How Objects Become Social in the Brain: Five Questions for a Neuroscience of Social RealityPerspectives on Social Ontology and Social Cognition

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Chapter 9

How objects become social in the brain: five questions for a neuroscience of social reality

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Abstract. Little empirical work has been conducted on social objects and we are still at the very early stages of understanding how the brain permits us to represent, recognize, and constitute a social reality. In this chapter, we consider five core questions for a neuroscience of social objects and speculate on ways in which these questions might be addressed combining behavioural, developmental, neuropsychological, and neuroimaging approaches.

9.1 Social objects and the brain

Money, property, universities, driving licences, chess games, and elections. As highlighted by John Searle (1995), a peculiarly puzzling feature of these objects is that they exist because *we think* they exist. Consider a ten dollar bill. It is an objective fact that the piece of paper in my hand is a ten dollar bill. But the objective fact only exists in virtue of collective acceptance. What makes the piece of paper count as money is the fact that we, collectively, accept and recognize that the piece of paper has the status of money (Searle 1995, 1998; Smith and Searle 2003). But how can "collective acceptance or recognition" create a social reality? What it is the nature of this creation? Are social objects parts of physical reality? What is the ontology, the mode of existence, of social institutional reality?

Social objects have been at the centre of philosophical discussion and debate over the last decade. So far, however, little empirical work has been conducted and we are still at the very early stages of understanding how the brain permits us to represent, recognize, and constitute social objects. In this chapter we consider five core questions for a neuroscience of social objects and, speculate on ways these questions might be addressed combining data from a variety of different approaches, including behavioural, developmental, neuropsychological, and neuroimaging studies.

9.1.1 Are social objects a category of objects in the brain?

Questions about the organization of conceptual knowledge in the human brain can be addressed by studying category-specific semantic deficits, in which the ability to identify specific categories of objects can be selectively impaired while performance with other categories remains relatively intact (Caramazza and Mahon 2003). Category-specific semantic deficits have been demonstrated for animals, fruits and vegetables, and artefacts (Capitani, Laiacona, Mahon, and Caramazza 2003).

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An open question is whether category-specific semantic deficits for non-living things fractionate into more fine-grained deficits. The domain specific hypothesis assumes that conceptual domains in the brain are restricted to those domains for which rapid and efficient identification could have had survival and reproductive advantages (Caramazza and Shelton 1998). Plausible candidate categories in this view are thus 'animals', 'fruit/vegetables', 'conspecifics', and possibly 'tools'. The existence of sub-category of artefacts, including 'social objects', is however implausible. In contrast to this viewpoint, the sensory-functional models assume that object concepts are not explicitly represented, but rather emerge from weighted activity within property-based brain regions (Warrington and McCarthy 1987; Martin 2007). Category-specific knowledge disorders occur when a lesion disrupts information about a particular property or set of properties critical for defining that object category and for distinguishing among its members. For example, damage to regions that store information about object form will produce a disorder for musical instruments, but not for tools, because visual appearance is a critical property for defining musical instruments, but not tools (Masullo, Piccininni, Quaranta, Vita, Gaudino, and Gainotti 2012). In this view, the question is not whether social objects form an object-category in the brain, but whether there is a critical property or set of properties defining social objects in the brain.

Finkelnburg (1870) described the inability to recognize the values of coins and military marks observed in aphasic as a form of asymbolia, implying that the ability to symbolize, i.e., imbue object configurations with an arbitrary meaning, is crucial not only to recognize words, but more generally, symbolic objects. In this interpretation, social objects should be associated with words because, as for words, the source of knowledge that critically contributes to their construction is symbolic. An alternative possibility (see below) is that social objects are recognized by their function and are thus more similar, in terms of properties, to tools than words.

9.2 Tool theory of social objects: Is a ten-dollar-bill a tool?

Although many animals use simple tools to extend their physical capabilities (e.g., sticks for reaching), only humans seem to posses the ability to manufacture and use complex artifacts to perform specific *functions*. Neuropsychological evidence and contemporary findings in functional neuroimaging indicate that this ability arises from a temporo-parietal network encoding critical knowledge of the functional use of tools (Johnson-Frey 2004). Activation within this network has been demonstrated for familiar tools such as screwdrivers, knifes, fountain-pens and nutcrackers (Vingerhoets 2008). Is this network also associated with knowledge of the *function* of social objects? Consider the case of money. As a screwdriver is *for* screwing, money is *for* representing the value of goods and services. In contrast to a screwdriver, a ten-dollar bill, however, does not perform its function on the basis of its physical characteristics, but in virtue of the fact that we have a certain set of attitudes toward it. Only our social practices tie the function to that physical substrate. We acknowledge the piece of paper the *status* of money, we count it as money, and in virtue of this, impose on it a function which could not be performed without the collective acceptance of that status (Searle 1995, 1998; Smith and Searle 2003). The fact that social objects are special in this way raises the question of whether brain regions associated with complex tool use also subtend functional knowledge associated with social objects. When we use money or see it being used, do we employ similar representations as those of concrete tools such as screwdrivers? Despite the material substrate is clearly of far less importance for money than for concrete tools, does the brain treat money as a tool? Using functional MRI, Becchio, Skewes, Lund, Frith, Frith, and Roepstorff (2011) demonstrated that observing bank notes being cut up or torn, a critical violation of their function, elicits activation within the left temporo-parietal tool network. This activation was the greater the higher the value of the banknote manipulated, suggesting value modulated activations within functional use areas. These findings lend plausibility to tool theories of money, interpreting money as a tool for parametrically symbolizing exchange (Lea and Webley

2006). However, studies with more sophisticated experimental designs are needed before any strong conclusions can be advanced regarding the representation of functional knowledge associated with social objects. Are activations within the tool network reflecting properties specific to money or to all social objects? What specifically differs in the attribution of physical functions and collectively assigned status functions? A crucial next step will involve comparing, within the same design, neural activation on the presentation of tools, money, and social objects other than money (e.g., chess pieces, passes). Complementary to this, future research should examine whether and how the the perception of affordances offered by social objects differs from the perception of affordances offered by tools (see Fiebich, ChapterXXX in this volume).

9.3 How do status functions emerge?

Another approach to studying the possible mechanisms status functions assignment is to examine how children develop this ability (see also Paternotte, Chapter XXX in this volume). Children use of language – a system of status functions – has been proposed to involve some appreciation of status and normativity (Kalish 2005). For example, the fact that children by 18 months of age children will correct a speaker who mislabels an object (Pea 1982) seems to suggest that they appreciate the normative structure of language. As noted by Rakoczy and Tomasello (2007), however, the case of language is difficult to interpret because children may use language even without appreciating the logical structure of status function assignment. Clearer cases are games of pretence involving objects which children know and which get additional status in the context of the game, for example, a banana used as a telephone receiver. In contrast to the case of language, in games of pretence involving familiar objects children have to be aware that of the dual structure of status function assignment: "X count as Y in C". This banana counts as a telephone receiver in the context of this pretence (Rakoczy, Tomasello, and Striano 2005; Rakoczy and Tomasello 2007; Rakoczy 2008).

Children begin to engage in pretend play from 18 months. From 24 months they understand that one or even several different fictive identities can be assigned to an object in pretence; they can follow simple pretence scenarios, join in with appropriate own pretence actions and produce normatively appropriate inference acts (Rakoczy and Tomasello 2006; Rakoczy, Tomasello, and Striano 2004). For example, they pretend to drink from a cup into which the experimenter had pretended to pour into (Harris and Kavanaugh 1993). When a third joins the game, but does not respect the pretence status of the object, they protest and criticize her, displaying a clear understanding of the normative status of the practice (Rakoczy 2008). In embryonic and isolated form, games of pretending of 2-year olds seem thus to have the basic structure of institutional reality. However, it remains an open question as to how the awareness of status and normativity in pretend games relates to children's developing an understanding of "serious" status in areas of institutional reality such as money and private property. Children think and talk about money, norms, roles, and ownership. But how do they understand about such things?

Research using a verbal interview methodology has usually not revealed much competence until age seven (e.g., Kalish, Weissman, and Bernstein 2000). For example, while 7-year-old children understand that statements about pretences ("This bear is now called George") and conventions about property ("This horse in now yours") have different truth values, 3- and 5-year old children fail to evaluate that conventions, but not pretences, change reality. This might indicate that in young children normative awareness of status only reaches as far as the very limited pretence game context. However, it is also possible that young children understand *in action* more about conventionality and normativity than what they are able to distinguish *in words* (Rakoczy, Tomasello, and Striano 2006). Rossano, Rakoczy, and Tomasello (2011) addressed this possibility by using a novel interactive measure of normative awareness based on spontaneous protest against property right violations. Children watched as an actor took possession and attempted to dispose of

an object. What varied was who owned the object: the actor himself, the child subject, or a third party. While both 2- and 3-year-old children protested when their own object was involved, 3-year-old children also stood up when a third party's object was involved. This suggests that by 3 years of age, children have some implicit understanding of the basic normative structure of property and property rights violations. Whether these results generalize to other social objects and which factors are important in the development from early implicit to later explicit understanding of normativity are questions for future research.

9.4 Do social objects depend on a uniquely human ability to share goals and intentions?

Approaches from a developmental and comparative viewpoint have gone some way towards addressing this issue, suggesting that creation and maintenance of social objects may critically depend on "shared intentionality" (Tomasello, Carpenter, Call, Behne, and Moll 2005) or "we-intentionality" (Becchio and Bertone 2004). Already at 14 months of age, human infants show some rudimentary skills for engaging in cooperative activities (Warneken and Tomasello 2007). During the second year of life, they become progressively more adept and active as social partners and by their second birthday they engage various kinds of collaborative activities in which they flexibly adapt their individual intentions and actions towards their partner's intentions and actions based upon an intention to act jointly (Warneken, Gräfenhain, and Tomasello 2012). This – has been proposed - creates the possibility of culturally constituted entities that exist because *we* believe and act as if they do (Tomasello and Herrmann 2010).

Nonhuman primates show some understanding of the goals and the perception of social partners, but they seem to lack the social-skills and motivations for shared intentionality (Tomasello, Carpenter, Call, Behne, and Moll 2005). For example, they do not try to direct the attention of conspecifics by pointing, showing, or offering (Call and Tomasello, 2008). Moreover, although they can learn to use human artefacts, they do not engage in pretend play or in any other behaviour suggesting that they understand the normativity in those artefacts. One hypothesis is therefore that nonhuman primates lack the type of collective intentionality needed to create the structure of institutional reality (Tomasello and Hermann 2010).

An alternative view, inspired by field studies of primates in their natural environments, suggests that, non-human primates may share a symbolic culture. In chimpanzees, for example, some communicative traits have been shown to follow group-specific norms (Boesch 2008, 2011). The most complex example is the leaf-clipping behavior: In Taï chimpanzees, leaf-clip is used by adult males just before a display to signal their intention; in Bossou chimpanzees, it is used by youngsters to get others' attention and invite others to play; and in Mahale chimpanzees, it is used by sexually active males to attract estrus female to mate with them (Nishida 1987; Sugiyama and Koman 1979; Boesch 1995). The actions themselves are arbitrary; the significance of the behaviour is defined by the individuals within the group to create a convention. Using a diffusion approach, Bonnie, Horner, Whiten and de Waal (2007) demonstrated that arbitrary conventions can spread among chimpanzees as a result of social learning. Different conventions concerning a sequence of arbitrary actions were seeded in two chimpanzees group. Each sequence spread in the group in which it was seeded, with many individuals adopting the sequence demonstrated by a group member. Although one individual in one group consistently performed an alternative action sequence and was rewarded for doing so, no other member of the group adopted the alternative sequence, showing an unprecedented fidelity to the experimentally seeded convention. These and other observations (Boesch, 2011) support the idea that object-directed behaviours in non human primates may follow specific social norms. In this view, the human uniqueness would not reside so much on shared social practices and

conventions, as on cultural transmission modes not available to other species (e.g., speech, writing, radio, internet).

9.5 Do social objects influence the sensory-motor system?

An increasingly important theoretical notion in cognitive psychology and neuroscience is the idea that high-level cognitions rely in part on embodied conceptualizations and can therefore be reflected in and influence bodily states (e.g. Niedenthal 2007). In the social domain, 'embodiment' has been demonstrated for affective judgements (Beilock and Holt 2007; van den Bergh, Vrana, and Eelen 1990), stereotypes (Mussweiler 2006), persuasion (Sherman, Gangi, and White 2010), and helping behavior (Liljenquist, Zhong, and Galinsky 2010). Moreover, there is evidence that moral cleanness may be metaphorically linked to physical cleanness. For example, it has been demonstrated that cleaning one's hands with soap or an antiseptic wipe can alleviate the guilt of moral transgressions (Zhong and Liljenquist 2006) and influence one's moral judgment (Schnall, Benton, and Harvey 2008; Schnall, Harber, Stefanucci, and Proffitt 2008). Other work has highlighted the impact of metaphorical links between verticality and power (e.g., ''high in the hierarchy''; Schubert 2005), and spatial concepts, such as left and right, and political attitudes (Oppenheimer and Trail 2010). For instance, it has been demonstrated that participants who are oriented to their right report more conservative political attitudes, while those who are oriented toward their left report more liberal attitudes (Oppenheimer and Trail 2010), suggesting that, to the extent that strong association exist between spatial concepts and political ideology, bodily orientation can influence political attitudes. Taken together, these studies indicate that common metaphors in which abstract target concepts are described may use concrete concepts derived from sensori-motor experience. However, as recently noted by Meier, Schnall, Schwarz, and Bargh (2012), it remains controversial whether such metaphors are a manifestation, a reinforcement, or the cause of embodiment effects in social judgment and behavior.

Adopting a somewhat different approach, Constable, Kritikos, and Bayliss (2010) asked whether the concept of ownership may exert an influence on the action system. In a first experiment, participants performed natural lifting actions with mugs that differed in terms of ownership. Analysis of trajectory and acceleration as the mugs moved through space revealed that participants lifted the mug owned by the experimenter with greater care, and moved it slightly more towards the experimenter, while they lifted their own mug more forcefully and drew it closer to their own body. In a second experiment, the same participants responded to stimuli presented on mug handles in a computer-based stimulus–response compatibility task. Overall, they were faster to respond in trials in which the handles were facing in the same direction as the response location. However, this compatibility effect was abolished when stimuli were presented on the experimenter's mug – as if the action system were blind to the potential for action towards objects own by others (Constable, Kritikos, and Bayliss 2010). A similar approach could be used to investigate the sensory-motor grounding of money, passports, signs, and flags, i.e., social objects that have some physical realization. According to Searle (1995), however, all social objects are ultimately "place holders for patterns of activities": they are associated with deontic powers (right, duty, obligation, and requirement) and deontic powers create reasons for action. This holds both for social objects that have a physical realization and for objects that have no physical realization or whose physical realization is partial, scattered, or intermittent, such as marriage, government, universities (Smith 2003). If this is correct, then also social objects that have no physical realization – free-standing social objects, as Smith (2003) calls them - might be expect to influence the action system.

9.6 Concluding remarks

So far social cognitive neuroscience has been mainly, if not exclusively focused, on interaction between minds and brains. The above questions force us to think about the complex interactions that tie minds and brains to material objects. Brains –it has been proposed – help make new objects, which in turn help create new brains (Gosden 2008). This proves especially true for social objects. Being material and social at once, social objects may serve as a platform to understand how interacting minds/brains can establish new ontologies, which in turn may expand and create new possibilities for thinking.

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