

**Cognitive Sciences**  
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Cognitive science is the interdisciplinary attempt to understand mind and intelligence by combining insights from psychology, neuroscience, linguistics, artificial intelligence, and anthropology. What are the relations among the cognitive sciences such as psychology and neuroscience and the social sciences such as economics and sociology? This broad question raises many subordinate issues such as the following. What distinguishes the cognitive sciences from the social sciences? Are theories and explanations in the cognitive sciences different from those in the social sciences? Can the cognitive sciences be reduced to the social sciences, or are the social sciences methodologically independent from or even conceptually prior to the cognitive sciences? What is the relation between social entities such as companies and nations and the individual people in them? This entry will outline some of the main answers that have been given to these questions.

The term “cognitive science” was coined in the 1970s to advocate a common set of concerns and ideas that form the intersection rather than just the union of all the fields that might be called cognitive sciences. There is no analogous interdisciplinary field called “social science”, but rather a host of largely independent disciplines such as sociology, economics, political science, anthropology, and psychology. Several fields are often placed among *both* the cognitive and the social sciences, including psychology, anthropology, and linguistics. This double placement is natural for fields that are

concerned with the operations of individual minds *and* with the operations of minds in social contexts, as occurs in subfields such as social psychology, cognitive anthropology, and sociolinguistics.

Despite this overlap, there is an obvious difference in primary focus between the cognitive and social sciences, with the former concerned with the mental processes of individuals and the latter concerned with the social processes of groups such as companies and nations. Hence we can use the term *mind-group problem* for the set of issues about the relation between the cognitive and social sciences. Progress in both the cognitive and social sciences requires dealing with these issues, as is evident from recent interdisciplinary developments. For example, cultural psychology has been challenging presuppositions of individualist cognitive psychology; and behavioral and neural economics have begun to provide alternatives to traditional approaches to economic analysis.

Dealing with the mind-group problem must begin with an understanding of the nature of the theories that are used to explain cognitive and social processes. Little is to be gained by viewing theories as sets of formalized universal statements as the logical positivists advocated, because theories in both the cognitive and social sciences rarely have this kind of structure. Instead, there is growing appreciation that cognitive and social theories can be better understood as descriptions of mechanisms, which are systems of parts whose interconnections produce regular changes. From this perspective, explanations of both cognitive and social phenomena consist of describing the mechanisms – parts and interactions – that causally produce the changes that require explanation. The relevant mechanisms are not just the simple push-pull interactions of

Newtonian physics, but can involve all the complexity of biological systems including feedback relations and chaotic unpredictability. Then the mind-group problem takes on the form: What are the relations among the mental mechanisms relevant to explaining individual behavior and the social mechanisms relevant to explaining social behavior? This formulation is obviously controversial for practitioners of the cognitive and social sciences who claim that explanations of human behavior cannot be mechanistic because they need to rely on introspection of self or empathic interpretation of others.

There are several alternative views of the relation between cognitive and social mechanisms: cognitive reduction, social construction, autonomy, and interaction. Reductionism is the view that social changes can be explained in terms of psychological mechanisms, which in turn can be explained by neural mechanisms. Social constructionism, in contrast, makes social explanations fundamental on the grounds that all knowledge is socially constructed. Autonomy is the view that the cognitive and social sciences do and should operate independently from each other, so that neither psychology nor sociology, for example, needs to pay attention to ideas from the other field. I prefer the interactionist view that there are many important connections between the cognitive and social sciences that can be understood in terms of interacting mechanisms.

In order to adjudicate among these views, we need multiple examples of the kinds of mechanisms that currently appear to have the most explanatory potential at both individual and group levels. Modern approaches to cognitive science arose in the 1950s because ideas about computing provided an alternative to behaviorist explanations whose inadequacy was increasingly becoming evident. Behaviorists in psychology and

linguistics thought that explanation of the performance of humans and other animals should only concern how behavioral responses result from environmental stimuli that produce learning by reinforcement. Psychologists such as George Miller drew on new ideas about computer programs to argue that behavior could be better explained by supposing that animals from humans to rats employ mental representations and algorithmic processes that operate on the representations. This approach is clearly mechanistic: the parts are representations, the interactions are computational operations, and the behavioral changes result from applying the operations to the representations. For example, one important kind of explanation in cognitive science proposes that the most important mental representations are IF-THEN rules that can be used to solve problems by means of algorithms for selecting and applying rules in particular situations. A navigational problem can be solved by reasoning that operates with rules such as IF you want to get to Australia, THEN arrange a flight.

Many other kinds of representations have also been proposed as important to explaining human cognition, including concepts, images, and analogies. These representations also function as parts of systems for processing information via computational interactions. In the 1980s, a new approach to cognitive explanations became influential called *connectionism* or *parallel distributed processing*. Inspired in part by neural processing in the brain, connectionists view thinking as resulting from simple neuron-like processors connected by excitatory and inhibitory links. Computational models using neural networks, rules, concepts, images, and analogies have been used to simulate and thereby explain a wide range of kinds of thinking, including inference, problem solving, learning, and language use.

In the twenty-first century, by far the most striking trend in cognitive science is the increasing prominence of cognitive neuroscience, which has both experimental and theoretical sides. The experimental side has exploded because of the availability of brain scanning technologies such as functional magnetic resonance imaging (fMRI). These technologies make it possible to examine what is happening in the brain while people perform complex tasks such as solving problems. Brain scanning experiments produce vast amounts of data that need to be explained using new theories about how brains process information. The field of theoretical neuroscience develops computational models that simulate how interactions of large numbers of neurons can produce mental changes. These models are more biologically accurate than the earlier connectionist models through employment of neural networks that are closer to those in the brain with respect to firing and connection properties. Explanations of thinking employed by cognitive neuroscience are obviously mechanistic: the parts are neurons, the interactions are the electrical and chemical ways in which neurons influence each other, and the resulting changes correlate well with mental changes revealed in behavior.

These advances in cognitive neuroscience make all the more pressing the traditional philosophical issue of the relation between body and mind, which becomes the *brain-mind problem*. This problem concerns the relation between neural mechanisms and mental ones, and hence is similar to the mind-group problem concerning mental mechanisms and social ones. Connecting these together, we get the *brain-mind-group* problem, whose solution would provide answers to a host of questions concerning the cognitive and social sciences. Before approaching this extended problem, we need a

brief characterization of the kinds of social mechanisms that need to be connected with mental and neural ones.

Social scientists are must less accustomed than biologists or cognitive scientists to describe explanations in terms of mechanisms, but it is easy to view social processes as consisting of interacting parts. At the first level, the parts are persons and the interactions are all the forms of communication that occur between them. These include not just verbal conversations but also electronic messages and the full range of nonverbal communication such as the transfer of emotional information by bodily signals. The social interactions that result in social changes can take many forms, such as power relations in which some individuals use verbal or nonverbal communication to induce emotional reactions in others that make them act in ways that the powerful want. For example, a political leader can wield power over a population in many ways, such as making them fear a foreign power or convincing them that the leader is the solution to their economic problems. Hence power is a social mechanism that depends on cognitive mechanisms by which the powerful induce emotional reactions in the weak. Higher levels of social mechanisms concern group-group interactions, for example in international relations where multiple countries cooperate and compete.

If that understanding of social mechanisms is correct, we can approach the brain-mind-group problem by considering the relations among neural, psychological, and social mechanisms. There are two main reasons for rejecting the reductionist views that social phenomena are fully explainable by psychological mechanisms and that psychological phenomena are fully explainable by neural mechanisms. First, the phenomena to be explained are so complicated that it is difficult to see how a full account of them could be

given just in terms of lower level mechanisms. Consider, for example, social movements such as feminism and environmentalism. These involve the interactions of large numbers of people formed into identifiable groups that help to determine who interacts with whom. There is no obvious way to identify social entities such as groups with psychological or neural entities. Second, causal explanation does not always operate in the reductionist direction from lower mechanisms to higher phenomena, but sometimes can proceed from higher mechanisms to lower phenomena. For example, it might be a part of the explanation of why there is neural firing in dopamine pathways of a fervent environmentalist to say that he or she is happy to be interacting with other members of an activist organization. In this case the social causes the neural.

Recognition of social causation is not the imperialistic position found in some postmodernist social scientists that *all* knowledge is socially constructed, which implies that psychology and the other cognitive sciences can be ignored. Social processes undoubtedly contribute to all scientific developments, but so do psychological processes such as problem solving as well as the neural processes that enable human brains to think. Experimentation in psychology and neuroscience, not to mention physics and chemistry, is sufficiently robust that the claim that scientific knowledge is *only* socially reconstructed is hugely implausible.

Perhaps, then, we should conclude that the cognitive and social sciences are simply independent of each other and can pursue their own agendas. In the early decades of cognitive science, it was common to suppose that psychology was largely autonomous from neuroscience in that it dealt abstractly with information processes in common with computers, concerned with software functions rather than the underlying

hardware. Advances in brain scanning technologies, however, have utterly undermined this view, and since the 1990s cognitive psychology has increasingly been integrated with neuroscience. Similarly, there are growing signs of recognition of the relevance of the cognitive sciences to the social sciences, for example in the subfields of cognitive sociology and neuroeconomics. The social sciences are not so successful in their explanations and predictions that they can afford to ignore what psychology and neuroscience have to say about how people behave in social contexts. For example, the financial collapse of 2008 was inexplicable in terms of economic views of idealized individuals assumed by rational choice theories, but begins to make sense from the perspective of psychological theories of human cognitive and emotional limitations.

In the other direction, the cognitive sciences do not hesitate to draw on the social sciences for many kinds of explanatory factors that contribute to explanation of how people behave in interaction with others. There is increasing recognition that social processes are an important part of intelligence, even in computer science where the subfield of multi-agent systems looks at how artificial intelligence can be distributed across multiple interacting machines. Hence the autonomy view is implausible as an account of the primary relation between the cognitive and social sciences.

The weaknesses in the reductionist, social constructionist, and autonomy views show the need for development of a richer account of how the cognitive and social sciences can fruitfully interact. Consider, the important phenomena that involve ideological change, for example the rise of new social movements such as communism and fascism, or more recently the Tea Party and Occupy Wall Street interest groups in the United States. Such ideological developments are social phenomena observable in

rallies and demonstrations, but they are also cognitive phenomena rooted in the beliefs and attitudes of the participants in the movements.

What cognitive mechanisms are responsible for the adoption and maintenance of ideologies by individuals? Ideologies are appealing as the result of processes of emotional coherence in which people form their beliefs and attitudes in response to their goals as well as the available evidence. The main psychological mechanisms include motivated inference, in which people marshal evidence in ways that suit their goals, and fear-driven inference, in which people arrive at beliefs that scare them because anxiety causes them to focus on limited evidence for those beliefs.

These cognitive mechanisms are complemented by social mechanisms that transmit both cognitive and emotional forms of information. Here are some of the relevant mechanisms that bridge the cognitive and the social:

1. Verbal communication, in which people make statements and perform other kinds of speech acts.
2. Neural mirroring, in which observation of the experience of another person can produce the same neural activity that would be produced by having the experience oneself.
3. Emotional contagion by mimicry, in which people mimic the facial expressions of those with whom they interact, inclining them to acquire similar emotional reactions because emotions are in part responses to bodily changes.
4. Attachment-based learning, in which emotional attitudes are acquired from people such as parents to whom a person is emotionally attached.

5. Empathy, in which people acquire an emotional response from others by imagining themselves in the others' situations and experiencing emotions similar to theirs.
6. Altruism and sympathy, in which people can acquire emotional responses directed toward the well-being of others.
7. Social cuing, in which people's facial expressions such as anger can cue negative emotions such as guilt in their targets.
8. Power manipulations, in which one person gains power over others by offering them something they desire, or by offering to protect them from something that they fear.

All of these social communication mechanisms depend on underlying psychological and neural mechanisms but do not reduce to them, because their description requires reference to social processes of different people interacting with each other. Hence explaining the spread of an ideology through a population requires attention, not only to the cognitive/emotional mechanisms operating in individual brains, but also to important social events such as conversations, meetings, rallies, demonstrations, and occupations. These events provide the occasions by which the social mechanisms ranging from verbal communication to power manipulations can affect the psychological and neural mechanisms operating within individuals.

The spread of ideologies in groups exemplifies the principle that the actions of groups result from the actions of individuals who think of themselves as members of groups. On this principle, the explanation of group behaviors is:

- (a) not individualist, because groups are not reduced to mental representations;
- (b) not holistic, because the psychology of individuals is considered;

(c) emergentist, because the actions of groups are different from properties of individuals and depend on complex interactions between the individuals, including their representations of the group and each other.

The concept of emergence is a hotly contested one in the philosophy of science, but a reasonable and non-mystical version is available: emergent properties belong to the wholes, do not belong to any of the parts, and are not aggregates of properties of the parts. A social group such as a political party can have emergent properties such as coming to power that are not just aggregates of the people in the party because they depend on interactions between the members of the party and interactions between the party and other social groups. Similarly, a key aspect of a solution to the brain-mind problem is appreciation of how psychological properties such as representation, emotion, and even consciousness emerge from neural mechanisms.

In sum, the following principles describe the key relations between the cognitive and social sciences, which deal primarily with individual thinkers, and the social sciences, which deal primarily with group action. (1) The social does not reduce to the cognitive, nor the cognitive to the social. (2) Explanation of social and cognitive phenomena will all require attention to the mechanisms at both levels and to the interactions among them. (3) Social groups can have emergent properties that are neither reducible to nor independent from the psychological properties of their members, but rather emerge from them as the result of cognitive and social mechanisms. Philosophy can serve a valuable role by helping cognitive and social scientists to make the conceptual and methodological connections that should some day lead to an integrated cognitive social science.

## Further Reading

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**Cross-references:**

Analytical Sociology and Social Mechanisms

Causation in the Social Sciences

Cognitive Anthropology and Mental Architecture

Emergence and Social Collectivism

Explanation, Theories of

Mechanism and Mechanical Explanation

Neuroeconomics

Reductionism in the Social Sciences

Social Anti-Individualism and the Mental

Social Constructivism

Social Neuroscience

Sociolinguistics