From Attachment to Groups: Tapping Into the Neurobiology of Our Interconnectedness

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> In a real sense all life is inter-related. All persons are caught in an inescapable network of mutuality, tied in a single garment of destiny. Whatever affects one directly affects all indirectly. I can never be what I ought to be until you are what you ought to be, and you can never be what you ought to be until I am what I ought to be. This is the inter-related structure of reality.
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> —Martin Luther King, Jr. (1963)

INTERCONNECTIVITY AS A CORNERSTONE OF THE HUMAN EXPERIENCE

Bonds are a cornerstone of the human experience. People are fundamentally social creatures, highly motivated to be with others and to create affiliations.[1] The growing magnitude and significance of Web-based social groups and social media are providing novel avenues for human interconnections. Interconnections are also a fundamental feature of the brain's structure and function. In the brain, with its 100 billion (10^{11}) neurons and 100 trillion (10^{14}) synapses, "ceaseless activities of groups of neurons are choreographed into waves, oscillations, synchronized rhythms, and transient coalitions" (Christof Koch, professor of Computation and Neural Systems, California Institute of Technology, http://mitpress.mit.edu/books/dynamic-coordination-brain). Advances in brain imaging analytical techniques are highlighting interconnectedness within the brain; connectivity analysis and the default mode network are methodologies that emphasize how functional networks in the brain might be relating to each other. Neuroscientists also are examining neurophysiologic systems during interactive states to better identify and accurately describe networks that activate in naturalistic shared settings.[2]

Considering how shared experiences and interconnectivity are inherent to the human experience and neurophysiology, it is surprising how little research has tapped into the neurophysiologic basis of group experiences throughout the life span, beyond individual experience or dyadic and, more rarely, triadic interactions. We are born into groups and "join" others very early in life. Groups are a hugely important part of how we function in society. From kindergarten to the classroom and onto professional organizations in adulthood, groups are the mechanism by which we take care of each other, work and play, create and destroy. They teach us what to feel and often when to feel. From groups we learn about our own identity and our beliefs about others. One can argue that individual beliefs and motivations are often internalizations of group norms. Cultural transmission, a critical aspect of human existence and survival, is accomplished through membership in groups. Social psychology teaches us that the group formation process is so basic that a sense of connectedness among group members happens very swiftly, creating a sense of security and belonging and shaping perception, behavior, identity, and beliefs.[3,4] We suggest that these shared group processes also have distinct neurophysiologic underpinnings that have not been comprehensively studied.

We propose that a group is a set of interacting individuals with interdependent relationships and a shared task or goal that engages group members over time. Group processes are ways in which these sets of interacting individuals address the issues that arise when tackling a shared task. These processes can be explicit and conscious (Who will lead? How will we decide? How will we manage speaking and listening?) or implicit and unconscious (How do we handle the discomfort of conflict? Will I be rejected?

How much individuality will be surrendered in this?). Just as neuroscientists strive to study more realistic interactions, we should strive to study naturally occurring group processes in real time.

It is vital to study shared processes beyond the individual or dyad, not simply because it has not been done much, but because group processes are powerful. Groups can define us, but perhaps even more importantly the explicit participation in shared group discussion and action has the potential to bring about change. Evolutionary psychobiology teaches us that interconnections and the level of involvement in groups are literally associated with the sizes of our brains.[5] Research in animals is continuously proving that participation in groups goes beyond basic senses to involve an animal's genetic makeup, neuroanatomy, and neurophysiology (wonderful examples come from studies of schooling in fish,[6] swarming in desert locusts,[7] and the social behavior of pods of dolphins[8]). Considering the powerful nature of group processes, we are suggesting there is a need to explicitly increase the attention given to studying shared processes and to improve our description of shared experience as we begin to examine its physiologic underpinnings. In a keynote address at the 2009 Meeting of the Society for Research on Child Development, Jerome Kagan, a pioneer of developmental psychology and temperament research, gave advice to young researchers, suggesting they start out by meticulously observing and describing variance in naturally occurring behavioral phenomena. Only then should they delve into studying the neurophysiologic basis of phenotypes. If the starting point should be a naturally occurring behavioral phenomenon, one that is especially meaningful at a group level, one fascinating area of study will focus on scapegoating.

Scapegoating is a shared experience within a group. It occurs when a shared group issue (concern, anxiety, fear) is allocated to an individual as if the shared issue were the sole responsibility of that single individual. Scapegoating is also interesting because it involves issues of affiliation and distancing (between members of the group and the scapegoated individual) and belonging and rejection at the same time. Biblically, scapegoating was an explicit ritualistic act meant to resolve a group experience of guilt. However, when it occurs in groups, it is almost always done without conscious awareness or acknowledgement of any shared responsibility. In fact, the act of bringing these processes into awareness is an opportunity to address, more effectively, shared group issues and concerns. In the case of unconscious scapegoating, describing an underlying neurophysiologic activity across group members would be fascinating. It may help us illustrate the fact that scapegoating resides in the shared consciousness of a group rather than in the apparently unique characteristics of the scapegoat.

NEUROPHYSIOLOGY OF SHARED STATES

Clearly, there are methodologic limits when attempting to tap simultaneously into the neurophysiology of more than a single individual. It is challenging to conduct simultaneous brain imaging studies on multiple individuals during real-life interactions. We suggest that the challenge is not only methodologic but also psychological. Documenting and acknowledging the power of group processes can pose a challenge to our sense of individualism and autonomy. Yet these challenges (psychological and methodologic) are also opportunities to bring meaning into an overly reductionist point of view of shared phenomena and a chance to bring the bench and the bedside closer together. Advances in measuring real-time behavior in concurrence with online neurophysiologic activity (whether it be autonomic activity or the peripheral concentration of biomarkers) provides an opportunity to come up with more advanced paradigms that are tailor-made for group processes. Some inspiring examples from research that is delving into the neurophysiology of interconnection are described below.

Brain imaging studies are showing that interconnectedness is not just a feature within one brain, but exists across brains. When we listen to music, it appears that there are many similarities in brain activation across individuals, although the personal listening experience is idiosyncratic.[9] Similarly, when we watch movies, there are certain brain networks that have a high degree of synchronization between individuals, a tendency of individual brains to "tick collectively," especially during scenes that are highly emotional or surprising.[10] A unique example of tapping into the physiology of interconnectedness arises from the developmental neuroscience literature and the concept of behavioral synchrony. In synchrony, 2 or 3 individuals (usually described

in a parent–infant dyad) are behaviorally coordinated with each other, with these individuals displaying positive affect, gazing at each other, and smiling concurrently and contingently. In extremely synchronous moments during a face-to-face interaction, there is increased physiologic synchrony between mothers and their infants so that they share virtually identical heart rhythms within lags shorter than 1 second. Researchers have concluded that "humans, like other mammals, can impact the physiological processes of the attachment partner through the coordination of visuo-affective social signals."[11]

Overall, studies of the neurophysiology of attachment-related processes teach us that there are certain brain circuits, genes, and biomarkers dedicated to affiliative processes. The neuropeptide oxytocin exemplifies how a biomarker can be used for studying interconnections. Oxytocin has received considerable attention for its involvement in early parent–infant bonds and in subsequent attachment relationships, such as friendship and romantic partnership. Soon after fathers received a dose of oxytocin, there was a significant increase in their infants' oxytocin levels, although the infants had not received the hormone directly or even been in the room when their fathers received the oxytocin.[12] It also has been documented that circulating oxytocin in romantic partners and in cohabitating new parents are positively related.[13] This phenomenon, if it can be determined in groups, may provide a window into how our physiology represents shared states.

From a developmental point of view, there is a great need to consider the developmental stage when we aim to explore the neurophysiology of group processes. Adolescence would seem to be an especially meaningful period for research on shared group processes and their impact on individuals. It is during this period that youth move away from their initial attachment bonds and toward individuated identities as part of peer groups. Understanding how this group-mediated life stage unfolds in the brain may help us understand our children better as they strive to balance acceptance and rejection and individuality and group membership. &

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