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DOI
10.1037/1089-2680.12.2.127
Publication date
2008
Document Version
Final published version
Published in
Review of General Psychology

Review of General Psychology
2008, Vol. 12, No. 2, 127–136

1089-2680/08/$12.00 DOI: 10.1037/1089-2680.12.2.127

The Diverging Force of Imitation: Integrating Cognitive Science and Hermeneutics

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Recent research on infant and animal imitation and on mirror neuron systems has brought imitation back in focus in psychology and cognitive science. This topic has always been important for philosophical hermeneutics as well, focusing on theory and method of understanding. Unfortunately, relations between the scientific and the hermeneutic approaches to imitation and understanding have scarcely been investigated, to the loss of both disciplines. In contrast to the cognitive scientific emphasis on sharing and convergence of representations, the hermeneutic analysis emphasizes the indeterminacy and openness of action understanding due to preunderstanding, action configuration, and the processual nature of understanding. This article discusses empirical evidence in support of these aspects and concludes that hermeneutics can contribute to the scientific investigation of imitation and understanding. Since, conversely, some grounding—and constraining—aspects of hermeneutics may be derived from cognitive science, both should be integrated in a multilevel explanation of imitation and understanding. This holds also for explanations that are largely based on mirror neuron systems, since these appear to be sensitive to developmental and experiential factors, too.

Keywords: imitation, cognitive science, hermeneutics, philosophy, explanation

Imitation is a phenomenon that has attracted more and more attention in psychology and cognitive science in recent years, as recent article collections demonstrate (Hurley & Chater, 2005; Meltzoff & Prinz, 2002b). In their foreword, Meltzoff and Prinz (2002a) referred to developments in four areas of research that have renewed interest in imitation: neonate imitation, adult social cognition, action–perception interaction, and mirror neuron systems. Taken together, these and other developments show imitation to be a crucial part of explanations of (human) understanding and interpretation of other subjects and actions.

These collections offer a wide range of approaches to imitation, ranging from ethology to economics, from neurophysiology to morality. Astonishingly, however, philosophical hermeneutics is not included, not even in their indices. This is unfortunate, because hermeneutics has much to offer to research on imitation and understanding, and cognitive research could empirically ground the processes that hermeneutics investigates. Since hermeneutics can be an investigation of both the process and the properties of understanding and a theory for understanding complex intersubjective interactions, its contributions could be manifold. Moreover, it focuses directly on imitation.

Originating in 19th-century continental Biblical scholarship, hermeneutics investigates problems of translation, understanding, and interpretation, focusing on questions about faithfully rendering the meaning of texts, symbols, intentions, and thoughts. Imitation was a central site of analysis and, from the outset, exhibited a crucial ambivalence: all mimetic acts are required to reflect their original, but they all inevitably diverge from that original. These directions of convergence and divergence were in turn influenced by differences in cultural context, tradition, expectation, worldview, and so

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Many thanks are due to John Hunter and Nico Frijda for their comments and editorial suggestions pertaining to an earlier version of this text.

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forth. This ambivalence is reflected as far back as Plato and Aristotle. Plato repudiated imitation, arguing in his Republic that objects in the material world and cultural artifacts and thoughts are only a shadow of the eternal ideas, as pictured in his metaphor of the cave (Plato, 1961). Aristotle, in contrast, was interested in a more naturalistic approach to imitation, considering man to be "the most imitative animal" and analyzing imitation in artistic and sociocultural relations in which both continuity and innovation can be observed (Aristotle, 1984). For Aristotle, imitation as a crucial form of human (and animal) interaction has implications for complex moral functions, the role of tragedy, and learning in children and adults.

This positive assessment of imitation, implying both convergence and divergence, grounded several lines of research in the humanities and social sciences. In investigating the relations between imitation and history, imitation was seen not just as a repetitive and consequently conservative skill, but as one that fostered both continuity and transformation, both sedimentation and innovation. Auerbach's (1964) *Mimesis* showed how literary modes were imitative and innovative at the same time with authors (starting with Homer) imitating reality while gradually developing new ways of representing newly discovered layers of reality. The cultural historian Girard (1988) argued that many episodes in the history of literature and religion reflect different aspects of mimetic behavior, including mimetic violence, as a driving force in culture. Psychologist Donald's (1991) *Origins of the Modern Mind* considers mimetic culture as a vital stage in the development of human culture and attributes to mimetic acts not just the expected properties of intentionality, communicativity, and reference but also some properties that do contribute to its innovative possibility, such as generativity, unlimitedness, and autocueing. Cognitive archaeologist Mithen (2005) made imitation central to his theory on the coevolution of music, language, and mind in humans. Taken together, these authors argued that sociocultural interactions and developments rest to a large extent on imitation. It is crucial to both the transmission of behavior, knowledge and culture, as it is to their divergence, innovation, and even violence.

Imitation in Cognitive Science: Focusing on Sharing and Convergence

Recent interest in imitation in psychology and cognitive science has underestimated this divergent and innovative force in imitation to a large extent, focusing instead on convergence and transmission in intersubjective relations. Here, imitation is what bridges the gap between individual adults, between neonates, and between humans and animals. This renders imitation a major candidate for the solution of the riddle of the development of understanding both philogenetically and ontogenetically. Moreover, imitation is an attractive research topic because of its directness and its apparent lack of conceptual and cognitive complexity, while still taking part in more complex forms of intersubjective understanding. Nevertheless, its prominence in naturalistic theories is fairly recent. Neonate imitation suggested imitation to be a phenomenon relying at least partly on innate mechanisms (Meltzoff & Moore, 1977). Despite this, imitation in animals and apes proved less ubiquitous and also harder to investigate, because of contextual factors, difference of experimental paradigms, and so forth (Miklosi, 2000). An unexpected confirmation of the hypothesis that imitation is partly innate and not a strictly human phenomenon came with the serendipitous discovery of mirror neurons. These mirror neurons show activity in both action production and action observation or imagination states, nourishing the idea that imitation is facilitated by equal neuronal activity on both sides of the intersubjective gap. Neuronal activity in two subjects involved in an imitation relation turned out to be partly identical (Rizzolatti, Fadiga, Gallese, & Fogassi, 1996) and it was immediately postulated that this "similarity of representations" in imitation could foster other forms of social understanding as well.

Since then, several scientific theories on imitation have been developed on the basis of a form of similarity or sharedness in the two persons involved in the imitating relation. Gallese, Keysers, and Rizzolatti suggested that activating similar brain networks in two subjects involved in an understanding relation creates "a bridge between others and ourselves" (2004, p. 400) and that this bridge rests upon mirror systems. Others (Gallese, 2003; Gallese, Ferrari, & Umilta, 2002) presented a broader *shared man-*

ifold hypothesis, in which shared mirror system networks enable various forms of social understanding and empathy. Hurley (2006) presented a shared circuits model that integrates the shared manifold and shared mirror systems hypotheses in a more comprehensive model. More modestly, Georgieff and Jeannerod (1998) discussed shared representations that pertain more strictly to motor representations. Such representations appear, however, to be active in different types of action simulation, including verbalization (Grezes & Decety, 2001; Jeannerod, 2006). Others believe that the shared representations are wider in scope. Thomas, Press, and Haggard (2006) related them to an interpersonal body representation that offers direct mapping of interpersonal tactile–visual sensations without a relation to motor actions. More important, and in accordance with the hermeneutic perspective, imitation appears not to be limited to mirror neuron activity but seems to depend on general brain mechanisms involved in action and learning (Brass & Heyes, 2005). More recently, it has been suggested that we should not just think of shared representations but also of a shared world in which we act together and can share intentions (Legrand & Iacoboni, in press).

Of course, discussions of divergence are being offered in the cognitive scientific literature, but mostly in the contexts of blocked or failed imitations, and are considered secondary. The complexity of imitation is thus often underestimated, as are the cognitive processes it requires and its sociocultural and developmental elements. Because progress in cognitive science often depends on the integration of conceptual and empirical insights (Keestra & Cowley, in press), I argue as to why an explanation of imitation should include both scientific evidence and hermeneutic insights.

Hermeneutics and Cognitive Science Contributing to Each Other

Interdisciplinary cooperation between approaches as different as the neuroscientific and the hermeneutic often elicits fears of reduction, in this case the fear of the reduction of understanding to mirror neuron systems activity. Such fears are misguided in many respects. First, such forms of intertheoretic reduction are extremely scarce in the history of science (McCauley, 1986). Second, even when lower-level explanations are required for a particular phenomenon, the upper levels retain their own explanatory force, referring for instance to contextual influences that modulate the functions of lower-level mechanisms or even their recruitment (Bechtel, 1990). Hermeneutics and cognitive science can contribute to each other, and since hermeneutics has since long offered analyses of the processes of understanding and interpretation that cognitive science investigates, these analyses may be helpful in avoiding oversimplification of the imitation tasks to be investigated. Indeed, hermeneutic analysis of imitation helps in uncovering its complexity, emphasizing the diverging force of imitation in many respects. This could lead to suggestions for novel experimental designs and hypotheses. Conversely, cognitive science can help to explain which constraints often do play a role in instances of understanding and interpretation, putting limits on actual hermeneutic activity. Obviously, this implies that hermeneutics does not just apply to textual understanding but also to action understanding, as both Gadamer (1986) and Ricoeur (1971)–the two most prominent hermeneutic philosophers—have argued. Action and text share several properties crucial for their understanding and interpretation, which will always remain incomplete and ambiguous. Furthermore, both philosophers have elaborated on earlier theories of understanding that put imitation forward as paradigmatic. Ricoeur (1984) especially has uncovered in detail how imitation (or *mimesis,* as philosophers often term it) enables the understanding of action as well as of symbolic systems.

Mimesis in this connection is threefold: mimesis_1 is the preunderstanding or prefiguration of what human action is; mimesis_2 is the configuration of the action itself; and mimesis_3 is the transfiguration (or reflective understanding) of the two earlier stages in the mimetic relation. Ricoeur (1991) emphasized that in any act there are several stages at which structure and complexity allow for different interpretations. Interpretation is therefore always a productive and creative act (like imitation itself) and not just a matter of simple reproduction or correspondence.

Mimesis is thus productive and creative at all three stages in the process and never ends. It is

not, moreover, a unidirectional process. Rather, it can be conceived of as an endless cycle in which all stages or phases mutually affect each other. This is why Gadamer (1986) and Ricoeur (1984) have held that, in understanding an artistic or symbolic action, we should not strive to erase its *Wirkungsgeschichte* or effective history in order to reach a pure or original meaning. This is simply impossible.

I now follow Ricoeur's (1984) analysis of mimesis' three stages and discuss evidence that proves their empirical plausibility as well. One can expect such a comparison to emphasize the indeterminateness and processual nature of imitation. These latter properties will not be equally present in cognitive scientific research, partially because of its methodological limitations (Adolphs, 2006; Bogen, 2001). If, however, the scientific evidence partially confirms the hermeneutic analysis of the imitation process, then further integration of hermeneutic insights in the scientific endeavor will call for a more detailed investigation of the mechanisms involved and their functions. This will be especially true for the mechanisms that cause the unavoidable divergences between subjects in an imitation relation and for the mechanisms that help to detect such divergences or that contribute to the subsequent adjustment of the imitation interactions. Since there also appears to be a mechanism that allows subjects to switch between cognitive strategies for imitation, this should be considered as well. Such further integration falls outside the scope of this article. Instead, I focus on the analysis of the process of imitation.

Prefiguration and Transfiguration in Mimesis in Hermeneutics and Cognitive Science

Perhaps the best known aspect of hermeneutic philosophy is its analysis of the so-called hermeneutic circle (Bontekoe, 1996), grounded upon the insight that one does not and can never start from a zero point in interpretation and understanding (Ricoeur & Gadamer, 1991). As Ricoeur explained with respect to mimesis_1, or the prefiguration stage in the process, prior to any action performance, understanding, or imitation, the subjects involved must already possess some knowledge of "what human action is, of its semantics, its symbolism, its temporality" (1991, p. 142) However, individually acquired repertoires will not be identical in different subjects, nor are they static in character. Repeated intersubjective interaction affecting the prefiguration of action in the subjects can lead to a growing shared repertoire, although it will inevitably confront subjects with divergences as well.

That the mimetic process has effects on the previous stages of the mimetic interaction is captured by Ricoeur's (1991) mimesis_3, or the transfiguration stage. Each instance of understanding implies that two subjects, with their respective prefigurations, have to decide on the configuration of an action and may have to revise their self-understanding of an action after seeing an unexpected response or imitation. This implies adjustments in both subjects, aiming perhaps at a "fusion of horizons that are believed to exist just for themselves" (Gadamer, 1986, p. 311). Conflicts will inevitably emerge between the understanding or interpretation of an action and its possible rebuttal by the sequel of the interaction (Ricoeur & Gadamer, 1991). As Ricoeur concluded: "Mimesis is an action about action. What it prefigures in the first stage and configures in the second, it transfigures in the third. To transfigure is still to do something" (1991, p. 150).

Before offering more detailed analysis of the middle stage of the mimetic process, I lay out only some of the empirical results that align with these hermeneutic analyses of mimesis_1 and mimesis_3. It has been suggested that the cognitive acquirement of such a repertoire in the form of prototypes, schemas, or protocols deploys a structure similar to that of the hermeneutic circle (Gallagher, 2004). Following this, one can expect experiences affecting the prefiguration stage to enhance specific imitation behavior, even if they are quite unusual. This has been shown in numerous experiments, for instance in macaques using tools, which affects their body schemas for action and perception (Iriki, Tanaka, & Iwamura, 1996), in cross-species familiarity with types of action (Buccino, Lui, Canessa, Patteri, Lagravinese, Benuzzi, et al., 2004), in humans familiar with particular cultural gestures (Molnar-Szakacs, Wu, Robles, & Iacoboni, 2007), with ballet-dancing or capoeira (Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005), and with various forms of musical experience that

modulate our hearing–doing system (Lahav, Saltzman, & Schlaug, 2007).

Much of this scientific research on imitation unfortunately avoids the complexity of interaction between subjects (Adolphs, 2006), which could show reciprocal influences that pertain to the transfiguration stage. It is well known that even simple motor behavior is continuously adjusted (Jeannerod, 1994). More complex dynamics have been found in studies of reciprocal exchanges, affective mirroring, and mututal imitations in early infancy (Rochat, 2007). This involves a comparison process that normally implies self–other discrimination (Asendorpf & Baudonniere, 1993; Meltzoff & Decety, 2003), which appears to be hampered in pathologies (Georgieff & Jeannerod, 1998), although attribution errors are not limited to patients (Jeannerod & Pacherie, 2004). Awareness of divergence between predicted outcomes of intended behavior and its actual outcomes is important for the experience of agency in general (Knoblich & Sebanz, 2005) and self-correction mechanisms involving mirror systems are functional during interactions (Shmuelof & Zohary, 2007). Indeed, even young infants do correct their imitative behavior (Meltzoff & Moore, 1997), for which play offers much exercise (Bolton, 1995).

Such confirmations of the hermeneutic analysis of mimesis invite reconsideration of imitation. In particular, its processual, interactive nature and tendency toward divergence should not be taken as signs of failed imitation or ascribed to other cognitive processes. They may well pertain to the heart of imitation.

Hermeneutics on Configuration in Mimesis

Each text or action contains internal formal and symbolic structures that allow for multiple relations and instantiations. Clearly, no intention or interpretation can fully cover all the possibilities that an artifact or action offers (Gadamer, 1977). Ricoeur (1984) used the term *mimesis*$_2$ to refer to this intermediate stage in the continuous process of mimesis. While referring to the familiar elements of the plot of a myth that allow for rearrangements, he mentioned three sets of relations that direct such arrangements or emplotments of a narrative (Ricoeur, 1984). I here translate them to the domain of action.

Configuration is important because an action is never merely a single event or a simple succession of events. There are always complex relations between discernable subactions and the responses that the action provokes. Also, an action always involves heterogeneous ingredients such as "agents, goals, means, interactions, circumstances, unexpected results" (Ricoeur, 1984, p. 65). The third set of relations that contributes to the configuration of an action is temporal, such as its duration or the temporal variations between its parts. This temporality will also influence the response of an interpreter or imitator, for which his own experiences will play a role again. Even apart from the divergence caused by the prefiguration and transfiguration stages of mimesis, this configuration of any action in itself implies heterogeneity. Imitation therefore requires a lot of cognitive processing to reach an agreeable mixture of convergence and divergence between subjects.

Some Cognitive Scientific Indications of the Configuration of Action

It is important to keep in mind that most behavioral or imaging experiments to date have used simple actions. For experimentation with children and monkeys, and for ensuring identical repetitions of an action, this simplicity is essential, but it seriously limits the configuration characteristics of the actions.

Nevertheless, it has been noted that children and apes show a striking difference in their imitative behavior relating their observation and performance of the different configuration of an action. Apes tend to imitate an action in a limited way, geared toward imitation of its goal (Tomasello, Carpenter, & Hobson, 2005). That is, they compress the action, leaving out parts that are not relevant to its end or goal. In comparison with children, who will imitate complete actions, chimpanzees try to eliminate the irrelevant elements of an action (Horner & Whiten, 2005), affecting the mimesis of its configuration. Human capability for a complete encoding of an action facilitates mimesis of an action on multiple levels of intentional granularity and distinguishing between end goals and intermediate or subsidiary goals (Lyons, Santos, & Keil, 2006). Thus imitation not only contrib-

utes to the succession of cultural conventions but also allows for some subtle divergence from such conventions; a subject may choose flexibly among different strategies for the same goal, or use the imitated means for reaching a different goal, for instance.

Research also shows that mirror neurons are not only important in the performance, imitation, simulation, and recognition of actions thanks to the fact that they provide-partly-shared representations for these. These mirror neurons are also integrated in larger systems, that contribute in other ways to the processing of actions. For instance, mirror neurons appear to help in recognizing and action even if it is partly hidden from sight behind a screen (Umiltà et al., 2001). This has led to the idea that they do not just code for observed actions but that they are indeed parts of logically related systems that code for complete—yet partially unobserved—actions. For instance, an experiment in which contextual factors (another ingredient of the configuration of action) are varied proves that even monkeys react differently depending on the context (Iacoboni, Molnar-Szakacs, Gallese, Buccino, & Mazziotta, 2005). This means that they code for the chain or association of a context to a particular goal of an action and thus for the intention of the action.

However, as we have learned from hermeneutics, the configuration of an action is open to diversity, and therefore goals and intentions are not always easy to infer. Indeed, overimitating the details of an action may help to preserve its configuration details and consequently to flexibly change the configuration in imitation. Children do not always "ape," for example, but will shift to another strategy under certain conditions (Gergely, Bekkering, & Kiraly, 2002). Such switches in imitation strategy are confirmed by another finding in which they switched cognitive strategies when confronted with novel situations and used an inferential strategy (Gergely et al., 2002). It is still a matter of debate whether great apes are similar to humans in this respect. However, using the same experimental paradigm as Gergely et al. (2002), Buttelmann, Carpenter, Call, and Tomasello (2007) proved that apes that were encultured and used to observing human actions take secondary factors about the model into account when choosing their imitation strategy as well. It may therefore be that these abilities do not just depend on neural machinery, but on rearing conditions (such as the presence of models) and development as well.

The research mentioned in this section emphasizes the complexity of action imitation, partly due to the many different types of configuration of seemingly simple actions. As those configurations are partly dependent on action goals and intentions, not only is imitation a rather complex task, but so is the detection of intention. In light of this, the sharing or convergence of representations between subjects could be only of rather limited value. Instead, a proposal has been made recently for a rather complex intentional network in humans that would allow differentiation between private or social intentions while discriminating between present or future goals (Ciaramidaro et al., 2007). It is likely that in such intention detection, the recognition of convergence and of divergence would play a role, recruiting different brain areas.

Since hermeneutics is mostly associated with language interpretation (although Gadamer [1986] and Ricoeur [1971] emphasized its applicability to action interpretation, too), I pay some attention to evidence related to language processes. An analysis has been offered suggesting that imitation may depend primarily on two components: the possession of a vocabulary of action elements and a string-parsing mechanism that helps to discover regularities in the chains of elements (Byrne, 2002). This is not to say that action processing occurs along identical pathways as language processing, but the two appear to be less modular and more related than previously thought. Action and language processing do, for instance, partly recruit identical brain circuits (Pulvermüller, Hauk, Nikulin, & Ilmoniemi, 2005; Tettamanti et al., 2005). Language development may indeed build on simple forms of imitation behavior, progressing to more complex and indeterminate action sequences (Arbib, 2005). Language reception and production and action recognition partly recruit similar brain areas (Hamzei et al., 2003; Watkins & Paus, 2004), and action and language semantics appear to contribute simultaneously to establishing interpretations (Willems, Ozyurek, & Hagoort, 2006). The mirror neuron system would ground the parallel developments of such action and language constructions (Kemmerer, 2006), while Broca's region

allegedly has some specific time-related functions in both the action and language domains (Nishitani, Schurmann, Amunts, & Hari, 2005). These correlations between language and action developments and processes reinforce the possibility that the figurations of mimesis can be found in language as much as in action processing, and thus in imitation, too.

In conclusion, actions contain configurations that are responsible for their indeterminateness and ambiguity. In imitation this can lead to divergence in goal or intention ascriptions, which in turn will influence expectations and anticipations. As is noted in the previous section, imitation should be conceived of as a continuous process and not as an unidirectional singular event. Therefore we should expect a complex interaction between partially overlapping and partially nonoverlapping brain areas involved in the process.

Integration of Hermeneutic and Cognitive Scientific Approaches to Mimesis in a Multilevel Explanation

Our proposal for integrating hermeneutics and cognitive science is not new, but more detailed discussions of what such an integration could look like are rare. The brain, being a highly dynamic and self-organizing system, has been called a hermeneutic device (Erdi, 1996) that uses a hermeneutic circle during visual object recognition (Stent, 1981), while others have referred to neurohermeneutic systems (Reyna, 2002) involved in understanding and interpretation.

Hermeneutics empasizes particularly the intersubjective and interactive nature of understanding, which is difficult to investigate empirically (Looren de Jong & Schouten, 2007). Similarly, understanding is variously dependent on contexts (as hermeneutics shows) that our brain is capable of incorporating in its functioning (as cognitive science shows; Gallagher, 2004). This has led to hypotheses that also acknowledge the cognitive influences of cultural models (Shore, 1996) or that incorporate social and cultural aspects in theories of situated, embodied, or embedded perception and cognition (Semin & Smith, 2002). Clearly, hermeneutic processes that include the figurations of mimesis play a role in these aforementioned processes that imply understanding and experience of many forms of divergence.

I have discussed evidence for aspects of imitation depending on, among others, individual experiences, expectations, and different cognitive strategies. It follows from this that it is impossible to predict what types of processing will be used in each instance of mimesis. Indeed, it is not surprising that some no longer consider imitation to be a unitary phenomenon, but rather a complex one (with different levels and mechanisms), allowing for bottom-up as well as top-down influences. Obviously, such a complex process will follow a developmental trajectory (Jones, 2007), in which earlier stages may scaffold later mimetic skills. These skills may be partly performed at will, offering not just low-level but also high-level mind reading, recruiting mirror systems and more complex semantic or inferential processes, respectively (cf. Arbib, 2005; Frith & Frith, 2006; Gergely et al., 2002; Goldman, 2006; Muthukumaraswamy & Johnson, 2007). Similarly, theory of mind processes covary with linguistic and cultural experience (Kobayashi, Glover, & Temple, 2006). Moreover, since mimesis turned out to be a highly interactive and dynamic process, it is probable that mimesis frequently starts as a low-level process but that interactions are so divergent as to enforce involvement of high-level processing, or vice versa. Elements of sharing or convergence are therefore likely to be only partially responsible for the imitation process and should not be taken as more fundamental than those divergent elements that do not just hinder imitation but—paradoxically—equally contribute to it. Consequently, since mirror neurons or mirror neuron systems seem to be particularly active in convergent aspects of imitation, they can at most play a limited role.

As has been witnessed, hermeneutics plays a double role in all of these analyses, helping both to explain the general process of mimesis and to show how particular cases could play out. This leads to the conclusion that mimesis consists primarily of convergence only in exceptional cases; for the rest, it will depend on a complex variety of processes that will lead to convergence and divergence between subjects.

Of course, in such a multilevel explanation, the converse also holds: the hermeneutic plea for indeterminacy and divergence in mimesis can lose some plausibility when facing particular instances

of mimesis that appear to be unambiguous and easy to process via low-level mechanisms, leaving hardly any room for divergence between subjects. Indeed, many action paradigms studied presently in cognitive science experiments are of this kind. In such cases, room for hermeneutic contribution to mimesis or action understanding may be extremely limited and constrained by the mechanisms involved. However, if indeed low-level mechanisms such as mirror neuron systems are susceptible to developmental and contextual influences, then hermeneutics may even contribute to the explanation of such "simple" cases. More than anything else, hermeneutics could help cognitive science to expand its field of study and to acknowledge the complexity of most actions and interactions. Through such interdisciplinary cooperation we will gain knowledge and insight in the rich texture that human action and interaction offers, and not just in its impoverished variants.

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Received February 1, 2007
Accepted February 1, 2008 ■