# Modeling Self on Others:
# An Import Theory of Subjectivity and Selfhood*

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\*  **Dedicated to the memory of Bruce Bridgeman,
   erudite scholar, inspiring scientist, constructive critic.**

**Abstract**

This paper outlines an Import Theory of subjectivity and selfhood. Import theory claims that subjectivity and selfhood are initially perceived as key features of other minds before they then become imported from other minds to own minds. Import theory builds on perception-production matching, which in turn draws on both representational mechanisms and social practices. Representational mechanisms rely on common coding of perception and production. Social practices rely on action mirroring in dyadic interactions. The interplay between mechanisms and practices gives rise to model self on others. Individuals become intentional agents in virtue of perceiving others mirroring themselves.—The outline of the theory is preceded by an introductory section that locates import theory in the broader context of competing approaches and followed by a concluding section that assesses import theory in terms of empirical evidence and explanatory power.

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This paper outlines what I call an import theory of subjectivity and selfhood. The central claim is that subjectivity and selfhood are first perceived and understood in others and then imported from others to self, to the effect that individuals model themselves on others.

Import theory combines old ideas concerning the nature of consciousness with recent discoveries concerning the interplay between perception and action. Old ideas pertain to the claim that consciousness subserves major social functions and may even be rooted in sociality (e.g., Baldwin, 1913; Hegel, 1807/1977; Mead, 1934; Smith, 1759/1976; Vygotsky, 1925/1979). Recent discoveries pertain to mechanisms and practices of perception/action-matching that may be seen to instantiate these social functions (e.g., Gordon, 2005; Meltzoff, 2005; Pineda, 2009; Prinz, 2012; Rizzolatti & Sinigaglia, 2008; Schütz-Bosbach & Prinz, 2015).

My argument will take three steps. The first addresses notions of subjectivity and selfhood and discusses their theoretical implications. The second explains how import theory works and what it requires. Finally, the third step discusses how import theory helps to demystify consciousness.

## 1 Subjectivity and Selfhood

### 1.1 Conscious Experience

Let us first see what we need to explain. What do we mean when we talk about conscious experience? How does such experience come about and what does its conscious character exactly mean? While numerous answers have been suggested to these questions (cf., e.g., Block, Flanagan, & Güzeldere, 1997; Cohen & Schooler, 1997; Shear, 1995), only few have kept an eye on drawing a clear dividing line between description and explanation. A noteworthy exception is offered in Brentano's "Empirical Psychology" (1874/2014). In his discussion on the nature of consciousness, Brentano started from a purely descriptive account of conscious experience that may still serve as a useful starting point today. According to Brentano, conscious experience emerges from mental acts. To explain what counts as a mental act, he used a straightforward example: What actually happens when we hear a sound? What is it exactly that constitutes the conscious nature of this event? According to Brentano, two items are interwoven in this act: the *sound* that we hear and the fact that we *hear* it. However, these two items are not represented in the same manner. The sound is the primary object of the act; hearing, in contrast, its secondary object. Brentano says of this secondary object that it cannot be directly observed in the mental act but nevertheless enters consciousness in another, more indirect form:

> "We can observe the sounds we hear, but we cannot observe our hearing of the sounds, for the hearing itself is only apprehended concomitantly in the hearing of sounds."

> (Brentano, 1874/2014, p. 99).

This is as far as Brentano goes. Yet, in order to exhaustively characterize the structure of mental acts, we need to go forward another step that we find sketched out by Immanuel Kant. If it is the case that in hearing the tone, not only the tone itself, but its hearing is also implicitly included, then the subject who hears must also be included in the act in a further encapsulation. This is because just as the tone is unimaginable without being heard, so too is hearing unimaginable without a mental self, or subject, who is hearing. Conscious mental acts

are therefore characterized by the fact that a mental self, or subject, is implicitly included and, in fact, involved in them. This idea is sketched out in Kant's doctrine of the unity of apperception.

> "The *'I think'* must accompany all my representations, for otherwise something would be represented in me which could not be thought; in other words, the representation would either be impossible, or at least be, in relation to me, nothing. […] All the diversity or manifold content of intuition has, therefore, a necessary relation to the *'I think',* in the subject in which this diversity is found."
>
> (Kant, 1781; 1787/1996, p. 49)

In sum, the mental acts that a person performs *differ from one another* according to their primary objects (hearing a tone, a voice, a melody, etc.) and, naturally, according to their secondary objects (hearing, seeing, thinking, believing, hoping, etc. that something is the case). Yet, *they resemble one another* in virtue of the fact that the same subject is present in the background of all acts. When I hear a tone, the hearing is *my* hearing, when I think about something, it is *my* thoughts, and when I plan to do something, it is *my* intentions that I am aware of. In other words—and now detached from Brentano's act terminology—for the conscious character of mental content, the implicit involvement of the mental self seems to be essential and constitutive. The mental self forms the mutual clip that binds the multifaceted kinds of phenomena of conscious experience.

At a more theoretical level, a descriptive account like this may be rephrased in terms of self-representational approaches to consciousness (Frank, 2015; Kriegel, 2009; Kriegel & Williford, 2006; Musholt, 2015; see also Graziano, 2013, Lacan, 1977, and Silverman, 1996 for similar ideas embedded in entirely different and divergent conceptual frameworks). These approaches posit that conscious experience requires self-representation, that is, that it builds on representations that represent both the content they refer to (*tone*) and the intentional relation entailed in representing that content (*hearing*). This is the reflexive sense of self-representation: representations representing themselves. Moreover, since intentional relations always imply, and require, a mental subject, there is a transitive sense of self-representation as well: representations representing the self. While the reflexive and the transitive sense may be conceptually separable (addressing what has been called non-egological vs. egological aspects of self-representation; cf. Gurwitsch, 1941), they are empirically inseparable because reflexive, non-egological self-representation must, by implication, always include transitive, egological self-representation.

## 1.2    Mental Selfhood

### 1.2.1    Kinds of selves

This raises the issue what kind of entity counts as a mental self and how we can understand its implicit involvement in mental acts. Basically, we attribute individuals mental selfhood, or subjectivity, when we believe that they perform mental acts, that is, entertain mental relations with things and events in the world. This understanding has two important implications, singularity and continuity. As a rule, when we attribute an individual subjectivity, we attribute them a single self as the common center on which all mental acts converge. At the same time, we maintain that their present self is continuous with their past and their future self. This is how we understand others and ourselves in everyday life, and

this understanding expresses what we consider the normal human condition (notwithstanding the fact that singularity and continuity may both break down under a variety of pathological conditions).

Ever since the notion of self has attracted researchers from quite diverse fields of study such as philosophy, psychology, neuroscience, and anthropology, trying to identify kinds and/or parts of selves and ways of making distinctions between them (cf., e.g., Damasio, 2010; Koffka, 1935; LeDoux, 2002; Martin & Barresi, 2006; Neisser, 1993; Neisser & Jopling, 1997; Zahavi, 2005). One major distinction that shows up in many classificatory schemes builds on a divide between bodily and mental self (e.g., Eilan, Marcel, & Bermúdez, 1995; Gallagher, 1995; Merleau-Ponty, 1962/2002). While the bodily self (or, the bodily part of the self) addresses the body as the center of sensory and motor activity, the mental self (or, the mental part of the self) addresses the mind as the center of mental activity. The relationship between the two is often regarded as a mystery. On the one hand, the mental self appears to be inseparable from the body and thus to depend on it, but at the same time it is understood to own the body and control its action (body ownership and action authorship, respectively).

A further important distinction pertains to two kinds of self-involvement in mental acts, viz. explicit and implicit, or reflexive and pre-reflexive (Frank, 2011, 2015). While the explicit self builds on declarative knowledge about one's individual mind, the implicit self emerges from procedural knowledge for performing mental acts where it takes the role of the center on which all of these acts converge. The explicit self is usually seen to be shaped from without (i.e., by cultural, social, and biographical context) whereas the implicit self is seen to be shaped from within and emerge as part and parcel of an individual's natural endowment.

Given this coarse landscape of self-concepts, we are now in a position to narrow down to which kind of self the Brentano-/Kantian claim may refer that conscious experience relies on the involvement of the self in mental acts. For obvious reasons we must exclude both the bodily and the explicit mental self. The bodily self does not qualify since it addresses physical, not mental forces and interactions. The explicit mental self does not qualify either, because it already presupposes conscious experience (at least a particular kind thereof), rather than explaining it. This leaves us with the implicit mental self as the critical candidate that we need to consider: a token of procedural knowledge that instantiates the center of mental acts in perception, cognition, and action.

### 1.2.2    Proper functions

This raises the issue what mental selfhood and subjectivity may be for. What may be the proper functions for which evolution has created and optimized these features of human mentality? The crucial thought experiment here is what humans could *not* do if their minds were devoid of subjectivity and selfhood while all other features and capacities that make up human mentality are in place. What can zombies *not* do that real humans can? The answers offered by philosophy, science, and science fiction fall in two broad categories, individual and social. While the individual camp emphasizes consequences for individual performance, the social camp considers consequences for interindividual interaction.

Typical answers on the individual side focus on the role of conscious experience and awareness. They see the proper function of conscious awareness in supporting high-level functions and metafunctions such as (1) providing *integration*, or global broadcasting, of otherwise disintegrated modules, functions, or contents (e.g., Baars, 1988; Morsella, 2005;

Morsella, Godwin, Jantz, Krieger, & Gazzaley, in press; Tononi, 2008), (2) providing *agency* and top-down control as a complement to otherwise stimulus-driven processing (e.g., Haggard & Eitam, 2015; Norman & Shallice, 1986), or (3) providing *reflectivity and flexibility* in otherwise association-driven operations (e.g., Baddeley, 1986; Strack & Deutsch, 2004). Yet, while it is certainly true that these functions are closely associated with conscious awareness, it is far from clear (i) whether they really *require* that feature on any functional grounds (Frith & Metzinger, 2016), (ii) why it should not be possible to implement them in artificial systems, or zombies that are entirely devoid of conscious awareness and subjectivity (Vierkant, Kiverstein, & Clark, 2013), (iii) what precisely the added value may be that the very feature of conscious awareness can offer them—and (iv) why conscious awareness has to be precisely what it is like in order to subserve these functions and provide this added value (Graziano, 2013; Prinz, 2003).

By contrast, typical answers on the social side focus on the role of selfhood. They see the proper function of subjectivity and selfhood in enabling intersubjectivity and certain kinds of interindividual interaction, rather than individual processing. The key question here is what kinds of things individuals endowed with mental selves *can do with each other* that self-less individuals cannot do. Answers to this question have been offered by political philosophy— preshaped by Hegel (1807/1977) and Marx (1844/2007) and updated and elaborated more recently by scholars and scientists like Gerhardt (2012), Habermas (2008), Honneth (1996), Jaynes (1976), Kusch (1999), Mead (1934), Prinz (2012), Rose (1990, 1996), Taylor (1989), Vygotsky (1925/1979), and Zawidzki (2013); see also Lee (1982). Naturally, the answers offered by these authors differ profoundly in several respects. Still, they have one idea in common. In one or the other way, they all converge on the claim that the proper function of subjectivity and selfhood is to bridge the gap between individuals' own minds and other minds. The proper function of mental selves is, in other words, to act as interfaces between the privacy of individual minds and the publicity of social practices and discourses in which they are embedded (Habermas, 2008). For instance, mental selfhood may be seen as a prerequisite for the social game of assigning individuals responsibility for the consequences of their actions (Frith, 2014; Frith & Metzinger, 2016; Prinz, 2012, ch. 10). A game like this obviously requires attributing each individual a single self and maintaining that their present self is continuous with their past self.

## 1.3    Self and Others

In everyday life we find it natural to attribute to others precisely the same kind of subjectivity and mental selfhood that we experience ourselves. Are we, in doing so, addressing the same thing from two perspectives? The naïve, commonsense answer is *Yes, of course*: I am like you and you are like me. However, as we know, the philosophically educated answer is *No, no way*. Philosophers' educated skepticism builds on what they consider a fundamental difference: To my own experience I have direct, unmediated 1st person access from within, whereas to others' experience I have only indirect, mediated, and inferential 2nd or 3rd person access from without. This difference is then seen to create a deep problem for metaphysics and epistemology: the problem of other minds (Avramides, 2001; Ayer, 1963; Sellars, 1963; Wisdom, 1968).

Philosophers have addressed this problem in several vocabularies. Sellars, for instance, suggested a distinction between two roles of talk about so-called 'inner episodes', descriptive and explanatory (Sellars, 1963, pp. 186-189). As long as we talk about our own inner episodes we report what we experience. By contrast, when we talk about others' inner

episodes we talk about theoretical constructs to explain their behavior. Thus, since one talk is descriptive and the other explanatory, it would be a mistake to believe that they address the same thing from two perspectives. Instead, they address two different things whose mutual relationships remain to be explored. In a similar vein, Goldman claims that "*having* a mental state and *representing* another individual *as* having such a state are entirely different matters" (Goldman, 2006, p. 3). Having a mental state is for him a direct, first-order activity whereas representing another individual as having such a state is a derived, second-order activity. Again, the relationship between the two activities needs to be explored. One of the central issues of this exploration pertains to the hen-and-egg problem which of the two is primary and foundational and which secondary and derived.

### 1.3.1    Export Theory

Export Theory finds it natural to regard individuals' own inner experience as primary and their understanding of foreign experience as derived. This seemingly natural view has been dominant for centuries. It builds on the intuition that individuals can only be at home in their own minds, not in foreign minds. They are, in other words, believed to have direct (and perhaps even infallible) access to their own mental states, but not to states of others (e.g., Descartes, 1641/1990; cf. Russell, 1996; Shoemaker, 1996; Zahavi, 2005). If so, the sole way to understand others is to *export* one's inner episodes to them. To understand other minds, individuals need to find a way to impute their own mental resources on others.

Based on its mainstream role in philosophy, Export Theory has broadly invaded modern cognitive and developmental science. For instance, in theorizing about the roots of imitation, mindreading, and social interaction, it is broadly taken for granted that the sole way to understand other minds is for individuals to assimilate them to their own minds, that is, to use their own mental states as tools for understanding foreign states—be it through non-inferential operations like re-enactment, imitation, or simulation, or through theory-based inferences (Frye, 1991; Goldman, 2006; Meltzoff, 2005; Meltzoff & Moore, 1995; Sommerville, Blumenthal, Venema, & Sage, 2011; Tomasello, 1999). In any case, such use of one's own mental resources is believed to help understanding unknown states (in the other) in terms of well-known states (in oneself). Export Theory thus offers a seemingly natural solution to the hen-and-egg problem.

### 1.3.2    Import Theory

Still, while export has been mainstream, there has always been a marginal stream of dissenting votes as well, considering the idea that the roles of hen and egg might be reversed and export be replaced by import. The list of supporters of Import Theory includes both philosophers like Bogdan (2010, 2013), Carruthers (2009), Habermas (2008), Hegel (1807/1977), Honneth (1996), Marx (1844/2007), Sellars (1963), and Smith (1759/1976) and social, developmental, and cognitive scientists like Bigelow (2008), Cooley (1902), Gopnik (1993), Graziano (2013), Mead (1934), Prinz (2012), Taylor (1989), Vygotsky (1934/1962), and Wegner (2002). Though based on quite divergent theoretical backgrounds, these authors converge on the idea that individuals may first detect and understand subjectivity and selfhood in others before they then begin to *import* this understanding for making up their own mentality.

For instance, in Sellars' Saga of Jones, it is a fictitious stone-age character by name of Jones who brings subjectivity to humankind. To get there, Jones takes two steps. The first

deals with other individuals and introduces thoughts as inner episodes that explain their behavior. In this step

> "[…] *thoughts* are introduced as *inner* episodes—which [means] that they are introduced as *theoretical* episodes—they are *not* introduced as *immediate experiences*."

In other words, thoughts are in this step introduced as (invisible) inner episodes that are meant to explain (visible) outer behavior. Then, in a second step, Jones begins to import, as it were, this explanatory scheme from other minds to his own mind:

> "[…] once our fictitious ancestor, Jones, has developed a theory that that overt verbal behavior is the expression of thoughts, and told his compatriots to make use of the theory in interpreting each other's behavior it is but a short step to the use of this language in self-description."

> (Sellars, 1963, pp. 188/189)

As the Saga of Jones shows, import theory has two remarkable implications that may both sound a bit strange. One is the negative claim that we *do not naturally know our inner episodes*, that is, that we don't have privileged access to our own mental states in the first place. The second is the complementary positive claim that *we do have natural skills for inferring inner episodes of others*, that is, for explaining their overt behavior through mental states and traits preceding and underlying them. Below I come back to these implications.

Export and import are related to deeply divergent theoretical traditions of conceiving subjectivity and selfhood (Kihlstrom & Hastie, 1997; Kihlstrom & Klein, 1994; Wegner & Vallacher, 1980). Export theory instantiates the spirit of natural realism, regarding the mental self as the natural central organ of the human mind. This view takes own selfhood for granted and derives foreign selfhood from this naturally given, primary source. By contrast, import theory instantiates the spirit of social constructivism, regarding selfhood as a key feature of human mentality that individuals first attribute to others and then apply to themselves. This view takes perception of foreign selves for granted and derives own selfhood from this primary source.

## 2  Import Theory

This paper aims at giving import theory a fresh start. There are two complementary motives for engaging in this endeavor. One builds on dissatisfaction with the internalism entailed in export theory. As pointed out, export theory takes individuals' subjectivity and selfhood for given and granted, without explaining it—a classical instance of a *petitio principii*. The complementary motive builds on the attraction of the externalism entailed in import theory. This theory claims that we first need to understand and construe other minds before we can begin to shape our own minds—a view that is well in line with the broader functionalist principle that cognitive systems are naturally designed to enable individuals to perceive and control events in the distal world, not in the proximal machinery for perception and control. Taken together, these two motives give rise to a fresh start on import theory.

However, a fresh start requires more than just confirming and extending theoretical arguments. It requires elaborating the theory in terms of representational mechanisms and social practices. As compared to export theory, import theory is so far grossly underspecified. While various brands of export theory offer mechanisms that are meant to account for the putative transition from self to others, such as imitation (e.g., Hurley & Chater, 2005a, 2005b;

Meltzoff & Prinz, 2002), motor simulation (e.g., Decety, 2002; Jeannerod, 1997, 2006), mental simulation (e.g., Goldman, 2006; Gordon, 1995), theory-based inference (e.g., Gopnik & Wellman, 1994; Sellars, 1956), or projective identification (e.g., Freud, 1895–1926/1987; Klein, 1952), import theory has so far not much to offer to account for the alleged transition in the reverse direction.

Here, I offer a framework meant to close this gap. It builds on earlier work on interactions between perception and action (Hommel, Müsseler, Aschersleben, & Prinz, 2001; Prinz, 1990, 1997) and social mirroring (Prinz, 2008, 2012). To outline the framework, I move from description (Action Mirroring) to explanation (Action Matching) and application (Empirical Evidence).

2.1     Action Mirroring

Mirrors and mirror-related concepts and metaphors have, in many cultures, a long tradition of being associated with practices of self and other understanding. Remarkably, this applies to both physical and social mirrors.

*2.1.1     Physical mirrors*

Mirrors are remarkable devices. In one sense, they are nothing but physical things— polished surfaces that reflect light according to simple geometrical rules. Yet, in another sense, when used by human perceivers, they may become powerful tools for extending the reach of what they can see and providing them with novel perspectives on their surroundings (Gregory, 1997; Melchior-Bonnet, 2002; Pendergrast, 2003). Related to these capacities, mirrors have, in many cultures, also enjoyed a career as symbolic devices for self-recognition, self-reflection, and self-understanding. Not only do they function as technical tools for checking one's outer appearance, but also as symbolic tools for deeper ways of reflecting one's inner self. Such symbolic use of mirrors is widespread in western art and literature. For instance, in the act of portraying oneself, mirrors are often thought to reflect aspects of the artist's inner self through his or her outer appearance. Occasionally, one can even find the act of self-mirroring included in the self-portrait as a symbolic indication of the reflective and reflexive intentions entailed in that act.

In a similar vein, the act of seeing and recognizing oneself in the mirror has long been a literary topic. A dramatic incidence of this is provided by the myth of Narcissus. According to Ovid, Narcissus was bound to die at the very moment at which he discovered that the beautiful face in the mirror that he had fallen in love with did not belong to some beloved other but to himself (Ovid, 1977, p. 157). In more recent times, the French psychoanalyst Lacan revitalized the myth of mirror self-recognition. Lacan believed that the very first incidence of mirror self-recognition is, for the young infant, a dramatic Aha! experience—an act of utmost importance in the shaping of the human mind and the formation of self-consciousness (Lacan, 1949/1977). Some decades later this view seemed to get support from research on the so-called mark test (Amsterdam, 1972; Gallup, 1970). However, in the meantime we have learned that mirror self-recognition is not an exclusive signature of human mentality. Chimps do it, elephants do it, magpies do it and some other species as well, suggesting the conclusion that mirror self-recognition has perhaps more to say about understanding mirror reflection than mental selfhood (cf., e.g., Plotnik, de Waal, & Reiss, 2006; Prior, Schwarz, & Güntürkün, 2008; Swartz, 1997; Uchino & Watanabe, 2014).

### 2.1.2   Social mirrors

In discussions of the role of mirrors for self-recognition one also encounters a metaphorical use of the notion of mirroring that refers to persons as social mirrors. In social mirroring, other individuals serve as mirrors for self. A commonplace notion is, for instance, that individuals come to better understand themselves through mirroring themselves in others—that is, by perceiving how their conduct is perceived, received, understood, and evaluated by others. What this suggests is that social mirrors can for individuals take a similar role as physical mirrors do: Both help them to perceive themselves as others perceive them.

Back in the 18th century Adam Smith pioneered this idea in the domain of moral intuition and judgment. In his *Theory of Moral Sentiments*, he formulated the idea that individuals can only become self-conscious subjects if they internalize others' watching of themselves, in a manner of speaking:

> "We can never survey our own sentiments and motives […] unless we remove ourselves […] from our own natural station and endeavor to view them as at a certain distance from us. But we can do this in no other way than by endeavoring to view them with the eyes of other people […]"

To illustrate, Smith addresses a hypothetical Kaspar Hauser scenario in which an individual grows up isolated from the rest of the world. He posits that such an individual can indeed know things about the world but nothing about himself. To know himself and his own mind he needs a mirror—just as he needs a mirror to know his own face:

> "All these [*one's own face and one's own mind*] are objects which he cannot easily see, which naturally he does not look at, and with regard to which he is not provided with [a] [mirror]. [That mirror] is placed in the countenance and behaviour of those he lives with […]; and it is here that he first views the propriety and impropriety of his own passions, the beauty and deformity of his own mind."

> (Smith, 1759/1976, p. 110).

In sum, Smith claimed that looking into social mirrors provided by others helps individuals making and shaping their own minds—just like looking into physical mirrors helps artists creating themselves in the act of painting.

### 2.1.3   Modes of mirroring

Acts of social mirroring require (at least) two individuals, a target individual whose acting is being mirrored and a mirror individual who mirrors the target's acting. In their interactions we may discern two basic modes of mirroring, reciprocal and complementary (see Fig. 1). In the most fundamental form of social mirroring, target individual T sees her own action imitated, or replicated by mirror individual M *(action imitation through reciprocal mirroring)*. In a setting like this, M acts as a mirror for T in a more or less literal sense. Still, we must not forget that social mirrors are fundamentally different from physical mirrors. Even if M attempts to provide as-perfect-as-possible copies of T's acting, these copies will always be delayed in time, and their kinematics will never be as perfectly correlated with T's acting as specular images are. We can therefore speak of efficacious reciprocal mirroring as long as T is in a position to recognize and understand M's acting as a

delayed copy of her own preceding action. Hence, the constitutive feature of reciprocal mirroring is *T's understanding of M's action as a copy of T's foregoing own action*.


insert Fig. 1 about here


A different form of social mirroring arises when T sees her own action complemented, continued, or carried on, rather than replicated by M *(action alignment through complementary mirroring)*. This form of social mirroring is, of course, entirely different from physical mirroring. Still, what is being mirrored in this case, too, is the overarching action goal that M reads from T's current action and then uses to guide her own complementary action. Thus, what complementary mirroring has in common with reciprocal mirroring is that (1) both individuals share the same overarching action goals, so that (2) M's action is strongly contingent upon T's preceding action, and that (3) this contingency needs to be perceived and understood by T. Again, in the complementary case, too, the reach of mirroring goes as far as *T is in a position to understand M's acting as a complement of her own acting*.

In a sense, then, social mirroring draws on embodied communication (Prinz, 2008). Communication is here embodied in the sense that it relies on T's and M's competence for action production and action perception. Such action-based mirroring does not even require explicit intentions to communicate something to someone else on either side. The sole requirement is that competent perceivers/actors meet, act, and watch each other. Not surprisingly, embodied social mirroring plays an important role in interactions between young babies and their caretakers. Babies and their mothers will often find themselves involved in what has been called protoconversational interactions (Trevarthen, 1993, 1998; Trevarthen, Kokkinaki, & Fiamenghi, 1999). They communicate by imitating and continuing each other's actions, taking turns in this funny game from time to time. Still, as we will see in the next section, there is reason to believe that action mirroring is even for more than just joy, entertainment, and social glue.


2.2    Action Matching

Action mirroring builds on action matching. This term addresses a theoretical framework for perception/production matching, that is, matching perception of foreign action to production of own action and vice versa. As we will see, the framework accounts not only for mirroring episodes at the behavioral level but also for structural extensions at the representational level that lay the ground for importing mental selfhood from others.

The framework builds on two basic claims. The first concerns the development of action perception and production in early infancy. The claim here is that perception leads over production in the sense that action perception draws initially on richer representational resources than action production. In other words, young infants' knowledge base for (perception of) foreign action is believed to comprise a large number of features that are not contained in their knowledge base for (production of) own action. The second claim pertains to perception/production matching as a means of overcoming this asymmetry. Perception/production matching is seen to offer a trick for extending production to catch up with perception. The trick relies on exploiting episodes of social mirroring. These episodes are seen to provide interindividual loops between perception and production that help individuals to model (production of) own action on (perception of) foreign action and, by

implication, self on others. For instance, if individuals perceive others as agents authoring intentional actions, the claim is that they will themselves *become* mental agents and *acquire* the capability of authoring intentional actions in virtue of importing to, and implementing in themselves what they first see going on in others.

To understand how such a seeming miracle can happen, we need to consider (i) how action perception works and what kind of knowledge it delivers and (ii) how perception/production matching works and what kinds of representational and social resources it requires.

### 2.2.1    Action perception

As is known since Michotte's classical experiments, event perception goes far beyond the information entailed in the stimulus configuration (e.g., Heider & Simmel, 1944; Michotte, 1946/1963; Shipley, 2008). Consider a billiard ball as it hits another ball and sets it in motion. Perception of such an event is, on the one hand, exclusively grounded on visual information arising from the kinematics of the balls on the table—information that specifies temporal and spatial coordinates and their derivatives. On the other hand, however, perception delivers much more than this. For instance, perceivers see and understand the non-visual dynamics entailed in the visual kinematics (i.e., the forces and masses involved in generating the spatio-temporal pattern). Such perceptual enrichment seems to come for free—effortlessly, automatically, and even unavoidably. Not surprisingly, perceptual enrichment applies not only to physical events but also (or even more so) to actions. Here, it pertains to both action identity and action dynamics.

To identify an action as X means to classify it as an instance of the category of Xs. For instance, to identify an arm-and-hand movement as a grasp, a grasp of a cup, or the start of an act of drinking, means to classify the action as a particular kind. These classifications must draw on pre-established action ontologies that specify action categories in terms of their content and their mutual relationships (Chellappa, Cuntoor, Joo, Subrahmanian, & Turaga, 2008; Gruber, 1995). Typically, perception specifies actions in terms of three basic elements: agent, movement, and effect. For instance, in grasping a cup for drinking, the agent is perceived to plan, initiate, and carry out the action, her bodily movement is seen to realize its execution, and the resulting effect to instantiate the intended goal. Actions are thus perceived as events that emerge from interactions between mental and physical forces entailed in agents, movements, and effects.

To understand an action is therefore tantamount to understanding the interaction between the mental and physical forces giving rise to it. Such understanding pertains to both action and agent dynamics. As concerns action dynamics, perceivers may distinguish between two modes of control, bottom-up and top-down. In the first case, movements are seen to arise as responses to given states of affairs whereas in the second they are seen to arise as means for realizing intended states of affairs. Likewise, as concerns agent dynamics, they may distinguish between two modes of perceiving and construing the source of the action: physical and intentional. When they see individuals acting, they localize the source of their actions in the agents, carried out by their physical bodies and guided by their intentional minds. Thus, in assessing the dynamics of actions and agents, perceivers are both dualists and interactionists. They clearly distinguish between physical and mental forces, but find it natural to see them interacting.

Physical dynamics pertains to the forces that underlie and generate the kinematics entailed in the stimulus configuration. The physical dynamics of perceived action is directly specified by the kinematics derived from the visual stimulus (Runeson & Frykholm, 1981). For instance, when we see someone lifting a box, we see not only the pattern of body movements and object motions involved in that act, but also the forces behind these movements (such as the weight of the box and the physical effort in terms of muscle forces required for its lifting). In such an act, we see the agent's body as the source from which these physical forces emerge.

Intentional dynamics goes beyond physical dynamics by also addressing the mental forces giving rise to the actions we perceive. For instance, the box may be seen to be lifted for the sake of being put on a table. As we know since Heider's classical studies, intentional dynamics is also directly specified by the kinematic pattern entailed in the stimulus configuration (Heider, 1944, 1958; Heider & Simmel, 1944). Such mentalizing, too, seems to be automatically and inevitably entailed in the act of perceiving. Even when we watch nothing but two innocent triangles moving in particular ways relative to each other, we cannot help but seeing one chasing the other or trying to escape from the other (Abell, Happé, & Frith, 2000; see also video by 'G Fan', 2015).

In sum, to perceive an action means to perceive an agent authoring it and generating the mental and physical forces to realize it. It means, in other words, to perceive a sequence of transient mental and physical states that are generated and controlled by the agent as permanent mental and physical source.

### 2.2.2    Perception/production matching

What does it mean to match production of own action to perception of foreign action and what kinds of resources are required to get there? Here, I consider representational and social resources.

As concerns *representational resources*, perception/production matching requires mirror-like devices inside individual minds—that is, devices for coupling perception to production that allow for a role of similarity in that coupling (Goldstone, 1994; Hahn & Chater, 1998; Hommel et al., 2001; Pineda, 2009; Prinz, 1990, 1997, 2015; Rizzolatti & Craighero, 2004; Rizzolatti & Sinigaglia, 2008). In this respect, coupling by matching is different from coupling by mapping. Unlike mapping, which draws on arbitrary assignment rules, matching invokes a role for similarity in creating assignments. The question how such a role can be instantiated is as old as the never-ending debate on principles of association. Over centuries, two basic camps have been struggling against each other, resorting to extrinsic context and intrinsic content, respectively. While contingency theory claims that items become linked to each other in virtue of contingency of occurrence (and irrespective of content), similarity theory claims that they become interlinked in virtue of similarity of content (and irrespective of contingency). Similarity of content, in turn, requires commensurate representations, that is, representations whose mutual relationships can be assessed in terms of representational overlap (Kornblum, 1992; Kornblum, Hasbroucq, & Osman, 1990; Prinz, 2015).

This is what the principle of *common coding* posits for the domain of action representation (Prinz, 1990, 1997). Common coding claims that planning and control of own action (= production) and representation of foreign action (= perception) draw on common representational resources. In other words, tokens of one's own action get entries in that

domain on the same representational dimensions as tokens of foreign action. Common coding thus makes it possible to both produce and perceive similarity relationships between own and foreign action. To illustrate, consider once more two individuals involved in social mirroring, target individual T and mirror individual M. As concerns production, M's mirroring of T's acting relies on M's production of own action that resembles perceived foreign action. Conversely, as concerns perception, T's understanding of the mirror nature of M's action relies on perception of foreign action resembling T's own foregoing action. Common coding is thus a prerequisite for the mirror game between the two to work.

However, as noted above, the claim that import theory raises goes one step further than this. Import theory claims that these games lay the ground for representational enrichment, that is, for exploiting rich resources for perception to enrich poor resources for production. To understand how this works, we need to consider *nested coding* as an instantiation of common coding in a partial domain (cf. Fig. 2).

insert Fig. 2 about here

The graph on the left of Figure 2 illustrates common coding, indicating the idea that one and the same representational space subserves both perception of foreign action and production of own action. This scheme allows for symmetrical interactions between perception and production. Since all entries in the common space are mutually commensurate, they can interact with each other in virtue of representational overlap, or similarity—irrespective of their origin in perception or production. The graph on the right illustrates nested coding. Here, the representational space for production is embedded in the space for perception so that common coding only applies to the overlap zone in the center. With this scheme, interactions become asymmetrical. Since production is now nested in perception, it is still the case that all entries subserving production overlap with entries emerging from perception. However, this is no longer true for all entries that emerge from perception: some will still overlap, but others will have no counterparts in production entries anymore.

insert Fig. 3 about here

Nested coding may thus be seen to capture the functional condition of rich resources for perception and poor resources for production. For instance, as illustrated in Figure 3, we may think of the overlap zone in the center covering physical action features (pertaining to the kinematics and dynamics of movements and bodies) and the surround zone covering mental action features (pertaining to the intentional dynamics of actions and agents). In any case, with a representational scheme like this, the knowledge base for action production will be much poorer than the knowledge base for action perception.

Here we may to turn to *social resources* and consider social mirroring. The critical claim here is that mirroring episodes can alter this asymmetrical functional condition and help modeling production on perception. Consider once more target individual T who first produces an action and then, based on an interindividual loop involving M's mirroring, perceives M matching that action. Figure 4 illustrates T's representational resources for action production at two stages. The initial stage relies exclusively on T's initial production resources whereas the final stage adds new resources to them. These new resources are

provided by T's perception of M's mirroring in episodes of social mirroring occurring between the initial and the final stage. Critically, since the new perceptual resources always include the initial production resources, perception and production will be understood to refer to one and the same event. As a result, poor production can take over resources from rich perception, to the effect that production resources will eventually become as rich as perceptual resources have been from the outset. This way, nested coding turns eventually into common coding.

insert Fig. 4 about here

The trick here is that perception of others' mirroring provides individuals with perceptual access to their own actions so that their rich resources for perception of foreign action become available for production of own action. If we assume that the surround zone in the nested coding scheme addresses resources for capturing the intentional dynamics of actions, the trick of matching production to perception can explain how we import the full picture of intentional dynamics from others to self, modeling own agency and selfhood on agency and selfhood perceived in others.

To match production to perception, individuals need to engage in mirror games (Prinz, 2008, 2012). Mirror games are interactive games designed to enable import from others to self. As mentioned above, these games are for young infants the only way of interacting and communicating with their caretakers. Conversely, for their caretakers the practice of reciprocating or complementing the infants' doings is common and widespread—perhaps a human universal. For babies, these games seem to be of crucial importance for tuning in with, and becoming attached to others, as well as laying the ground for perceiving and understanding their doings—and eventually themselves like others (e.g., Filippi & Woodward, 2015; Gallese, 2005; Meltzoff & Moore, 1995; Piaget, 1945/2013; Trevarthen, 1993, 1998, Trevarthen et al., 1999; von Hofsten & Rosander, 2015).

However, mirror games are not confined to babies and infants. At least to some extent, they also apply to interactions among adults. For instance, individual M may fold his arms behind his head while facing individual T doing the same. Likewise, M may carry on an action that T has failed to complete. As a rule, such mirroring is not explicitly cultivated as a social practice. It rather reflects automatic habits that are considered inappropriate conduct. Still, from T's viewpoint, these habits have exactly the same functions and consequences like explicit practices: they let her perceive and understand her own behavior through the mirror of others (Chartrand & Bargh, 1999; Chartrand & Dalton, 2009; Iacoboni, 2008; Pineda, 2009; Schütz-Bosbach & Prinz, 2015).

This is, then, what mirror games afford. They provide self-related information through others. By engaging in mirror games, people make capital out of their capacity to understand others as intentional agents for becoming intentional agents themselves. In a sense, then, they make use of others for building selves.

2.3    Empirical Evidence

So far, we have discussed import theory and the perception/-production-matching framework instantiating it as a hypothetical option. Now we turn to examining its empirical support.

As we have seen, the framework builds on a crucial supposition concerning the representational resources for action perception and production in early infancy, positing that action perception draws initially on richer representational resources than action production. The framework posits, in other words, that the early development of the machinery for action perception and production starts from the functional condition of nested coding and the structural asymmetry entailed in it, and it offers import from perception to production as a means for overcoming this asymmetry.

Importantly, however, import theory is not meant to monopolize the explanation of interactions between perception and production throughout the life course. Import in early infancy is entirely compatible with export at later developmental stages. Once a mental self is in place, import may become complemented, or even replaced by export, that is, by procedures like, for example, re-enactment, simulation, or inference that make use of self-related resources for understanding others. Accordingly, import and export may be seen to co-exist throughout the life course, be it in a permanent bidirectional relationship or a dialectic movement of switching from one to the other (Crapanzano, 1982, 1990; Hauf & Power, 2011).

Given this view, the claim raised by import theory must be seen to address the very first step in this dialectical movement. Basically, the claim posits a causal role of action perception for the making and shaping of action production. Unfortunately, however, since it addresses perception and production skills in early infancy, it is not easy to see how such a role can be empirically substantiated. To get there, one needs to face two problems. The first pertains to the assessment of these skills. How can one assess the depth of action perception and the dynamics of action production in young infants and, even more, how can one assess these skills in a way that allows one to compare them? The second problem pertains to the causal relationship entailed in the claim: How can one prove that two skills emerging on a developmental trajectory are causally related to each other?

One way of getting there—certainly a provisional one—is to rely on temporal order as a proxy to causality. For instance, one could try to make a case for import theory if one observed that certain perceptual skills always lead in time over comparable production skills. Such a conclusion would, however, at best be suggestive, not conclusive. This is because an observation like this would not only be compatible with import theory, but also with theories that posit common causes driving both perception and production skills.

Apart from this epistemological problem, the empirical picture that emerges from pertinent studies is not as clear-cut as import theory would like it to see. Studies using behavior-based and brain-based markers of perception and production skills both suggest that early signs of the capacity to perceive and understand visible action in terms of invisible drivers like beliefs and intentions emerge around 5 to 7 months of age—roughly at the same age at which early signs of top-down control and goal-directedness in production emerge (Daum & Aschersleben, 2014; Falck-Ytter, Gredebäck, & von Hofsten, 2006; Filippi et al., 2016; Gredebäck & Falck-Ytter, 2015; Hamlin, Hallinan, &Woodward, 2008; Kovács, Téglás, & Endress, 2010; Moore, 2006; Southgate, Begus, Lloyd-Fox, di Gangi, & Hamilton, 2014; Southgate, Johnson, Karoui, & Csibra, 2010). Since export is mainstream, most of these authors find it natural to conclude that this coincidence suggests that perception skills are driven and shaped by production skills. However, since temporal coincidence is likewise compatible with both export and import, the reverse conclusion is possible as well so that the picture emerging from these studies is inconclusive.

A perhaps more promising way of assessing a causal relationship between perception and production considers special populations exhibiting selective perceptual impairments, such as individuals with Autistic Spectrum Disorders (ASD) or Congenital Blindness (CB). As concerns ASD, it has been shown that most early behavioral markers of the disorder pertain to perceptual skills and habits involved in social communication like, for example, eye contact, looking at faces, or responding to (visual or auditory) communicative gestures, etc. (Landa, Holman, & Garrett-Mayer, 2007; Ozonoff et al., 2010). Some authors have taken these findings to suggest that ASD-trajectories may not only start with, but in fact be triggered and caused by a malfunction of social mirroring and its underlying functional and neural mechanisms (Iacoboni & Dabretto, 2006; Oberman & Ramachandran, 2007; Williams, Whiten, Suddendorf, & Perrett, 2001; but see also Southgate & Hamilton, 2008). Such early impairment of social mirroring may then be seen to drive later-emerging symptoms pertaining to impairments of self- and other understanding and control of thought and action (cf. Sperduti, Pieron, Leboyer, & Zalla, 2014; Uddin, 2011; Uddin et al., 2008; Zalla, Labruyère, & Georgieff, 2013; Zalla & Sperduti, 2015). However, the evidence is again not unequivocal since there is again no way to exclude the alternative interpretation of a common cause underlying both early and late symptoms.

This concern does not apply to studies of individuals with congenital blindness. For babies with CB, vision-based social mirroring does not work from the outset, this time caused by factors that are unlikely to directly affect later-emerging impairments of understanding self, others, and interpersonal relations. As has been shown by several studies, the CB condition is deeply detrimental to the development of these skills, causing developmental delays up to 36–48 months of age (Bedny & Saxe, 2012; Brambring & Asbrock, 2010; McAlpine & Moore, 1995; Minter, Hobson, & Martin, 1998). Moreover, it has been argued that some clinical features observed in CB children have "autistic-like" qualities (Hobson & Bishop, 2003; Hobson, Lee, & Brown, 1999). These observations suggest that the CB condition may deprive infants from early perceptual experiences in the social domain that are essential, if not indispensable, for the regular and timely formation of agency, self, and interpersonal relations. Remarkably, it seems that most of these impairments gradually disappear at later ages, perhaps suggesting that other communication channels take over, allowing for such seemingly paradoxical things like social mirroring in non-visual formats (Bedny & Saxe, 2012).

Taken together, we may conclude that the evidence from these studies lends some support to import as the initial move from which the dialectic interplay of import and export starts. The evidence is at this point suggestive, not conclusive, but in any case it offers more support for import than for export. To get at a more conclusive picture, we need further studies (of both regular and special populations) that are designed to allow us to directly pit import against export and examine relationships between perception and production skills in greater detail.


## 3  Consciousness Demystified

There are two kinds of reasons to go for a particular theory, like import, and not some other one, like export. One kind is empirical, pertaining to the supporting evidence. As we have seen, the empirical support is less unequivocal than one would like it to be. However, another kind of reasons, on which these concluding remarks will focus, is theoretical and pertains to the explanatory power entailed in the theory. In this regard there are in fact good reasons to prefer import to export. They come from comparing the two theories in terms of

their explanatory power for key features of conscious experience. With respect to these features, the crucial difference between the two theories is that import theory can *explain* what export theory can only *posit*. To conclude, let us see what the two theories have to say about selfhood, intersubjectivity, and intentionality.

### 3.1.1    Selfhood

As discussed earlier on, the implicit involvement of the self in mental acts is key to conscious experience. Theories of consciousness must therefore explain where the mental self comes from and how it gets in place. While import theory addresses these issues explicitly, export theory has not much to say about them. Instead, export theory takes a mental self for granted as part of the natural endowment of the human mind. In a sense, the mental self falls from heaven here, and the same applies to its becoming involved in mental acts. Import theory, by contrast, has a full story to offer on these issues, starting with perceiving others as intentional agents and ending up with interindividual loops for importing the dynamics of intentional agency from perception to production and from others to self. Thus, while import theory explains the emergence of selfhood and subjective experience, export theory invokes it as a *petitio principii*.

### 3.1.2    Intersubjectivity

A similar asymmetry applies to the roots of intersubjectivity. Import theory claims that intersubjectivity arises from modeling self on others and offers a detailed account of the involved representational and social resources. Export theory, by contrast, claims that intersubjectivity arises from putting oneself in the other's shoes, that is, using one's own mental experience for understanding that of others. According to this view individuals may, for instance, motorically re-enact what others do and/or mentally simulate their thoughts and intentions.

Yet, as indicated above, it is far from clear how these operations work and what they are meant to entail (Prinz, 2006). The critical point here is that export from self to others always requires, and in fact presupposes, some kind of foregoing import from others to self. For instance, in the case of action simulation, the choice of appropriate own action for simulating/re-enacting perceived foreign action always requires to identify that action in the first place. In other words, perceived foreign action needs to be fully identified (in terms of both physical and intentional features) before an appropriate simulation/re-enactment can be chosen and run. Running this simulation can therefore be no more than a later addition to the preceding perceptual identification. It may add new information to the resulting action representation, but it cannot contribute to the action's foregoing visual identification. I cannot simulate and re-enact your smile without having seen and identified the smile in your face in the first place.

### 3.1.3    Intentionality

Conscious experience builds on representational reference. Theories of consciousness must therefore explain how conscious content in the mind can refer to things in the world. There are two questions here that are often considered deeply enigmatic (cf. Brunswik, 1952; Dretske, 1981; Grice, 1991; Prinz, 1992). The first pertains to intentionality proper: How is it at all possible for one thing to refer to an entirely different thing in the sense of having it as

content? The other refers to distal reference: How is it possible for mental representations to skip over proximal events and refer to distal events? For instance, why do we see flowers in a meadow or the sun in the sky? Why do we see these things out there and why don't we, for example, see the retinal activation patterns or the brain states involved in generating these percepts? Likewise, when we use a hammer to bang a nail into the wall, we do not plan that action in terms of muscle contractions or cortical activations. Our planning rather addresses the action and its outcome. In both cases, the underlying representations focus on distal things out there, neglecting proximal things mediating access to them. This poses a paradox for theory: How can representations skip over proximal links in the causal chain of things leading to them and single out a particular distal link in that chain for representational reference?

As long as we adhere to the notion of consciousness as a natural kind that emerges from the natural endowment of individual minds, there is no obvious way to resolve the paradox. However, the paradox goes away when we see consciousness arising from import from others to self. Under this perspective, intentionality and distal reference appear to be natural ingredients rather than paradoxical features of conscious experience—by-products emerging from modeling self on others. The basic idea is illustrated in Graziano's story about Bill who looks at a cup and Abel who watches Bill doing so (Graziano, 2013, p. 86). In this scenario, the observer (Abel) construes the other (Bill) as having states in his mind that refer to things in their shared environment (cup). Abel understands, in other words, Bill's percepts and thoughts concerning the cup as private states in Bill's mind that still refer to public things in their shared environment. Mental states like percepts, intentions, or thoughts are thus, from the outset, perceived and construed as private states in minds that exhibit representational reference to public things in the world. Their proper function is to refer to things out-there, with no links in-between mediating that referential relationship. Thus, if we believe in import theory, we get intentionality and distal reference for free. This is perhaps the strongest theoretical reason for preferring import to export.

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**Figure Captions**

**Fig. 1** Two modes of social mirroring, reciprocal and complementary. See text for explanation.

**Fig. 2** Common coding and nested coding compared.

**Fig. 3** Mental and physical features in nested coding.

**Fig. 4** Representational enrichment through mirroring episodes. See text for explanation.