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Mirror neurons and the phenomenology of intersubjectivity

DIETER LOHMAR
Philosophisches Seminar, Universität zu Köln, Germany
(E-mail: dieter.lohmar@uni-koeln.de)

Abstract. The neurological discovery of mirror neurons is of eminent importance for the phenomenological theory of intersubjectivity. G. Rizzolatti and V. Gallese found in experiments with primates that a set of neurons in the premotor cortex represents the visually registered movements of another animal. The activity of these mirror neurons presents exactly the same pattern of activity as appears in the movement of one's own body. These findings may be extended to other cognitive and emotive functions in humans. I show how these neurological findings might be "translated" phenomenologically into our own experienced sensations, feelings and volitions.

Key words: mirror neurons, intersubjectivity, *phantasma*

More than 70 years ago Husserl established the question of access to other persons' minds as a philosophical problem. But even today the way in which we have access to other persons remains puzzling and enigmatic, i.e., how it is possible that we know about their sensations, insights, feelings and volition (*Wollen*). Sometimes it appears that we are connected with another person in an elementary and very body-bound way: If a person facing us is telling us about her actually experienced pain, then we might sympathize and even literally "feel with her."

Our co-feelings have a structure and they can be quite specific, but it is still difficult to describe exactly what we mean by "co-feeling." For example, if a person is reporting to me about a painful accident caused by broken glass while washing up, my co-feeling is totally different from the case when she reports about the death of a close relative. We might suppose that her report reminds me of my own bad experiences with broken glass – and these experiences somehow come back and become alive in a mysterious way. One of the most remarkable aspects of my co-feeling is that it appears to me as if it were somehow "located in my hands." But this localization is different when she mourns about a deceased close relative: We tend to co-feel the grief of other persons in our chest or our throat. Nevertheless, my co-feeling is not as strong as my corresponding own feeling. So there is some structure in our co-feeling which might allow for a closer analysis. It is specific, located in one sense field (or more) and in our body, but still weaker than my usual sensations.

Theories of sympathy and co-feeling are always in danger of becoming victim of quite easy objections. For example, someone might say: I do not feel like this. Or: In my view, fellow feeling and sympathy are old fashioned

theories which had their time in the 17th century moral philosophy but not today! – Perhaps just today this kind of hard skepticism may be refuted by neurological findings.

What I will point your attention to are not old-fashioned theories of sympathy. I want to describe something that is more basic, more widespread and that belongs to normal situations in everyday life. My analysis is based on the neurological discovery of "mirror neurons;" I think that this discovery is of eminent importance for the phenomenological theory of intersubjectivity.

The fundamental conviction behind my analysis is that the performances of mirror neurons have an "internal view," i.e., they can be experienced by me and these experiences are accessible to phenomenological description. Herein I am going to follow the philosophers who try to establish a connection between phenomenology and neurology.

In the first part, I will briefly present the findings on mirror neurons. In the second part I will make clear what phenomenology can contribute to the interpretation of the activity and performance of mirror neurons. In the third part I will formulate four theses which concern the experienced "inner view" of the activity of mirror neurons. In the fourth and final part I will discuss some questions concerning the role of co-feeling in bodily movement and of volition (*Wollung*) associated with it.

Mirror neurons

Mirror neurons are located in our premotor cortex (region F5), the part of our brain which controls motor activities like walking, grasping, turning and pulling with our hands. We know about the functions of the premotor cortex from the so-called "loss research." In loss research, one tries to find out which physical and mental performances are lost when a brain region is injured or removed for medical reasons. The descriptions of the motor function obtained with the help of loss research remain, however, quite rough.

Generally speaking, the improvement of the image-based methods of observation (e.g. PET, fMRI) in the last decades supports studies of the function of single brain regions. In this way one can observe the neuronal activity corresponding to cognitive, emotional and motor activities with different procedures which represent metabolism and neural activity in these regions. Yet, up to now, these impressive pictorial representations cannot achieve a reliable identification of the mental activity in question.

There are, however, still more precise instruments for the study of brain activity. The method of the "single neuron recording" in animals is particularly impressive. By means of this method, the activity of a number of individual neurons is observed in a small region of the brain. In addition, one can observe several hundred neurons simultaneously and record their activity so that

afterwards a statistical evaluation is possible. This method is so exact that, for example, in observation of the motor cortex we are able to assign to each kind of "precision grip" a unique pattern of neuronal activity. This unique neuronal activity pattern can be identified with the same movement again and again. That is, if we grasp a small thing with the right thumb and forefinger and we turn our hand right in the wrist, a characteristic pattern of neuronal activity can be observed in our premotor cortex. We can distinguish this pattern from all other movements, for example, from the same movement but turning the hand to the left.

Around 1995 G. Rizzolatti, V. Gallese and associates at the University of Parma, found during experiments with non-human primates that the premotor cortex is not limited to controlling the movements of *one's own* body: some of the neurons located in this area also represent the *visually* registered movements of *another* animal (Fardiga et al. 1995; Gallese et al. 1996; Rizzolatti et al. 1996; Rizzolatti et al. 1997; Gallese 2000; Gallese 2001). That means: Visually registering a specific movement of another animal provokes the same pattern of neuronal activity as appears in the analogous movements of one's own body. Therefore Rizzolatti and Gallese called these neurons *mirror neurons*. There were, however, some differences between the two cases of neuronal activity. The activity of neurons in the case of "mirroring" was not as strong as in one's own movement.

Mirror neurons have some further characteristics which are important for the understanding of their function. Likely, the most amazing peculiarity is the fact that mirror neurons become active only if the experimental animal (chiefly macaque monkey) sees a *purposeful action*. The visible goal seems to be a crucial component of the activation of the mirror system. Bare miming (mimicking) of the hand movement without the visible goal does not trigger the neural activity. Also, the use of tools to execute the action and to reach the action goal leads to clearly weaker activities in the mirror neurons.

Since these findings of Rizzolatti, Gallese, and their colleagues, the research on mirror neurons has been extended to other parts of the brain. The experiments centered at first on the cortical regions which are closely connected to the motor cortex and also the regions which give major inputs to area F5. With the method of single neuron tracing corresponding results were found in the posterior parietal cortex (area 7b) of macaque monkeys. The investigations were similarly dedicated to the study of neuronal activity during bodily movements of the monkeys and the visual observation of goal related movements of the body and hands of other monkeys. The results showed that around one third of the neurons which were active during the action performance were also active in visual observation of the same movements in other monkeys (Fogassi et al. 1998; Gallese et al. 2001). Disregarding the difference in intensity, a unique pattern of neuronal activity associated with a specific

bodily activity could be identified. As in the research on area F5, it turns out that the visibility of the action goal is one of the most important factors in activating of the mirror neurons. These findings led some neurologists to the supposition that there may be an expanded network of mirror neurons in the brain, which becomes activated both by self-performed and observed bodily action.

The mirror neurons research has been extended from non-human to human primate population and a far-reaching correspondence of the findings on mirror neurons between humans and other primates has been recorded (Fadiga et al. 1995). Additionally, it has become clear that there are no inter-species barriers in this type of bodily understanding of other subjects: Non-human primates interpret the movements of the human experimenter in the same way as they interpret the movements of their own species. We may suppose that the reverse is true as well.

New tasks for phenomenology

We may interpret the sense of this "mirroring" performance of our brain in different contexts. From the general point of view of the evolution theory the ability to grasp the sensations, feelings and intentions of other persons has a clear purpose: All socially living organisms (especially humans and other primates) must be able to grasp the feelings and intentions of other group members as precisely as possible for this is a decisive factor in the reproductive success of the species as well as in the individual survival within a co-operative group.

Aside from this general evolutionary interpretation of the role played by mirror neurons I would like to pose the same question from the point of view of the single person and his or her own firsthand experience. We might call this kind of sense a "concrete sense" of the experiential effects of mirror neurons from an experiencing first person point of view. In other words, what I want to know is how the experiential side of the mirror neuron's performance is experienced by me, how it shows up, how it feels and how it moves me. I want to know how other persons and their experiences appear in my consciousness and my own experiences. In my view, questions of this type can be worked on by means of descriptive phenomenology.

I believe that the discovery of the mirror neurons presents a real challenge for the phenomenology of intersubjectivity. At the very least, it provides an impulse for a renewed and deepened phenomenological analysis of our access to the sensations, feelings and volition of other persons. In this reflective analysis we should let ourselves be consciously inspired by the discovery of mirror neurons to pay new and concentrated attention to our feelings and sensations when we see bodily movements of other persons.

My suggestion is to interpret these neurological results by a refined description and analysis of our feelings. Maybe this analysis can in a certain sense "confirm" the neurological findings and also lead to new directions for experimental research. My basic thesis is that the experiential effects of mirroring neural activity will "show up" somehow in our consciousness. This showing-up of the mirroring activity (and our ability to notice it) means that we can pay heed to the "mental side" of this brain activity in our own experience and that we are able to examine it from a phenomenological point of view.

The past interpretations of mirror neurons research derive mostly from a third person perspective, which focuses on what can be observed "from the outside": One primate sees the movements of another primate and the same neuronal pattern (only with weaker activity) shows up in its motor cortex as when it executes the same bodily movement itself. All the interpretations of the mirroring brain activity lie so far in the hands of a psychology based on a rough transfer from the observation of the persons from the visual outside to the "inside" of experienced sense.

What phenomenology can contribute to this situation is an extension of the observational basis: We have to take up the clues and descriptions of the "interior perspective" of the experiencing consciousness. In this "internal perspective" elements of sense show up in our intentional experience itself and in the accompanying feeling. Accordingly, the first person perspective should also be consulted in the interpretation of neurophysiological findings.

Such a procedure is more appropriate to the abilities and strengths of phenomenology. If we cannot find the weakest trace of the "mirroring" brain activity in our own experience, then the feelings concerning other persons would remain unnoticed. Our way of constituting the sensations and feelings of other persons would remain completely "theoretical" and rest only on analogy. That is to say, they would be entirely inferential, resting on logical conclusions from conceptually grasped starting points (and without our own feeling). Surely this is conceivable but our own experience speaks against it. This interpretation of our access to other persons is close to the "theory-theory" approach (Premack) in the analytic philosophy of mind, which understands our access to other persons as a purely cognitive process based on concepts, algorithms and inferences. This conception is opposed by the simulation theory of understanding (Goldman), interpreting our access to other persons as a kind of construction or simulation in the medium of my own experience.

The task for phenomenology as a descriptive science of consciousness is a renewal and deepening of description. We might start with a very narrow idea of this task. If we are orienting literally to the discovery of mirror neurons in our premotor cortex then we might ask: How does the rotation of a hand really feel? What do we feel if we see the same movements in others? The findings

of mirror neurons suggest that we have a comparable feeling, if we watch the bodily movements of another. However, it is obvious that when we grasp someone else's movements we do not only think of his or her bodily movements in terms of kinesthetic experience but of his or her overall aims, feelings, volition and so on. Thus we have to broaden the scope of our investigations beyond the experience of movement alone.

Another important demand is that the methods of investigation and the resulting theses should somehow allow of testing and verification. On the other hand, they should lead to hypotheses and new experimental arrangements that can be experimentally verified by neurology and perhaps also by empirical psychology. Even if we are not able to fulfill the expectation of verification, then at least a "useful hypothesis" should lead to new questions which allow experimental verification. Otherwise phenomenological investigations remain useless for the experimental research and there would be no reason to prefer them.

The relationship between phenomenology and neurology at the present point of development should be one of mutual inspiration and fertilization. One could say that one discipline should serve as the "truffle-hound" for the other. A truffle-hound has an excellent nose and its only task is to lead the farmer to a place in the forest where truffles are likely to grow underground. The truffle-hound is not to excavate the truffles, however, since it would eat them immediately. One could rephrase this point by saying that the findings of one discipline must be evaluated with the means of the other in order to achieve fruitful co-operation. Phenomenology must dig with its own means where the neurology indicates possible rich finds; however, the relationship should be the same in the other direction: neurology can expect phenomenology to provide helpful hints for a worthwhile further investigation by its own means.

Phenomenological interpretation of the "mirroring activity"

The discovery of mirror neurons forces us to undertake a renewed and deepened phenomenological investigation of the way in which we co-feel or co-experience the bodily movements and actions of other persons in the weak "as if" mode.

I think that we should not limit our investigation to the co-feeling of the kinesthetic experiences (as the present results in mirror neuron research might suggest). An action always has an action goal and is accompanied by sensations and feelings. The indispensability of the visibility of an action goal became already clear with the analysis of the experimental findings of mirror neurons.

Thesis 1: Maximality

We should consider actions as a whole. Thus we have to investigate the dimensions of sensation, feeling, kinesthetic experience and volition both in

phenomenological descriptions and in neurological experiments (examining the mirror characteristics of parts of the cortex). All these dimensions of experience are involved within normal action. Therefore, it is reasonable to suppose that they could also be found within an action of another person that we have "understood" or "reconstructed." We call this first thesis the *thesis of maximality*. It is "maximal" concerning the number of the dimensions co-experienced with other persons: *We can co-experience all dimensions of experiencing in other persons.* I will argue for this somewhat risky thesis by means of all the concrete examples I will discuss in this paper.

I should, however, first mention another important point: The maximality thesis has a primarily heuristic character. In the first place, it should serve to preserve the unity of an action in the mode of co-experiencing. In the second place, it should prevent us from ignoring weak aspects of our co-experiencing so that even a weak mode of givenness would be relevant.

If the heuristic thesis of maximality can be accepted, then it appears to impose a claim on the experimental research to investigate the whole net of "mirroring areas" including all the dimensions that are present in normal actions. There must be groups of neurons with mirror characteristics in all specialized regions of the brain which are involved in sensations, feelings, willing, kinestheses, and bodily movements.

Thesis 2: Weakness

In co-experiencing the experiences of other persons we always deal with an experience that is dimmed or weakened in a characteristic way. There are some good examples for our ability to co-sense the sensations of others and to co-feel their feelings. In the last part of my presentation I will discuss examples that show our ability to co-act bodily actions and to co-will the willing of others - but in a weak, "as if," mode. This "as-if" mode (in co-sensing, so-feeling, co-acting and co-willing) is definitely not a cognitive mode that we would conceive in concepts only but would not feel. In fact, it is a weakened mode of real sensing, real feeling and real acting - but it is not identical with the full modes of these performances.

Recall the example of someone reporting that she cut herself with a broken glass in this regard. The co-felt pain is a very specific sensation. It is somehow located "in" the hand, rather than in the leg or in the head. The pain of cutting my hand with glass is also distinct from mourning, as well as from taste.

Thesis 3: Phantasmata

The third thesis stipulates that the unique mode of co-experiencing others (co-sensing, co-feeling, co-willing and co-acting), which we carry out at the

sight of other persons, is based on phantasmata of our sensing, feeling, willing and acting, which we produce within us.

A phantasma of a sensation is "something like" a sensation, i.e., it is given to us in the medium of a sensation. A phantasma is not, however, a real sensation, because phantasmata take place in the absence of that which normally evokes the appropriate sensation. The phantasmata, which make our co-sensing possible, do not appear deliberately but rather unwillingly. But the fact that they occur unwillingly does not imply that they occur automatically in all cases when I register that someone is hurt.

It is important to mention that the co-experiencing phantasmata to a certain extent are still "under the reign" of the ego. It is easy to illustrate this with an example: If I am watching a cowboy-film in which the bad guy is beaten up by the leading actor at the end, then I do not co-feel with the bad guy. On the contrary, I like the fact that he is suffering.

One of the advantages of the phantasmata thesis is that it lets me understand why my co-feeling of pain or grief of others does not reach the intensity of my own pain or grief. Apart from its lower intensity, my co-sensing is quite specific, i.e., I experience "nearly the same" sensation as the other person does. And the co-experiences supported by the phantasmata appear to me as if they were precisely localized (in my hand, in my mouth etc.). Nevertheless, the assumption of a feeling in the other person – and thus my co-feelings – may succumb to deception: I co-feel exactly what I believe the other person is experiencing now. But even this may change if I suspect the other of deceiving me or if I recall the fact that he is only an actor in a film. My co-feeling is dependant on my intentional performances.

Consider another example: If you see someone biting into a lemon, your own taste-field becomes affected, you feel as if there was something sour in your mouth and react accordingly. We are co-experiencing a specific sour taste which is localized precisely in our mouth. The experience is confined to the sense-field of taste and it is simultaneous and coordinated with the other person's biting into a lemon. Thus with the help of phantasmata we have a precise idea of the other persons' sensations in the realm of taste.

The above example shows that the phantasmata which are the medium of our co-experiencing depend on personal experiences. An inexperienced person, for example a child that is not yet acquainted with lemons, will not have the kind of co-experiencing an adult will have. A further merit of the phantasmata thesis is that we do not need concepts or language to have an idea of the sensations, feelings, bodily actions and volition of others. Thus it will work also with all other animals! This opens up a new way of understanding the kind of intentionality that non-human persons like primates are capable of. Language is not necessary to have a precise idea of what is going on in others. In co-experiencing with the help of phantasmata, we have "something

like" a sensation and thus acquire a medium with which to intend the feelings and volition of others. Humans may additionally be able to speak about this but linguistic ability is not essential to have a precise idea of the others' mind.

Yet another aspect of phantasmata is remarkable from the phenomenological point of view: We are "intending" with the help of phantasmata complex sensations and feelings of other persons as well as co-feeling them. Thus we might say that in this case phantasmata have both a sense-bearing and sense-fulfilling function at the same time (Cf. Husserl 1970, Section 9).

Thesis 4: Phantasmata are sense-bearing intentions

This leads us to the fourth thesis: Phantasmata with which we co-experience the sensations, feelings, volition and bodily actions of others have a precise sense. They are specific intentions-of-something, i.e., they are sense-bearing intentions.

This idea reveals another advantage of the phantasmata thesis. With the help of phantasmata, we are able to intend objects and their properties in a very precise manner. This ability applies even to cases where properties and objects cannot be properly distinguished by means of language. If we think of "the redness of tomatoes," we know that we are able to distinguish this red from other kinds of red even if we are not able to give an appropriate description of the differences. Phantasmata which are associated with objects of our thinking may help us to understand how this is possible. If you conceive the idea of "yellow cornfields," "red tomatoes," "the screeching of the dentist's drill" – all these ideas somehow arouse short term phantasmata in your mind which form precise pictorial (or auditorial) ideas of the intended thing or event.

Co-acting and co-willing

In this last part I will analyze co-experiencing bodily actions of others against the background of my four theses. In doing so, my special interest is to show that we can in fact co-experience bodily actions of others. Beside this I would like to show that there is a close connection between co-acting and co-willing. It needs to be specified that *co-acting* when viewing bodily actions of others is not real acting.

The idea of *co-willing* with others may appear problematic. Can we really claim that we can participate in the volitional acts of another person? How should this be possible keeping in mind the fact that we do not really act in our co-acting with him or her? Let us carefully investigate our feelings and actions when co-performing actions (and volitions) of others: are they composed exclusively of the sensation of bodily movement together with

kinesthetic sensations and the physical effort? Or is there more involved in my co-experience? It is especially interesting to know whether the volition of others is also to be co-experienced and how this would be possible. Do we have a phenomenological first person access to this experience?

I do not want to give the impression that I am able to provide an absolutely certain and comprehensive response to these questions. What I have to offer are some arguments and descriptive clues for the possibility of co-willing and the special mode of doing so. The first difficulty seems to be that I must claim the possibility of a co-willing that does not develop into a real willing and does not result in real acting. We have also to distinguish this co-willing from the case when we really want to act from our own motives but due to external obstacles are hindered in acting. The hypothesis of co-willing distinct from real willing is supported by the fact that in our own experience we know that there are "weak forms of willing" that do not develop into real willing and do not lead to real actions. Nevertheless we must interpret them as intentional experiences that are already striving towards an action and that are therefore experienced as a kind of willing. What I am thinking of is the following: we find in our own involuntary movements, especially in the context of co-experiencing bodily actions of others, something like an "indication of acting" (*angedeutete Handlung*), which does not develop into a real executed action. Let me point to two familiar examples of such "indicated actions."

Everyone remembers the scene in which Buster Keaton is hanging on the clock of Big Ben, desperately clinging to the hand of the clock. There are many similar scenes with cliffhangers in action films so if you do not remember Buster Keaton, think of Sylvester Stallone. Now, what we register in watching a cliffhanger scene is a strongly felt tendency to grasp something with our own hands. Sometimes our hands may unwillingly jerk, as if they were going to grasp and take hold. Apart from this strange behavior of our hands, we realize that our hands are sweating because we co-feel the fear of the person.

When we are co-experiencing this type of bodily action we are also co-feeling the desperate tendency of the other to take hold of something and the mode of experiencing this willing is the phantasma. Together with the co-acting (i.e. the co-acting of trying to hold on to) as a phantasma of a bodily action, the co-willing to take hold of something is present – and this is also experienced in the mode of a phantasma.

Another characteristic situation in which we co-experience these strange "indicated actions" can be found in a well known scene from *Jurassic Park*. I am referring to the scene where the leading actor lies injured on the loading area of a jeep while this jeep is being hunted by a gigantic Tyrannosaurus Rex. During the whole chase the T-Rex tries again and again to get at the legs of the leading actor, he is snapping at his legs. The whole scene is very thrilling – but perhaps the reaction of the audience is even more exciting:

Each time when the saurian is snapping at the legs of the actor, the spectators draw back their legs. That means that the spectators behave as if the threat was aimed at their own legs and they even "start to act" accordingly. They assume "indicated" but not real actions for they do not stand up and run out of the cinema. In my view, this is a case of co-acting and co-willing without really acting.

One might be tempted to understand the whole event as a mere psychological effect or some kind of an enigmatic identification of the spectators with the actor. But what is happening has a meaning, which can be laid bare by means of a careful description: We experience the fear and the will to defend ourselves or to flee the dangerous situation of the other person in a vivid and intense manner. That entails that we exceed the mere intellectual understanding of the willing act of the other and engage in a low-level co-willing. This mode of co-willing, however, is not strong enough to move us to real acting. Sitting in the cinema, we know intellectually that we do not have to flee the saurian - but this intellectual knowledge does not hinder our co-experiencing: It looks as if our legs do not know that they are not really endangered.

The result of this analysis is that we are not confined to a single consciousness. The "voices" of others, i.e., their sensations, feelings and volition are somehow "really there" and we co-experience them. In my view, a decisive progress in the phenomenological analysis of our access to others would be made if we tried to analyze these special forms of phantasmatic co-feeling, co-sensing, co-acting and co-willing.

I hope that my analysis has shown the ability of the human mind to represent all dimensions of experience in the mode of phantasmata (i.e., the sensations of pain and sour taste, the feelings of grief and joy, bodily movements and even volition) in every case of constitution of the experiences of others. We realize that it is not in the first place the face of the other that gives us an access to his or her inner subjectivity. We do not in the first line experience the other as an entirely different being who expresses the unconditional demand to rest unharmed, as in the philosophy of Levinas. It is also not the look of the other that challenges us and throws a shadow over our space and our possibilities, as in the philosophy of Sartre. Mirror neurons urge us to investigate the way we co-feel others' feelings and co-enact their bodily actions without acting really. In the phantasmatic co-experiencing, we experience an unavoidable proximity and a cognitively immediate bodily equality which is the basis of our access to others.

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