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Review

A geographical history of social cognitive neuroscience

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ABSTRACT

The history of social cognitive neuroscience (SCN) began with isolated islands of research in Europe and the United States in the 1990s. In the decade between 1995 and 2004 most of the major areas of current SCN research were identified in a series of high profile first studies. This paper reviews the timeline as well as the geography of important moments in the short history of this field. Of note is the different focus seen in European contributions (theory of mind, mirror neurons, and empathy) and the more self-focused U.S. contributions (self-knowledge, emotion regulation, implicit attitudes).

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This special issue commemorates the twentieth anniversary of the journal Neuroimage and this period covers the vast majority of social cognitive neuroscience's history as well. If one were so motivated, the history of *social cognitive neuroscience* (SCN) could be traced to Phineas Gage in the mid-nineteenth century or to Floyd Allport's (1924) first textbook on social psychology, which included a chapter on the brain bases of social psychology. Although these may represent the oldest layers of sedimentation, they are thin layers that did not generate further activity in the decades that followed. The bedrock supporting SCN's current endeavors began much closer to Neuroimage's founding. When Tania Singer and I were each asked to contribute papers for this issue, one of the things that stood out were the geographical differences in the contributions to the field. The topics of study that were initiated in either North America or Europe reveal interesting patterns and even as those patterns begin to blend across the Atlantic ocean, they seem to retain some of the flavor of the originating continent. As a result, I have chosen to characterize the timeline of SCN, undoubtedly incomplete, with an eye towards the location of different contributions.

Perhaps the best modern date to start our history of SCN is the 1985 publication of *The Social Brain*, authored by Michael Gazzaniga of Dartmouth University (see Fig. 1), who also coined the term 'cognitive neuroscience' a decade earlier with George Miller. This book focused on the differing contributions of the two cerebral hemispheres and in particular how lateralized functions could explain social psychological peculiarities such as rationalization. Although current SCN theories rarely rely on lateralization as a key distinction, this book represents the first modern attempt to explain the emergence of social psychological phenomena in terms of the organization or function of the brain.

The 15 years following *The Social Brain* saw a series of small islands of SCN research, typically limited to a single lab working on a particular problem. In 1990, Leslie Brothers at the University of California, Los Angeles (UCLA) observed neurons in the primate amygdala that responded selectively to social stimuli (Brothers et al., 1990) and, separately, David Perrett (Perrett et al., 1989) at St. Andrews University in Scotland discovered neurons in the superior temporal sulcus that responded in primates to the presence of biological motion such as eye gaze movement. For the next few years, single-unit primate studies were the only game in town as functional neuroimaging techniques in humans were just beginning to be used by cognitive psychologists. Social psychologists would not get their hands on a scanner for a few more years.

The next seminal year was 1992. Robin Dunbar (1992) at University College of London published his first major piece of evidence supporting the claim that humans evolved larger brains not so that they could perform abstract cognition, but rather so that they could live in larger groups and keep track of complex social relationships between the different members of the group. The decades since have seen

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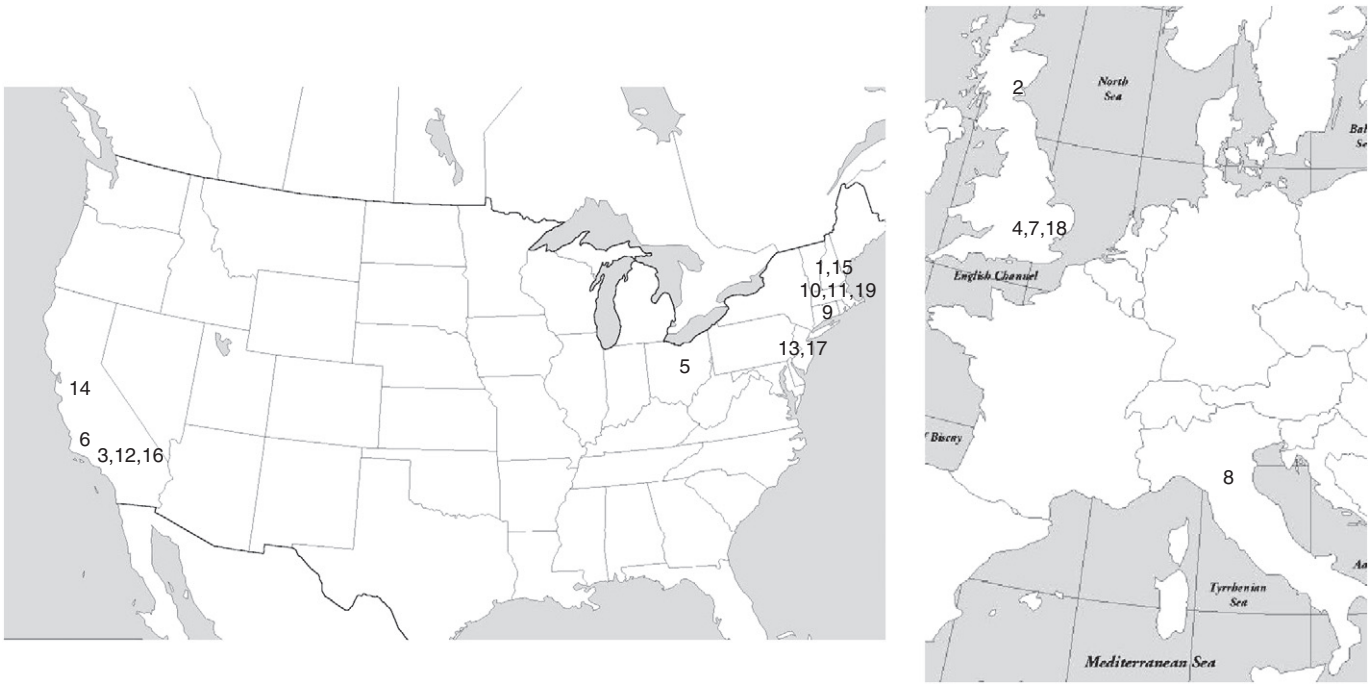

1 – The Social Brain (1985) Gazzaniga
2 – Biological motion & STS (1989) Perrett
3 – Social amygdala (1990) Brothers
4 – Social brain hypothesis (1992) Dunbar
5 – Social neuroscience (1992) Cacioppo & Bernsten
6 – Self-knowledge (1995) Klein
7 – Theory of mind (1995) Frith & Frith
8 – Mirror neurons (1996) Rizzolatti
9 – Implicit attitudes (2000) Phelps & Banaji
10 – Social cognitive neuroscience (2000) Ochsner & Lieberman
11 – Cognitive dissonance (2001) Lieberman & Ochsner
12 – First SCN conference (2001) Lieberman, Iacoboni, & Fiske
13 – Moral reasoning (2001) Greene
14 – Emotion regulation (2002) Ochsner
15 – Self-reference (2002) Kelley, Macrae, & Heatherton
16 – Social rejection (2003) Eisenberger
17 – Fairness (2003) Sanfey
18 – Empathy (2004) Singer
19 – Explicit attitudes (2004) Cunningham

Fig. 1. The location and years associated with various milestones in the history of social cognitive neuroscience.

mounting evidence supporting this claim that our sociality is at the heart of modern brains, rather than it being a secondary function that any cognitive system is capable of, but not designed for.

The term *social neuroscience* was also popularized in 1992 in an influential review paper by John Cacioppo and Gary Bernston, both at Ohio State University. In this review, they called for the active development of a new field of social neuroscience that would combine various methods and levels of analysis (Cacioppo and Bernston, 1992). It is worth taking a moment to consider the history of the term social neuroscience as the connotations of this term have changed over the past two decades, if not its formal definition. Most of Cacioppo and Bernston's review was focused on the general benefits of multi-level analysis, with the discussion of social neuroscience specifically coming in the final pages of this seminal paper. Two examples were given of how social neuroscience might proceed. The first focused on how our social environments can affect our immune systems. The second focused on how greater degrees of contextual control over evaluative and appetitive processes are added when moving from decerebrate, to limbic lesions, to sparing of the entire brain. Of these two examples, it was the former that took root under the name social neuroscience over the subsequent decade. Social neuroscience in the 1990s was largely identified with how social factors influenced autonomic, neuroendocrine, and immune systems. In other words, social neuroscience was more aligned with health psychology, than social cognition or what was to become SCN a decade later. Over time, the meaning of social neuroscience has shifted to incorporate the content and methods of SCN, but it would be a mistake to think that SCN did not add a distinct perspective to what had been present prior to this convergence.

In the mid-1990s, three more labs added their fingerprints to the early history of SCN. At the University of California, Santa Barbara, Stan Klein and his colleagues (Klein et al., 1996) published an early case study on the role of memory in self-knowledge. Philosophers had argued centuries earlier (Locke, 1689/1975) that there is an intimate relationship between what we can remember from our lives and extent of our self-knowledge; 'if I cannot remember what I have done, how am I to know what kind of person I am?' Klein had published earlier research using clever cognitive paradigms to demonstrate that under most circumstances, people do not appear to rely on episodic memory for past events when drawing general inferences about themselves (Klein et al., 1992). In 1995, he reported on a patient with temporary amnesia who could not recall past episodes from her life reliably. Nevertheless, by multiple criteria, her self-knowledge was preserved to a normal level. This was the first attempt to examine the processing components of a social psychological capacity by using the integrity of a neurocognitive mechanism, in this case the brain's episodic memory system.

The other two labs making contributions in the mid-1990s set the stage for the two neurocognitive models of social cognition dominant to this day. In the early 1980s developmental and comparative psychologists began studying the ontogenetic and phylogenetic origins of the ability to consider the mind of another as distinct from one's own. This ability was referred to as *theory of mind* (Premack and Woodruff, 1978; Wimmer and Perner, 1983) and corresponded to the use of propositional thinking to make sense of the current state of another's mind. If one knows that another dislikes the taste of fish, even if one likes it oneself, it can be logically inferred that the other, having just taken a large forkful, is currently having an

unpleasant taste experience. University College of London researchers, Uta and Chris Frith, published a positron emission tomography (PET) study identifying the neural correlates of applying this theory of mind ability (Fletcher et al., 1995; see also Baron-Cohen et al., 1994) with activity in dorsomedial prefrontal cortex (DMPFC), posterior cingulate, bilateral temporal poles and left posterior superior temporal sulcus.

A second account of the neurocognitive bases of social cognition emerged from Giacomo Rizzolatti's group at the University of Parma around the same time (Gallese et al., 1996). This group was conducting single-unit recordings from macaque premotor and inferior parietal cortex and discovered what they called *mirror neurons*. These mirror neurons responded both when the macaque performed an action and when the same action was observed being performed by the experimenter. The neurons putatively allowed the observer to automatically recreate the experience of an observed individual by literally activating similar neural patterns in oneself as in the observed. Mirror neurons have been posited to explain *in toto* a wide array of human behavior including language, imitation, cultural transmission, and social cognition. Like most new discoveries the resulting enthusiasm for the explanatory power of the mirror neuron is both understandable and yet probably overstated. To be sure, though, the notion that mirror neurons in humans contribute to a direct, non-propositional, apprehension of the experience of another is still a dominant view within SCN.

The Frith and Rizzolatti groups were highly successful in pursuing their respective models of social cognition over the next few years (and see Klein and Kihlstrom, 1998), but it was unclear whether others were going to join the party and whether these few labs would give way to the emergence of a field of like-minded researchers covering the broad expanse of topics in SCN. For 4 years, no one that I am aware of publicly joined the fray. Almost as soon as the ball dropped on the new millennium, everything changed. New islands of SCN collaboration between social psychologists and cognitive neuroscientists that had been bubbling up behind the scenes for a few years led to a series of papers from different labs that laid down markers for the various topics in SCN.

I was a graduate student at Harvard in Daniel Gilbert's social cognition lab and Kevin Ochsner was a graduate student in Daniel Schacter's cognitive neuroscience lab. Kevin and I had talked about trying to combine the kind of work we both did and began using the term social cognitive neuroscience around 1996. At about this same time, Dan Schacter asked Kevin if he wanted to have a task included in the next run of studies with their amnesic population. We used a classic cognitive dissonance paradigm to examine whether rationalizing one's recent behavior depended on remembering the to-be-rationalized behavior. Our data indicated that it did not and instead appeared to emerge automatically during the process of performing such behaviors given that amnesics, who could not remember that recent behavior, showed just as much rationalizing as healthy controls (Lieberman et al., 2001).

The reason I digress about my graduate school experience is that it was during this same period that, then Yale professor, Mahzarin Banaji took a sabbatical at Harvard. We told her about our work and learned that she, a social psychologist, and Elizabeth Phelps, a cognitive neuroscientist at Yale had been collaborating on a study of race, implicit attitudes, and amygdala responses. Kevin and I had been working in isolation and, frankly, it was a revelation to hear that two scientists we both admired had begun collaborating across the same disciplinary boundaries. It was not long before we learned that other prominent social psychologists like Todd Heatherton at Dartmouth University and Susan Fiske at Princeton University had also taken the leap. Discovering that the best and brightest among the 'grown-ups' in the field thought this was a new direction worth pursuing was tremendously encouraging to a generation of graduate students who were nervous about the wisdom of betting their careers on this endeavor.

In 2000, Phelps, Banaji, and Wil Cunningham (Phelps et al., 2000) published their paper and that really opened the floodgates to using functional magnetic resonance imaging (fMRI) to study the neurocognitive bases of social cognition and to use the brain to clarify the functional bases of various social psychological processes or procedures. At the time, there was a heated debate about whether the implicit association test (IAT) actually measures implicit processes and indeed the *Journal of Personality and Social Psychology*, the premier social psychology journal, had a moratorium on papers using the IAT until the debate could be resolved. The link between IAT scores and amygdala responses to Black faces (in White subjects) went a long way towards validating the IAT as an implicit measure.

In 2000, Kevin Ochsner and I each published papers that first used the term *social cognitive neuroscience* in print (Lieberman, 2000; Ocshner and Schacter, 2000). In 2001, a group of us (Marco Iacoboni, Alan Fiske, and myself) hosted the first SCN conference at UCLA. Many of those in attendance or speaking would go on to make major contributions to the field of SCN including Elizabeth Phelps, Todd Heatherton, Neil Macae, Jonathan Cohen, Jason Mitchell, William Cunningham, Jennifer Beer, Thalia Wheatley, David Amodio, Naomi Eisenberger, and Kevin Ochsner.

Nearly a decade after Cacioppo and Bernston (1992) made a call for a field of social neuroscience, Kevin Ochsner and I (Ochsner and Lieberman, 2001) made a similar call for a field of social cognitive

Fig. 2. The European and American contributions to social cognitive neurosciences.

neuroscience. Specifically, we argued that the tools of cognitive neuroscience could complement those already used in the study of social cognition and that such tools could be used to test whether hypothesized sub-processes were present or absent, whether two processes that seem phenomenologically similar in fact depended on different processes (e.g. physical vs. mental causal inferences; Fletcher et al., 1995), or whether two processes that seem phenomenologically different actually relied on common neurocognitive processes.

Clearly, our call for the field of SCN and the rapid emergence of SCN in the next few years was a classic case of a 'third variable' problem. Here the third variable was the increasing availability and accessibility of fMRI to those with social psychological interests. In the next 5 years, papers marking the beginnings of nearly every topic in SCN came out in rapid-fire sequence. In 2001, Josh Greene and his colleagues at Princeton published the first paper on moral reasoning (Greene et al., 2001). The following year, then Stanford postdoc, Kevin Ochsner published a major paper exploring the neural bases of emotion regulation (Ochsner et al., 2002) that has set in motion its own mini-field. In the same year, Bill Kelley, Neil Macrae, and Todd Heatherton (Kelley et al., 2002) at Dartmouth published a seminal paper on self-reference and the brain. In 2003, Naomi Eisenberger and I, both at UCLA, published the first fMRI study of social rejection (Eisenberger et al., 2003) and on a related theme, Alan Sanfey and colleagues at Princeton University published an fMRI study examining the neural responses evoked by being treated unfairly (Sanfey et al., 2003). Finally, in 2004, Tania Singer and others at University College of London published the first fMRI study of empathy (Singer et al., 2004) while Wil Cunningham published a key fMRI paper on explicit attitude processes (Cunningham et al., 2004).

Obviously, 2004 is an arbitrary stopping point for the early history of SCN, but it does represent the end of a decade from the 1995 findings on self-knowledge and theory of mind. Also, around this time, SCN really began to bootstrap itself into being a field rather than a series of isolated findings. There were enough studies being done to hold yearly SCN preconferences at the *Social for Personality and Social Psychology* and *Cognitive Neuroscience Society* (organized by Jenni Beer, Jason Mitchell, Kevin Ochsner, and myself). Other institutional changes paralleled this. Beginning in 2003, a string of journals published special issues on SCN including *Journal of Personality and Social Psychology* (2003), *Neuropsychologia* (2003), *Journal of Cognitive Neuroscience* (2003), *Neuroimage* (2005), *Brain Research* (2006), *New York Academy of Sciences* (2007), *Group Processes and Intergroup Relations* (2008), and *Child Development* (2009). Several funding agencies have had special funding initiatives for SCN; within the U.S. these agencies include the National Institute of Mental Health, National Institute of Drug Addiction, National Institute of Aging, and the National Institute of Alcohol Abuse and Alcoholism.

Perhaps the final institutional indicators that SCN was here to stay (at least for the foreseeable future) were devoted publications, meetings, and societies. In the first few years of SCN, several of the active researchers discussed whether it was best to have our own dedicated journal or to integrate into existing outlets. At the time, only a few of us thought having our own journal was a good idea. I was a strong advocate for it, because I believed that we needed to have a home where editors, reviewers, and readers would care about both the questions and the methods and at other journals we seemed to get one but not the other (though *Neuroimage* was a notable exception). I was approached in 2004 to edit a new journal and chose to name it *Social Cognitive and Affective Neuroscience* in part because I thought SCAN was a good acronym and in part because I was afraid there would not be enough SCN manuscripts to fill its pages without linking up with the burgeoning, but journal-less, field of affective neuroscience. At the time, I had no idea that Jean Decety had agreed to start another journal, *Social Neuroscience* (and early on, I think he was unaware of our journal as well). As much as the world did not need two journals for the nascent field in 2006, 5 years later both journals are thriving and there are many more submissions than spots in the journals.

In reviewing the key papers published in the first active decade of SCN (1995–2004) I was surprised by a major geographical distinction that emerges. In Fig. 1, the geographical locations of the key findings from the first decade are plotted. The major SCN findings that emerged from Europe all focused on ways in which we make sense of other people through theory of mind, mirror neurons, or empathy (see Fig. 2). In contrast, many of the most significant findings on the American side of the pond focused on self-processes including emotion regulation, self-reference, and attitude processes. Even the treatment of fairness and social rejection in the U.S. focused on being the target of these unpleasant social transactions and how the self responds, rather than on how observers understand those experiences in others. It is difficult to resist speculating that the American obsession with the self (e.g. a self-help aisle in every bookstore) may have contributed to this disparity. Ironically, the first researchers at American universities to examine the neural bases of mirror neurons and empathy were both Europeans who had moved to the U.S. Marco Iacoboni is an Italian neuroscientist who ran the first fMRI study at UCLA identifying brain regions that responded both when performing and observing an action (Iacoboni et al., 1999). Similarly, Jean Decety, a French neuroscientist at the University of Chicago has been central to empathy research in the U.S (Lamm et al., 2007). Along the same lines, Ralph Adolphs, born in Germany, pioneered the study of the amygdala's role in responding fearful facial expressions (Adolphs et al., 1994)—research at the border of affective neuroscience and social cognition. To be fair, though, Ralph grew up in Canada and was trained in the U.S. Finally, Jason Mitchell of Harvard University was one of the first U.S. scientists to make major contributions to the neural bases of theory of mind. This is ironic because his approach to theory of mind focused on how we sometimes project from the self to make sense of others (Mitchell et al., 2005). So even when studying how we make sense of others, we Americans like to get the self into the middle of things.

Looking back, the emergence of SCN was inevitable. Eventually the social sciences and biological sciences were bound to meet up in the brain. Now more than 15 years in, SCN is continuing to grow in everyway imaginable. Anyway who was involved back in those first years, at least in the U.S., will tell you, it felt anything but inevitable. Hindsight is 20-20, but 'back in the day' it was scary. Not a single U.S. academic department was advertising to hire a social neuroscientist. Of course, fear and excitement share many similarities and those early days were at least as exciting as they were frightening.

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