require the activation of the same motor plan required by the production of open behaviour. In other words, a simulated action is a veridical copy of an explicit act produced as the result of an automatic disposition of the body to virtually plan coherent reactions to external stimuli as if they were actually induced them.

Accordingly, there is no need of postulating any substantial distance between an executed action and an action which is either internally simulated or imagined according to a motor idea. Rather, the only relevant difference between them is simply a matter of degrees dealing with the statement that the former is actual and overt, while the latter remains potential and hidden. Nevertheless, the content of the respective programs is the same and, crucially, there is now the possibility of empirically testing such hypothesis, as demonstrated by clinical data collected about anosognosia for hemiplegia. In a recent study, for example,

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4 Anosognosia is a pathological disturbance which occurs after cerebral lesions and that is related to the explicit denial of motor deficits concerning the controlesional side of the body. In the majority of the cases, the lesion is located in the right hemisphere, so that the subject’s denial is usually involving left limbs. Although there can be some difference in the procedure used in order to test the anosognosia,
Spinazzola et al. (2008) have asked of anosognosic woman if she thought to be able in performing bimanual actions like opening a bottle or washing her hands. Since responses were almost affirmative, the woman was there required to perform the very same tasks. The results collected by authors are quite surprising. Indeed, even if evidently unable to accomplish such actions because of her hemiparesis, the woman tried to perform them and motivated her failures – when recognized – by confabulating some improbable reason. How to explain such a phenomenon, anyway?

Theorists of embodied simulation are used to explain these evaluations by claiming that in the case of anosognosia for hemiplegia the motor program is processed in its purest form namely, (1) planned in order to be effectively executed but (2) purged of any open outcome. Thus, the illusionary anosognosic tendency of believing in having accomplished correctly the required action, is due to fact that from the subject’s perspective the action is totally elaborated in the beginning of the action itself. Despite of the plegia, the woman’s brain is indeed able to plan both the entire series of movements required to accomplish the task and the predicted feedback associated to it. Accordingly, the problem is not relative to the beginning of the action. Rather, it is a matter of its terminal stage. More properly, the problem in anosognosia for hemiplegia is concerning the patient’s inability of confronting the predicted consequences of the planned action with the effective sensory responses related to the missing execution. It should be noted, interestingly, that in such a framework the effective feedback is not a pivotal element in the structure of behaviour organization. Rather, in these pathological cases, it is just a simple confirmation of something that was fully anticipated – i.e. simulated – when the action itself was nothing more than an “idea”, even if pragmatic – i.e. motor – in nature.

2. Ideo-motor actions’ structure: insights from mirror neurons

In this section I will provide a description of the basic assumptions that stay below the theory of motor idea. In such a way, I think, the proximity between ideo-motor actions and simulated actions would become more evident. As it is developed in the Principles of Psychology, the theory of ideo-motor actions is supposed to be based on the following three principles:

1) A motor idea is structured as a meaningful item.
2) A motor idea can intrinsically cause – and motivate – an action.
3) An ideo-motor action occurs when an imbalance between conflicting motor ideas occurs.

Since each of them could be subscribed as fundamental even from contemporary theorists of embodied cognition, let me face with them one by one.
The first assumption claims that an ideo-motor idea is something meaningful. The subsequent step, obviously, is to specify in what such a meaning precisely consists of. Once assumed the conceptual framework of embodied simulation, the answer is quite easy to provide. An action has a meaning when it has a goal. Crucially, attention is here required regarding the use of the word “goal”. In such a context, the term “goal” is declined in a motor way, rather than in with a teleological value: claiming that an action is an action in virtue of the presence of a goal, doesn’t imply anything about the reasons below the subject’s decision of acting or about his distal projects. On the contrary, an action is a proper action because it has a motor goal, i.e. because it is directed toward a target. The motor meaning of an action is thus intended as a practical value which binds the acting subject and the target, i.e. an object of the surrounding environment. Pragmatically speaking, it is identical to, or provided by, its consequences on the external environment. Interestingly, since this goal-relatedness doesn’t imply a high-order conceptual elaboration, the motor meaning of an action doesn’t require an inferential-like structure in order to be caught, as demonstrated by several experimental data concerning mirror neurons’ activity. It should be noted that, by adopting such a perspective an asymmetry between an action and a movement is introduced and, crucially, it is not a matter of simple terminology. Indeed, only actions have a meaning, while movements are simply units of mere kinematic features. Accordingly, an action can be defined as a goal-directed ensemble of movements. As a consequence, a primacy of the goal over the way an action is run must be assessed. An action can be performed in several ways, since the related task could be accomplished according to different strategies. Conversely, it is quite evident that a series of finalized movements can be directed only to a single target, thus showing the adhesion to a univocal meaningful relation. In other words, by using ideo-motor terms, a motor idea concretely embodies a tendency towards a goal that literally shapes every underlying movement and that provide them with a precise meaning.

Moreover, since movements by itself are meaningless, the proper significance of a motor idea is not completely reducible to the mere sum of the consequent movements. What is, thus, such an additional quid? And, since only observed actions can be understood, how it is possible to understand the meaning of an action? As stated, the motor meaning of an act is

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7 The full description of the functional characteristics of the mirror neuron’s system exceeds the aim of the present paper, in which such a neurobiological mechanism is simply handled as a conceptual tool useful for the explanation of some aspects of behavioral architecture. Accordingly, for the sake of my proposal is here sufficient to claim that mirror neurons are a special kind of visuo-motor neurons selective to the execution of transitive actions. More precisely, mirror neurons are selective to both the execution and observation of goal directed movements. For the description of the first report concerning mirror neurons, see Di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., Rizzolatti, G. (1992) “Understanding motor events: a neuropsychological study”, *Experimental Brain Research*, 91: 776-780. According to such an hybrid format – which is both motor and sensory – it has been suggested that mirror neurons are on the basis of our ability to comprehend other’s behavior without executing any inferential operation, by matching the other’s actions with our motor vocabulary. For further discussion about the characteristics of mirror neurons’ system see Rizzolatti, G., Fadiga, L., Gallese, V., Fogassi, L. (1996) “Premotor cortex and the recognition of motor actions”, *Cognitive Brain Research*, 3:131-141; see also Rizzolatti, G., Craighero, L. (2004) “The mirror neurons system”, *Annual Review of Neuroscience*, 27: 169-192. For the notion of motor vocabulary, see Rizzolatti, g., Luppino, G. (2001) “The cortical motor system”, *Neuron*, 31: 889-391.
provided by the existence of a certain subject-target interrelation, which shapes the kinematic profile of the whole action. As a consequence this goal-directedness might be recognisable in the early stages of open behaviour as it is clearly shown by physiological data from mirror neuron’s studies in macaque monkeys. For example, Umiltà et al. (2001) has demonstrated that the mirror neuron system can be activated by the observation of both complete and incomplete transitive motor acts. By considering the functional characteristics of mirror neurons – together with the role that they are supposed to play in others’ understanding by theorists of embodied simulation – these data clearly show that action comprehension is related to the presence of a target and not to the computation of action’s open consequences. Crucially, indeed, intransitive actions – i.e. those motor chains that are not provided with a target, do not activate the mirroring response of mirror neuron system. Once again, then, it is possible to provide recent corroborations to the ideo-motor assumption by which the importance of an action is located in the underlying motor idea rather than in its full open realization.

Let me move, now, to the second principle of our list namely, the one by which an ideo-motor action must be caused by the underlying motor idea. One of the most important claim of this paper, is concerning the fact that such a causal power is closely related to what – from Merleau-Ponty on – has been named motor intentionality. This is not the right place to fully explore the various faces of this concept, which would require a totally dedicated analysis. For the sake of my proposal, however, a brief sketch of this framework would be sufficient. In his Phenomenology of Perception, Merleau-Ponty described the clinical case of Schneider, an ex-soldier who after a traumatic brain injury incurred during the First World War showed evident difficulties in performing abstract movements. When he was asked to indicate a part of his body, for example, the performance was totally unsatisfactory. However, the deficit ceased when there were no abstract instructions to follow, and the task was merely pragmatic. In other words, in the patient Schneider it easy to note

“a dissociation of the act of pointing from reactions of taking or grasping: the same subject who is unable to point to a part of his body, quickly moves his hand to the point where a mosquito is stinging him. Asked to point to some part of his body, he can only manage to do so if he is allowed to take hold of it. […] If I know where my nose is when it is a question of holding it, how can I not know where it is when it is a matter of pointing to it?”

Accordingly, it seems that the patient knows how to reach a target, in our case a bodily part, while ignoring how to point to it. The general explanation of this asymmetry is due, in Merleau-Ponty’s argument, to the non uniqueness of the spatial experience. Spatial relations can be experienced in different ways, so that a spatial map of the surrounding environment can be drawn in agreement with several frameworks. More precisely, such knowledge can be accomplished both according to a high-ordered, top-down, cognitive act and according to a bottom-up activity which is antecedent to any ability of thinking. In order to explain the dynamics internal to the second relation, Merleau-Ponty introduced the notion

of motor intentionality, i.e. of a kind of intentional relation which is declined in motor terms. As the classical, cognitive, intentional relation binds together the mind and the world the motor intentional arc functions as a bridge between the body and the external environment and, interestingly, such a bridge is provided by the subjective capacity of acting.

In line with this perspective goal directed actions – or, alternatively, ideo-motor actions – rise as the result of a natural bodily project which remains internal to the action itself. It follows that the interactive nature of the relation between the subject and the external environment is sufficient for automatically causing the rise of different motor plans. Accordingly, there is no need of supplementary reasons to elaborating a motor plan, so that a motor idea can be defined – as in the Jamesian framework – the proper cause of the relative open behaviour. Once again, if the relation with a goal is the pivotal element in determining the meaning of an action, the observation of this relation can be sufficient to comprehend what the acting subjects is doing. Moreover, since the very same relation is the cause of the action, by comprehending this relation it would be possible to comprehend the cause of an observed action. Consequently, it would become possible to recausing – namely, to reproducing – it in first person.

This is why the theory of motor ideas has been adopted as a conceptual framework in many researches on imitation and skilful coping. For example, Greenwald (1970) has explicitly proposed that imitational processes have an ideo-motor basis by pointing out that in cases of imitation the motor schemata – and then the relative motor ideas – of the imitated subject and those of the imitator are reversible, i.e. mutually interchangeable. Crucially, the intuition of reversibility is totally in line with some mirror neurons’ functional characteristics, which are supposed to play a pivotal role in embodied simulation’s theories. If – as mirror neurons’ theorists are used to claim – the observed action and the executed one shares the very same motor program, imitational abilities are the simple consequences of such a common experiential ground between the observed and the observer. Notably, this operation does not require that the observed action is comprehended in its conceptual meaning. Rather, what is sufficient – and necessary – to understand here is the motor meaning of the action, namely its

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goal-directedness. Accordingly, such a comprehension could be accomplished without involving those high cognitive mechanisms which are usually responsible of conceptual interpretation. Moreover, the relation between coping and mirror neuron’s activation fits well with the quite intuitive statement that it is easier to reproduce a well-known action than an unknown behavior. Stated that the repeated execution of a certain motor program strengthens its specific weight in the subject’s behavioral economy,\(^{16}\) coping an already known action is indeed simpler than coping a new action because in the former case the observed act is already part of the observer’s motor repertoire, so that the motor idea could be immediately translated in motor terms and, consequently, both comprehended and replicated.

This condition of immediacy fails in the case of the observation of actions which are not already knows by the observer. Accordingly, the coping of these actions requires a multi-step process in which the observed action is firstly fragmented in small blocks of already known elements, then comprehended in this sequence and finally reconstructed and replicated. In other words, the basilar mechanism remains the same, although the process is obviously longer and more articulated. Accordingly, in order to be run, it requires a more complex mechanism. However, if mirror neurons are the core matrix of replicating others’ motor ideas, and if motor ideas are capable of intrinsically motivating the action it is possible to question why we are not always involved in coping processes or in compulsive imitative behaviors. This drives to some considerations about the third assumption of ideo-motor actions’ theory namely, the one concerning the necessity of breaking the already existing balance between motor ideas in order to produce an ideo-motor action.

First of all, it is important to stress that the class of ideo-motor action doesn’t contain reflex-like behaviours. On the contrary, the actions produced as a consequence of motor ideas are voluntary actions. The cause of these actions, as stated, is then totally internal to the subjective dimension. Moreover, according to James, in the subject’s mind several opposite motor ideas are continuously competing each other. Sometimes such competition has no practical consequences because the different motor ideas counterbalance each other, by mutually inhibiting their effects and by leaving the subject in a situation of inaction. Sometimes, however, it could happen that one motor idea gets stronger than the other ideas. In such cases – which are, of course, very frequently – a motor schema is properly activated so that an effective action is run. This could happen for different reasons – either the ideo-motor idea can be strengthened by some psychological factor, or the competing ideas can become weaker by some other psychological factor – the precise analysis of which is not in line with the more restricted aim of this paper. However, it is interesting to note that in both cases the achievement of one motor-idea among others is effectively due to a kind of breakup in an already existing dynamic balance between psychological states and motor programs.

Once again, by adopting a mirror neurons’ theory’s perspective, it is possible to shed interesting light on these dynamics. Stated that (1) the activation of a motor program can be considered the contemporary conceptual equivalent of the elaboration of a motor idea, and stated that (2) mirror neurons’ activity has an important role in these processes, it becomes possible to claim that (3) the elicitation of mirror neurons is normally inhibited by some other contrasting mechanism. In this sense, a purely bottom-up functional structure would be insufficient, since there is the need of the additional contribution of a putatively top-down mechanism of control. For example, such a framework suggests that the great imitational

attitude of infants – which surely plays a pivotal role in behavioral learning – is due to a not already complete functioning of the control inhibitor. Analogously, even the pathologic consequences of echopraxia\textsuperscript{17} can be explained according to the presence of a weak inhibitory system which cannot contrast the activity elicited by mirror neurons. Of course, further studies from the field of both primate physiology and human neuropsychology are required in order to make the structure of this mechanism clearer but, interestingly, all these considerations are perfectly in line with the general jamestian schema by which actions are effectively executed when an asymmetry is introduced in the equilibrated balance between already present competing motor ideas.

**Conclusion**

Despite the aversion of behaviourism, the theory of ideomotor ideas can nowadays receive new interest if opportunely updated in agreement with recent findings from the fields of cognitive neuroscience, psychology and philosophy. The thesis discussed in this paper is that such an implementation is possible and that the first steps in this direction are already done, as magisterially exemplified by the great theoretical development concerning the role of mirror neurons in understanding others’ behaviour. Further researches are of course required in order to fully develop this conceptual framework, but the quest is auguring well.

\textsuperscript{17} Echopraxia is the pathological tendency of compulsively imitating other’s gestures. For a mirror neurons’ account of echopraxia, see Pridmore, S., Martin, B., Ahmadi, J., Dale, J. (2008) “Echopraxia in schizophrenia: possible mechanisms”, *Australian and New Zealand Journal of Psychiatry*, 42: 565 – 571.