Wharton A S 1992 The social construction of gender and race in organizations: A social identity and group mobilization perspective. In: Tolbert P, Bacharach S (eds.) *Research in the Sociology of Organizations*. JAI Press, Greenwich, CT, Vol. 10, pp. 55–84

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Social Neuroscience

Social neuroscience refers to the study of the relationship between neural and social processes. A fundamental assumption in the science of psychology is that neurophysiological processes underlie social and psychological phenomena. The early American psychologist William James (1890/1950) was among the first to articulate this assumption; to recognize that developmental, environmental, and sociocultural factors influence the neurophysiological processes underlying psychological and social phenomena; and to acknowledge that these influences could be studied as neurophysiological transactions. James also asserted that unnecessary diseconomies and conundrums would result if neurophysiological events were the exclusive focus of psychological investigations.

Despite this early recognition that molecular processes and mechanisms bear on molar social psychological processes and vice versa, the early identification of biology with innate mechanisms and the identification of social psychology with self-report data contributed to an antipathy that endured long after each field became more sophisticated. Accordingly, neuroscientific analyses tended to be limited to behavioral phenomena occurring within an organism (e.g., attention, learning, memory), whereas social psychological analyses traditionally eschewed biological data in favor of self-report and behavioral data.

As neuroscientific approaches were applied to the study of diseases and to elementary cognitive and behavioral processes, subtler medical and behavioral phenomena succumbed to neuroscientific inquiry. The 1990s were declared by the US Congress to be the 'decade of the brain,' reflecting the interest in and importance of the neurosciences in theory of and research on cognition, emotion, behavior, and health.

1. *Doctrine of Multilevel Analyses*

The decade of the brain has led to a realization that a comprehensive understanding of the brain cannot be achieved by a focus on neural mechanisms alone. The brain, the organ of the mind, is a fundamental but interacting component of a developing, aging individual who is a mere actor in the larger theater of life. This theater is undeniably social, beginning with prenatal care, caregiver–infant attachment, and early childhood experiences and ending with feelings of loneliness or embeddedness and with familial or societal decisions about care for the elderly. Mental disorders such as depression, anxiety, schizophrenia, and phobia are both determined by and are determinants of social processes; and disorders such as substance abuse, prejudice and stigmatization, family discord, worker dissatisfaction and productivity, and the spread of acquired immunodeficiency syndrome are quintessentially social as well as neurophysiological processes.

Indeed, humans are such social animals that a basic 'need to belong' has been posited (Baumeister and Leary 1995, Gardner et al. in press). People form associations and connections with others from the moment they are born. The very survival of newborns depends on their attachment to and nurturance by others over an extended period of time. Accordingly, evolution has sculpted the human genome to be sensitive to and succoring of contact and relationships with others. For instance, caregiving and attachment have hormonal (Uvnas-Mosberg 1997) and neurophysiological substrates (Carter et al. 1997). Communication, the bedrock of complex social interaction, is universal and ubiquitous in humans. In the rare instances in which human language is not modeled or taught, language develops nevertheless (Goldin-Meadow and Mylander 1983, 1984).

The reciprocal influences between social and biological levels of organization do not stop at infancy. Affiliation and nurturant social relationships, for instance, are essential for physical and psychological well-being across the lifespan. Disruptions of social connections, whether through ridicule, separation, divorce, or bereavement, are among the most stressful events people must endure (Gardner et al., 2000). Berkman and Syme (1979) operationalized social connections as marriage, contacts with friends and extended family members, church membership, and other group affiliations. They found that adults with fewer social connections suffered higher rates of mortality over the succeeding nine years even after accounting for self-reports of physical health, socioeconomic status, smoking, alcohol consumption, obesity, race, life satisfaction, physical activity, and preventive health service usage. House et al. (1982) replicated these findings using physical examinations to assess health status. In their review of five prospective studies, House et al. (1988) concluded that social isolation was a major risk factor for morbidity and mortality from widely varying causes. This relationship was evident even after statistically controlling for known biological risk factors, social status, and baseline measures of health. The negative health consequences of social isolation were particularly strong among some of the fastest growing segments of

the population: the elderly, the poor, and minorities such as African Americans. Astonishingly, the strength of social isolation as a risk factor was found to be comparable to high blood pressure, obesity, and sedentary lifestyles.

Social isolation and loneliness are associated with poorer mental as well as physical well-being (e.g., Ernst and Cacioppo 1999, Gupta and Korte 1994, Perkins 1991). People who report having contact with five or more intimate friends in the prior six months are 60 percent more likely to report that their lives are 'very happy,' as compared to those who do not report such contact (Burt 1986). People appear to be cognizant of the importance of social relationships. When asked 'what is necessary for happiness?' most rated relationships with friends and family as being the most important factor (Berscheid 1985).

Initially, studies of the neural structures and processes associated with psychological and social events were limited to animal models, post-mortem examinations, multiple determined peripheral assessments, and observations of the occasional unfortunate individual who suffered trauma to or disorders of localized areas of the brain. Developments in electrophysiological recording, functional brain imaging, neurochemical techniques, neuroimmunologic measures, and ambulatory recording procedures have increasingly made it possible to investigate the role of neural systems and processes in intact humans. These developments fostered multilevel integrative analyses of the relationship between neural and social processes. Cacioppo and Berntson (1992) coined the term social neuroscience and outlined several principles for spanning molar and molecular levels of organization.

1.1 The Principle of Multiple Determinism

The principle of multiple determinism specifies that a target event at one level of organization, but particularly at molar (e.g., social) levels of organization, may have multiple antecedents within or across levels of organization. For example, consider the multiple factors that contribute to drug abuse. On the biological level, researchers identified the contribution of individual differences in the susceptibility of the endogenous opiod receptor system while on the social level investigators have noted the important role of social context. Both operate, and our understanding of drug abuse is incomplete if either perspective is excluded. A corollary to this principle is that the mapping between elements across levels of organization becomes more complex (e.g., many-to-many) as the number of intervening levels of organization increases. One implication is that the likelihood of complex and potentially obscure mappings increases as one skips levels of organizations.

1.2 The Principle of Nonadditive Determinism

The principle of nonadditive determinism specifies that properties of the whole are not always readily predictable from the properties of the parts. Consider an illustrative study by Haber and Barchas (1983), who investigated the effects of amphetamine on primate behavior. The behavior of nonhuman primates was examined following the administration of amphetamine or placebo. No clear pattern emerged between the drug and placebo conditions until each primate's position in the social hierarchy was considered. When this social factor was taken into account, amphetamines were found to increase dominant behavior in primates high in the social hierarchy and to increase submissive behavior in primates low in the social hierarchy. The importance of this study derives from its demonstration of how the effects of physiological changes on social behavior can appear unreliable until the analysis is extended across levels of organization. A strictly physiological (or social) analysis, regardless of the sophistication of the measurement technology, may not have unraveled the orderly relationship that existed.

1.3 The Principle of Reciprocal Determinism

The principle of reciprocal determinism specifies that there can be mutual influences between microscopic (e.g., biological) and macroscopic (e.g., social) factors in determining behavior. For example, not only has the level of testosterone in nonhuman male primates been shown to promote sexual behavior, but the availability of receptive females influences the level of testosterone in nonhuman primates (Bernstein et al. 1983, Rose et al. 1972). Within social psychology, Zillmann (1994) has demonstrated that exposure to violent and erotic materials influences the level of physiological arousal in males, and that the level of physiological arousal has a reciprocal influence on the perceptions of and tendencies toward sex and aggression. Accordingly, comprehensive accounts of these behaviors cannot be achieved if either biological or social levels of organization are considered unnecessary or irrelevant.

2. Insights Fostered by Multilevel Analyses

Recent research has provided growing evidence that multilevel analyses spanning neural and social perspectives can foster more comprehensive accounts of cognition, emotion, behavior, and health (e.g., Anderson 1998).

First, important inroads to the logic of social processes have emerged from theory and research in

the neurosciences (e.g., brain organization and localization of function, genetic determinants of behavior). Research in the neurosciences, for instance, has revealed that early ideas about memory, in which knowledge and skills were thought to be served by the same underlying mechanism, are incorrect. Instead, separable neural systems underlie the memory of people, episodes and ideas (declarative, episodic memory), and the memory of procedures, interactions, or skills (procedural, implicit memory).

Similarly, research in the neurosciences has influenced what are thought to be the processes underlying social attitudes and decisions. Mechanisms for differentiating hostile from hospitable environmental stimuli are imperative for the survival of species and for the formation and maintenance of social units. The human brain and body therefore can be conceptualized as being shaped by natural selection to calculate utility and to respond accordingly. Evaluative decisions and responses are so critical that organisms have rudimentary reflexes for categorizing and approaching or withdrawing from certain classes of stimuli, and for providing metabolic support for these actions (Lang et al. 1990). A remarkable feature of humans is the extent to which the evaluation of utility is shaped by learning and cognition.

The processes subserving the evaluation of hostile and hospitable events are also physiological processes and cannot be understood fully without considering the structural and functional aspects of the physical substrates. Noninvasive investigations of the physiological operations associated with evaluative processes provide an important window through which to view these processes without perturbing them. For instance, the neural circuitry involved in computing the utility of a stimulus (i.e., evaluative processing) diverges from the circuitry involved in identification and discrimination (i.e., nonevaluative processing). Furthermore, evaluative discriminations by humans (e.g., attitudes) have traditionally been conceptualized as being bipolar (hostile–hospitable) and have been measured using bipolar scales to gauge the net affective predisposition toward a stimulus. Such an approach treats positive and negative evaluative processes (and the resulting affective states and judgments of utility) as equivalent directions on a single scale, reciprocally activated, and interchangeable in the sense that increasing one is equivalent to decreasing the other. Physical constraints may restrict behavioral manifestations of utility calculations to bivalent actions (approach–withdrawal), but research in the behavioral and social neurosciences now suggests that approach and withdrawal are behavioral manifestations that come from distinguishable motivational substrates. This work has led to evolutionary models of affect and emotion in which a stimulus may vary in terms of the strength of positive evaluative activation (i.e., positivity) and the strength of negative evaluative activation (i.e., negativity) it evokes. Furthermore, the underlying positive and negative evaluative processes are distinguishable, are characterized by distinct activation functions, and have distinguishable antecedents (Cacioppo and Berntson 1994).

Second, the study of social processes has challenged existing theories in the neurosciences, resulting in refinements, extensions, or complete revolutions in neuroscientific theory and research. Classically, immune functions were considered to reflect specific and nonspecific physiological responses to pathogens or tissue damage. It is now clear that immune responses are heavily influenced by central nervous processes that are affected by social interactions and processes. For instance, the effects of social context now appear to be among the most powerful determinants of the expression of immune reactions (Glaser and Kiecolt-Glaser 1994). It is clear that an understanding of immunocompetence will be inadequate in the absence of considerations of psychosocial factors. Research on these interactions was activated by investigations demonstrating the direct and moderating effects of psychosocial factors (e.g., conditioned stimuli, bereavement, social support, major life events) on immune competence (Kiecolt-Glaser et al. 1984). Thus, major advances in the neurosciences can derive from increasing the scope of the analysis to include the contributions of social factors and processes.

Third, the social environment shapes neural structures and processes and vice versa. Meaney and colleagues (Liu et al. 1997, Meaney et al. 1993), for instance, have found that experimental manipulations of maternal care influence the development of individual differences in neuroendocrine responses to stress in rats. As adults, the offspring of mothers that exhibited more licking and grooming of pups during the first ten days of life were also characterized by reduced adrenocorticotropic hormone and corticosterone responses to acute stress. As mothers, these rats also tended to lick and groom their pups.

Finally, deciphering the structure and function of the brain is fostered by sophisticated social psychological theories in which the elementary operations underlying complex social behaviors are explicated, and by experimental paradigms that allow these social psychological operations to be studied in isolation using neuroscientific methods. Brain imaging studies of the neural bases of emotion have contrasted positive and negative emotions based on the assumption that these emotions are served by the same neural structures. Research and theory in the social and behavioral sciences now suggests that the processes underlying positive and negative emotions are separable, and paradigms for eliciting positive and negative emotions have been developed. Accordingly, recent brain imaging studies in which positive and neutral emotions are contrasted, and negative and neutral emotions are contrasted, have revealed the activation of distinguishable neural structures during positive and negative emotions.

In sum, social neuroscience is an interdisciplinary field that is helping to illuminate questions ranging from the social sciences to the neurosciences by examining how organismic processes are shaped, modulated, and modified by social factors and vice versa.

See also: Behavioral Neuroscience; Comparative Neuroscience; Psychophysiology

Bibliography

Anderson N B 1998 Levels of analysis in health science. A framework for integrating sociobehavioral and biomedical research. *Annals of the New York Academy of Sciences* **840**: 563–76

Baumeister R F, Leary M R 1995 The need to belong: Desire for interpersonal attachment as a fundamental human motivation. *Psychological Bulletin* **117**: 497–529

Berkman L F, Syme S L 1979 Social networks, host resistance, and mortality: A nine-year follow-up study of Alameda County residents. *American Journal of Epidemiology* **109**: 186–204

Bernstein I S, Gordon T P, Rose R M 1983 The interaction of hormones, behavior, and social context in nonhuman primates. In: Svare B B (ed.) *Hormones and Aggressive Behavior*. Plenum Press, New York pp. 535–61

Berscheid E 1985 Interpersonal attraction. In: Lindzey G, Aronson E (eds.) *The Handbook of Social Psychology*. Random House, New York

Burt R S 1986 Strangers, friends, and happiness. *GSS Technical Report* **72**: National Opinion Research Center, University of Chicago, Chicago

Cacioppo J T, Berntson G G 1992 Social psychological contributions to the decade of the brain: The doctrine of multilevel analysis. *American Psychologist* **47**: 1019–28

Cacioppo J T, Berntson G G 1994 Relationship between attitudes and evaluative space: A critical review, with emphasis on the separability of positive and negative substrates. *Psychological Bulletin* **115**: 401–23

Carter C S, Lederhendler I I, Kirkpatrick B 1997 *The Integrative Neurobiology of Affiliation*. New York Academy of Sciences, New York

Ernst J M, Cacioppo J T 1999 Lonely hearts: Psychological perspectives on loneliness. *Applied and Preventive Psychology* **8**: 1–22

Gardner W L, Gabriel S, Diekman A B 2000 Interpersonal processes. In: Cacioppo J T, Tassinary L G, Berntson G G (eds.) *Handbook of Psychophysiology*, 2nd edn, Cambridge University Press, New York, pp. 643–64

George M S, Ketter T A, Parekh P I, Horwitz B, Herscovitch P, Post R M 1995 Brain activity during transient sadness and happiness in healthy women. *American Journal of Psychiatry* **152**: 341–51

Glaser R, Kiecolt-Glaser J K 1994 *Handbook of Human Stress and Immunity*. Academic Press, San Diego, CA

Goldin-Meadow S, Mylander C 1983 Gestural communication in deaf children: Noneffect of parental input on language development. *Science* **221**: 372–4

Goldin-Meadow S, Mylander C 1984 Gestural communication in deaf children: The effects and noneffects of parental input on early language development. *Monographs of the Society for Research in Child Development* **49**: 1–121

Gupta V, Korte C 1994 The effects of a confidant and a peer group on the well-being of single elders. *International Journal of Aging and Human Development* **39**: 293–302

Haber S N, Barchas P R 1983 The regulatory effect of social rank on behavior after amphetamine administration. In: Barchas P R (ed.) *Social Hierarchies: Essays Toward a Sociophysiological Perspective*. Greenwood Press, Westport, CT, pp. 119–32

House J S, Landis K R, Umberson D 1988 Social relationships and health. *Science* **241**: 540–5

House J S, Robbins C, Metzner H L 1982 The association of social relationships and activities with mortality: Prospective evidence from the Tecumseh Community Health Study. *American Journal of Epidemiology* **116**: 123–40

James W 1890/1950 *Principles of Psychology*. Dover, New York

Kiecolt-Glaser J K, Garner W, Speicher C E, Penn G, Glaser R 1984 Psychosocial modifiers of immunocompetence in medical students. *Psychosomatic Medicine* **46**: 7–14

Lang P J, Bradley M M, Cuthbert B N 1990 Emotion, attention, and the startle reflex. *Psychological Review* **97**: 377–95

Liu D, Diorio J, Tannenbaum B, Caldji C, Francis D, Freedman A, Sharma S, Pearson D, Plotsky P M, Meaney M J 1997 Maternal care, hippocampal glucocorticoid receptors, and hypothalamic-pituitary-adrenal responses to stress. *Science* **277**: 1659–62

Meaney M J, Bhatnagar S, Diorio J, Larocque S, Francis D, O'Donnell D, Shanks N, Sharma S, Smythe J, Viau V 1993 Molecular basis for the development of individual differences in the hypothalamic pituitary adrenal stress response. *Cellular and Molecular Neurobiology* **13**: 321–47

Perkins H W 1991 Religious commitment, 'Yuppie' values, and well-being in post collegiate life. *Review of Religious Research* **32**: 244–51

Rose R M, Bernstein I S, Gordon T P 1972 Plasma testosterone levels in the male rhesus: Influences of sexual and social stimuli. *Science* **178**: 643–5

Uvnas-Mosberg K 1997 Physiological and endocrine effects of social contact. *Annals of the New York Academy of Sciences* **807**: 146–63

Zillmann D 1994 Cognition-excitation interdependencies in the escalation of anger and angry aggression. In: Potegal M, Knutson J F et al. (eds.) *The Dynamics of Aggression: Biological and Social Processes in Dyads and Groups*. Erlbaum, Hillsdale, NJ, pp. 45–71

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Social Properties (Facts and Entities): Philosophical Aspects

One area of philosophical concern, dating from the very beginning of philosophy itself, is ontology: what is there?; or, what kinds of things are there? Many questions about existence are straightforwardly em-

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