Social Baseline Theory: The Role of Social Proximity in Emotion and Economy of Action

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Abstract

Social proximity and interaction attenuate cardiovascular arousal, facilitate the development of nonanxious temperament, inhibit the release of stress hormones, reduce threat-related neural activation, and generally promote health and longevity. Conversely, social subordination, rejection and isolation are powerful sources of stress and compromised health. Drawing on the biological principle of economy of action, perception/action links, and the brain's propensity to act as a Bayesian predictor, Social Baseline Theory (SBT) proposes that the primary ecology to which human beings are adapted is one that is rich with other humans. Moreover, SBT suggests that the presence of other people helps individuals to conserve important and often metabolically costly somatic and neural resources through the social regulation of emotion.

To survive, grow, and reproduce, all organisms must take in more energy than they expend, a principle of biological systems called *economy of action*[1] (cf. Proffitt, 2006). We think this principle underlies the many benefits humans derive from the social networks they inhabit—that adaptations promoting social interaction and proximity have arisen partly as a function of the energy benefits social relationships confer to individuals. This perspective underlies a framework for understanding how humans utilize social resources that we call Social Baseline Theory (SBT). Below, we describe the sense in which SBT refers to social proximity as a 'baseline' condition, ground our perspective in the principle of economy of action, and review evidence that social relationships serve the energy saving functions that we claim. Afterward, we explore similarities and differences between SBT and Attachment Theory, and highlight the importance of emotion as a source of information about current and predicted resources. Although we review a large and diverse literature in support of SBT, we emphasize that some of the specific ideas discussed below are speculative and remain to be tested.

Our Social Baseline

There is no terrestrial environment to which humans are specifically adapted. Humans exist almost everywhere on the Earth, and have even walked on the moon. Moreover, virtually every measure of health and well-being is improved by access to close social relationships and rich social networks (e.g., Beals, Peplau, & Gable, 2009; Cohen & Janicki-Deverts, 2009; Gallagher & Vella-Brodick, 2008; Holt-Lunstad, Smith, & Layton, 2010; Simpson, Rholes, Campbell, Tran, & Wilson, 2003). These facts suggest that the dominant ecology to which humans are adapted is other humans (Berscheid, 2003; Brewer & Caporael, 1990), and introduces the first sense in which our theory refers to the social *baseline*—that close proximity to social resources is the baseline assumption of the human brain. In our view, the human brain is designed to *assume* that it is embedded

within a relatively predictable social network characterized by familiarity, joint attention, shared goals, and interdependence.

The other sense in which we use the term 'baseline' is grounded in neuroscientific investigations of social support. In our own work (e.g., Coan, Schaefer, & Davidson, 2006), and in the work of others (e.g., Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007), positive associations between neural activity and social support have been difficult to identify, even in regions where one might expect emotion–regulation effects to be mediated, such as the prefrontal cortex, (e.g., Drabant, McRae, Manuck, Hariri, & Gross, 2009). Neural circuits associated with the self-regulation of emotion (e.g., the dorsolateral prefrontal cortex (dlPFC)) are not *more* active when social support is provided, but less so. This presents something of a puzzle. How is the down regulation of negative affect being accomplished if (i) the structures typically involved in regulating emotion are actually *less* active when social support is provided, and (ii) few (or no) other potentially inhibitory structures appear to be more active when social support is provided? Some have suggested a role for the neuropeptide oxytocin (Carter, 2006; Coan, 2008), others have proposed the involvement of endogenous opioids (Eisenberger et al., 2007; Panksepp, 1998), or more tonic changes to various neurotransmitter fiber systems within the ACC and MPFC (Eisenberger et al., 2007). Still others have suggested that dopaminergic systems underlying reward sensitivity may mediate social support effects (Younger, Aron, Parke, Chatterjee, & Mackey, 2010). Although all of these possibilities are plausible, none of them are established neural mediators of social support.

In any case, these observations have led us to suspect that social proximity and interaction might not regulate emotion by activating regulatory processes intra–individually (Gross & Thompson, 2007), but signal instead a return to—or maintenance of—a baseline state of relative calm. This is congruent with our first use of 'baseline' above, which is that human brains assume proximity to their predictable social environments. When proximity is maintained or reestablished, the brain is simply less vigilant for potential threats, because it is embedded within the social environment to which it is adapted. This baseline state requires less emotional activation and commensurably less self-regulatory inhibition. From this perspective, no self-regulation of emotion regulation is actually required. Indeed, this raises the question of whether what we call 'the social regulation of emotion' constitutes emotion regulation at all (James Gross, pers. comm., October, 2010). From the perspective of self-regulation, the view of socially mediated emotion regulation discussed below bears greatest resemblance to *situation selection* as described by Gross and Thompson (2007), in which individuals act to promote emotionally desirable situations. The difference, in our view, is that social proximity represents an innate, prepared, default or *baseline* strategy for human emotion regulation—one that does not require (or exclude) overt or deliberate action.

What follows is a review of the literature that grounds our perspective in observations of human and nonhuman animal social and emotional behavior, as well as basic research on the management of metabolic resources and the efficiency of coping with external stressors. First, we elaborate our discussion of economy of action in order to acquaint the reader with the optimization of metabolic resources in biological systems, examples of which are ubiquitous throughout the animal kingdom. Second, we review evidence that social proximity results in decreased metabolic cost, especially in the aggregate. Next, we frame the brain's attempt to predict the costs and benefits of social proximity in Bayesian terms, describing how the brain utilizes internal and external information to make bets about how many resources to deploy in light of expected returns. Finally, we address remaining questions of SBT in relation to attachment theory and the social regulation of emotion.

Social Relationships Save Energy

To achieve a net energy gain, organisms must carefully manage energy expenditures, including bodily and neural activities. Proffitt (2006) suggests that the brain modifies sensory perception in ways that bias decision-making to manage energy use efficiently. For example, wearing a heavy backpack makes distances seem further away and uphill inclines seem steeper (Stefanucci, Proffitt, Banton, & Epstein, 2005). Thus, the brain discourages unnecessary and inefficient use of metabolic resources by making predictions about whether and to what extent personal resources should be deployed given the likely costs and benefits of a given action.

Numerous studies suggest that many animals are similarly sensitive to energy expenditure and procurement in their daily behaviors (Cuthill & Kacelnik, 1990; Krebs & Davies, 1993). Indeed, the behavior of animals during foraging and similar activities is often highly efficient with regard to the ratio of energy consumed to energy expended. For example, to consume whelks (a type of snail), northwestern crows must first break the whelk's hard shells by carrying them to a height only just above that which will cause the shells to shatter when dropped (Zach, 1979). Somehow, the crows are able to calculate this distance, minimizing energy use and maximizing procurement in foraging behavior (O'brien, Burger, & Dawson, 2005). As a general principle, the efficient management of energy resources allows animals to maximize their chances for growth, survival, and reproduction.

With all of the above in mind, it is possible to view social proximity, contact, and interaction as energy saving mechanisms for humans. According to SBT, being alone is, on average and in the aggregate, more effortful, because it renders a variety of activities more costly. In this way, being alone is similar to toting one of Proffitt's (e.g., 2006) heavy backpacks—it increases both the real and perceived costs of a host of activities. This is true even at the level of estimating the slant of a hill. In recent work by Schnall, Harber, Stefanucci, & Proffitt (2008), hill slants were judged as less steep when participants stood next to a friend. Moreover, this effect was moderated by the duration of the friendship—the longer the friendship, the less steep the hill. This all suggests that social proximity and interaction decrease the cost of responding to environmental demands. SBT proposes at least two ways in which social proximity is hypothesized to decrease costs related to engaging with the environment: *risk distribution* and *load sharing*.

Risk distribution

Risk distribution refers to the statistical distribution of environmental risks across individuals within a group. Even though group living can be costly in terms of resource competition, overall fitness is enhanced in groups by decreasing the risk of predation, injury, and other potential threats (Krebs & Davies, 1993). Social animals in particular adjust their own level of effort as a function of the distribution of risk across the groups they inhabit (Pinshow, Fedak, Battles, & Schmidt-Nielsen, 1976). For example, during foraging, threat vigilance constitutes an additional, parallel task—and an additional processing load—that decreases the efficiency of foraging behavior. As group size increases, however, vigilance processing decreases, because having more eyes and ears reduces the vigilance demands on any given individual (Roberts, 1996). Note that larger groups are not universally better, because at some point the group becomes too large to sustain available resources. Thus, social groups typically settle into sizes that optimize access to food against the distribution of risk across group members. Importantly, risk distribution does

not imply familiarity or relational partnerships. It is simply a numbers game, where group size changes risk exposure relative to resource acquisition.

Load sharing

Proximity to a familiar conspecific, however, has more profound benefits than those associated with simple risk distribution, especially when that familiar conspecific is a relational partner (romantic partner, family member, etc.). This is because energy conservation is no longer only a function of risk distribution, but also of trust and interdependence. In humans especially, degrees of familiarity frequently covary with degrees of interdependence, and interdependent others will often engage in behaviors that have significant benefits to one's well-being. For example, a relational partner can be counted on to share goals and care for young (e.g., Ehrenberg, Gearing-Small, Hunter, & Small, 2001), assist when ill or injured (e.g., Townsend & Franks, 1995), share resources (e.g., Roger & De Boer, 2001), and contribute vigilance for potential threats (Davis, 2010).

According to SBT, as an individual becomes accustomed to load sharing, his social system becomes an extension of the way his brain interacts with the world. This may be particularly true of his ability to regulate emotion, because self-regulation capabilities are mediated through the PFC, and the PFC may be a strong target of the resource conservation benefits that social relationships provide. In humans, executive functions such as self-regulation, effortful decision-making, and other forms of effortful control, may only be sustainable for limited periods of time, depending on a finite resource that can be depleted (e.g., Baumeister & Vohs, 2007). This has led to the suggestion that the PFC is energetically 'expensive' (Gailliot & Baumeister, 2007; although see Job, Dweck, & Walton, 2010; Kurzban, 2010; Raichle & Mintum, 2006). Indeed, effortful control may be a relative luxury in evolutionary terms—one that potentiates survival, growth, and reproduction, but also one that is not as critical as perceptual, motor, and autonomic processes, especially when environmental demands are urgent or life threatening. Physical exertion, for example, produces a consistent pattern of increased activity in circuits supporting perception, autonomic activity, and motor coordination that is proportional to decreases in prefrontal activity (Dietrich & Audiffren, 2011).

Social proximity can offset much of the costs associated with the PFC. For example, individuals who have recently entered a romantic relationship may come to rely less on their own prefrontal activity to regulate their behavior, because they will begin to perceive the environment as less threatening, dangerous, and difficult to cope with and because their partner will engage in behavior (e.g., supportive hand holding) that will help them achieve regulatory effects without having to regulate themselves. Put simply, individuals in close relationships experience fewer demands on their own neural resources when solving problems, sustaining vigilance for potential threats, and regulating emotional responses. A growing body of research suggests these and many other processes are indeed distributed across socially interacting brains as people outsource to, or share various tasks with, other individuals (cf. Hutchins, 1991; Woolley, Chabris, Pentland, Hashmi, & Malone, 2010; Fitzsimons & Finkel, 2011). By contrast, social isolation, especially sudden changes, such as the withdrawal of a romantic partner, can signal a sudden increase in the need to recruit personal resources, and the perceived cost of coping with those situational demands. The result is often an overall *decrease* in emotion regulation capabilities (cf. Diamond, Hicks, & Otter-Henderson, 2008; Sbarra, 2006; Sbarra & Nietert, 2009), because, as reviewed above, emotion regulation processing in the PFC may only be sustainable for limited periods of time.

Coan et al. (2006) have demonstrated the need for increased levels of threat responding as a function of distance from relational partners. In their study, women were confronted with the threat of shock while either alone, holding a stranger's hand, or holding their partner's hand. Women in the highest quality relationships showed the least threat-related brain activity. In women with lower quality relationships, threat-related activity increased in the right anterior insula, superior frontal gyrus, and hypothalamus, regions associated with threat salience and the release of stress hormones. When comforted by a stranger, threat-related activity increased further, including all previously noted circuits in addition to the superior colliculus, right dorsolateral PFC, caudate and nucleus accumbens. This suggests additional vigilance and self-regulation efforts were recruited. Finally, when facing the threat of shock alone, all preceding activations were observed in addition to increased activity in the ventral ACC, posterior cingulate, supramarginal gyrus, and postcentral gyrus.

These observations suggest that the brain's response to threat cues is minimized when a high quality relational partner is available, more effortful when accompanied by a stranger, and most effortful when alone. Note that even though the stranger was not as effective as spouses at regulating the threat response, they were still effective relative to having the participants face the threat alone. Thus, even minimal proximity to social resources confers some regulatory advantages, possibly due to the brain's ability to adjust its expectations of personal cost as a function of risk distribution. When alone, the brain typically perceives threats as more threatening, precisely because it is necessary to mobilize more personal resources in coping with the threat.

Although the mechanisms responsible for modulating the level of threat as a function of social support are not known, it is likely to be a substantially bottom–up, possibly sub-cortical, process (Coan, 2008; Eisenberger et al., 2007). Thus, effortful, metabolically costly, top down, cognitive, attentional, and regulatory processes involving the PFC are likely conserved or devoted to other useful purposes in the presence of a predictable social resource such as a trusted and devoted romantic partner. Another way of looking at this is that self-regulation requires the effortful inhibition of active emotional responses, often via the PFC—almost as if one were stepping on the gas and brake of a car simultaneously—whereas socially mediated forms of emotion regulation simply obviate the need for the emotional response in the first place, thus conserving not only the gas, but the brake as well. Thus, social proximity produces large savings in terms of neural and peripheral physiological resources.

Social Proximity and the Bayesian Brain

Coan (2008) has described the human brain as a Bayesian bet–making machine. That is, the brain blends experiential, conceptual and current contextual knowledge to estimate the likelihood of a given outcome, using those estimates to fill in gaps in perception such that favorable outcomes are more likely (cf. Knill & Pouget, 2004; Friston, 2010). Among the sources of information the brain uses for this is an internal representative model of the self, which it tests against sensory inputs in order to adjust its predictions (Craig, 2009). A key concept in this way of viewing brain function is the idea of a *prior probability distribution*. A prior probability (often simply called a 'prior') is essentially the knowledge we have of the likelihood of a particular outcome. SBT argues that judgments about the level of personal resources to deploy in coping with environmental challenges follow Bayesian rules of inference. That is, the brain manages energy and behavior by making predictions about outcomes given (i) the current situation (particularly constraints, risks,

and opportunities), (ii) the predicted possible future situation(s), (iii) situational goals, (iv) current energy states, and (v) expected future energy states (cf. Salinas, 2011). According to SBT, a vital variable in making such predictions is the perceived availability and responsiveness of social resources.

More specifically, the brain uses the principles of Bayesian inference to generate moment-to-moment estimates of the potential cost savings associated with the distribution of risk and load sharing across social networks. Thus, a history of finding others to be relatively unhelpful and unreliable may lead to priors that predict low levels of social support, biasing individuals to make 'bets' that social resources are unlikely to obtain, and leading to an increased recruitment of personal resources in the presence of various life challenges. By contrast, a history of responsive social support may lead to priors that predict higher levels of social support, leading in turn to bets that fewer personal resources are needed as one navigates the potentially dangerous world. SBT predicts that individuals in the latter group, if their priors are indeed accurate, will realize energy savings that will render many of their ongoing life activities less effortful, because they will cede higher levels of processing (vigilance for danger, attention to potential resources, etc.) to their social networks.

This Bayesian perspective is similar to accounts posited by relationship theorists regarding individual differences in attachment and responsiveness to social support (e.g., Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969/1982; Mikulincer & Shaver, 2003; Reis, Clark, & Holmes, 2004). SBT suggests that individual differences in attachment styles, relationship schemas, or internal working models can be conceptualized more concretely as prior probabilities in a Bayesian decision-making process (Coan, 2010). Further, one should be able to use this conceptualization to directly link energy processes to attachment related phenomena by measuring the impact of relationship histories on energy usage in a variety of situations while experimentally varying social contact.

One of the interesting implications of a neural resource management perspective is it suggests that many, if not most, important life tasks that people engage in should be perceived as more difficult for those considered by attachment theorists to be 'insecurely' attached. Because they are more likely to be socially isolated, because their social networks are unreliable, or both, insecure individuals likely incur more costs for a variety of tasks than do 'secure' individuals. This should result in attachment insecurity affecting performance on even nonattachment related tasks. An example of this comes from a recent investigation of attachment style and diabetes related self-care (Ciechanowski et al., 2004), which revealed that participants with a dismissing attachment style were less likely than their secure counterparts to exercise, engage in foot care, adhere to diet recommendations, take oral medication, and avoid smoking. Thus, attachment insecurity may in fact make a wide variety of self-regulatory, attention-intensive tasks more costly and difficult, especially under conditions of perceived threat (Mikulincer, Dolev, & Shaver, 2004). This increased cost may in turn motivate insecure individuals to conserve personal resources by simply relaxing their regulatory efforts and, colloquially speaking, 'letting themselves go'.

Attachment Theory and SBT

Social Baseline Theory and Attachment Theory share many common themes and underlying assumptions beyond those described by individual differences in social comfort and support processes. Nevertheless, the mechanisms proposed by SBT, those of risk distribution and load sharing to regulate affect and manage metabolic resources, are distinct from

those proposed by Bowlby (e.g., 1969/1982). It is true that the functions of protection and security experiences in past relationships currently assumed in the broader attachment literature (cf. Bowlby, 1973, 1980), as well as the emphasis on affect regulation in later life (cf. Mikulincer & Shaver, 2003), are shared with SBT. But relative to attachment theory, the impact of social proximity and interaction according to SBT is broader in scope.

There is very little in attachment theory, for example, that is analogous to risk distribution—the emotion-regulatory (and hence energy conservation) benefits of being in relatively close proximity to strangers under conditions of threat, or indeed under any circumstances. Moreover, because close relationships serve the primary function of metabolic resource management, many important life tasks are likely to be affected by load sharing. For example, a person without significant relationships may use more neural resources on a daily basis in order to make effortful decisions, engage in creative problem solving, and regulate his own vigilance for potential threats. Over time, this excess load could very well render the perceived costs of even fairly mundane daily tasks (e.g., grocery shopping, making a meal, cleaning house) more exhausting, leading to internalizing disorders or other maladaptive behaviors. Indeed, in relative isolation, one might expect an increased need for sleep, increased food intake, decreased physical activity, and perhaps even decreased immune activity, all as a function of increased perceived energy demands (cf. Segerstrom, 2007). Thus, load sharing functions to make a very broad number of goals easier to achieve by reducing demand on processes—particularly those supported by the PFC—that are metabolically 'expensive' according to the design of the brain. Only a very broad interpretation of attachment theory would incorporate these observations.

Social Baseline Theory may also provide respite from some persistent conceptual controversies in the attachment literature, such as the degree to which infant attachment styles extend into adulthood (cf. Fraley & Shaver, 2000), and the degree to which attachment theory is rooted in (and incorporates) psychoanalytic theory. Indeed, Hazan and Zeifman (1999) have argued that the question of whether romantic partners truly qualify as attachment figures is critical to the interpretation and validity of the entire adult attachment literature. But this question is unimportant from the perspective of SBT, which simply acknowledges that interpersonal relationships from strangers to romantic partners to parents, bosses, coworkers, siblings and friends vary only by their predictability, reliability, and familiarity—qualities that vary themselves within each type of relationship. We acknowledge that some relationships are especially familiar and predictable, and that different mechanisms may exist for the founding and maintenance of different kinds of relationships (e.g., sexual attraction in adulthood versus total physiological dependence in infancy), but also that these different mechanisms may and often do lead to similar social regulatory ends.

Finally, the primary functions hypothesized to undergird adult attachment are affect regulation and pair bonding (e.g., Hazan & Zeifman, 1999; Mikulincer & Shaver, 2003). The strongest evolutionary arguments usually favor pair bonding, and indicate exaptation of the attachment system to promote adult attachments in the service of child rearing (Fraley, Brumbaugh, & Marks, 2005; Zeifman & Hazan, 2008). Despite this, the fact that emotion regulation seems to play a key role in adult attachment dynamics (e.g., Davila & Kashy, 2009) makes the idea that adult attachment is simply a pair-bonding process seem unlikely. From the perspective of SBT, attachment processes have likely been exapted, in conjunction with other adaptations, to serve cooperative energy saving functions that include not only affect regulation, but also shared goal setting, joint attention and cooperation (cf. Tomasello & Warneken, 2008). If true, attachment-like adaptations likely

extend beyond romantic and parent–child relationships to include many other types of relationships.

Do Social Relationships Really Regulate Emotion?

Emotion regulation typically refers to changing the intensity of an ongoing or predicted emotional reaction (e.g., Gross & Thompson, 2007; Sheppes & Gross, forthcoming), yet much of what we describe here involves the implicit and automatic prevention of an emotional or affective reaction in the first place—a difference of social context that reduces the likelihood that an emotional response will even be generated. We acknowledge that this situation presents an apparent paradox, for how is emotion regulation occurring in the absence of emotion?

One answer may require a challenge to the widely held assumption that the basic unit of analysis in human psychology is the single individual—an assumption that may well be too limited (Aron, Clark, & Reis, 2010; Berscheid, 1999). If the sole unit of analysis is a single individual, then social proximity and interaction does not necessarily constitute an instance of emotion regulation, because the individual is not altering his emotional response so much as failing to generate an emotion at all. Extending our unit of analysis from the individual to the dyad or group, however, social proximity can be viewed as an adaptive strategy, shaped phylogenetically, that is partially rooted in an interactive regulation of costly, inefficient and redundant emotional activity. That is, although individuals doubtless benefit from social regulation, dyads and groups do as well, and viewing the dyad systemically, especially over evolutionary time, reveals again that one of the advantages of social relationships is the emotion regulation benefits they provide.

McComb and colleagues (2001) have described an example of this sort of group-level emotion regulation among female elephants, arguing that their reproductive success is enhanced by the regulatory presence of older female 'matriarchs'. When groups of elephants first meet, they frequently cluster together in 'bunches' for safety. Bunching behavior depletes resources in a number of ways, not least by limiting mating opportunities, and groups of young females will bunch indiscriminately unless their group includes an older female. This is because older females are more familiar with the broader regional elephant community, rendering their own anxious behavior more specific and decreasing the frequency and intensity of bunching among younger females, who watch the matriarch closely during new group encounters. We view this as a social emotion–regulation dynamic, where groups of young females lacking an older matriarch are dysregulated at increased cost to each individual and to the group as a whole.

Similarly, SBT proposes that the single individual is not, ontologically speaking, the sole or perhaps even the proper unit of analysis in human psychology (Coan, forthcoming). On the contrary, the question of where an individual is located relative to her social resources is likely to course through every other question we ask. Indeed, the study of individuals in isolation—the overwhelmingly most common approach in contemporary psychology—is probably best at identifying what humans are, strictly speaking, capable of, rather than what humans actually do. Ultimately, the dynamic, interpersonal *social* regulation of emotion does not much resemble the intra-individual, effortful *self*-regulation of emotion, but it is a form of emotion regulation just the same.

Social Baseline Theory emphasizes the role of social interaction in regulating emotional responses because emotions carry rapid, vital and often implicit information about the world that guides perception, action preparation, and behavior (e.g., Clore & Ortony, 2000; Schwarz & Clore, 1983). It follows that emotion plays a strong role in economy of

action. The hypothesis that emotion functions as an important source of information has been supported repeatedly in the literature (cf. Clore & Ortony, 2000). Numerous neuro-biological investigations of decision-making indicate that people must be able to access and integrate emotional information in order to make complex decisions (e.g., Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Tranel, Damasio, & Damasio, 1996; cf. Bechara, 2004). Thus, emotional information is also a critical component of good judgment and decision-making.

So emotion plays a vital role in alerting us to important features of the environment, mobilizing resources to deal with challenges, signaling the potential costs and benefits of any action or situation, and informing the budgeting of an individual's resources. The ability to choose behaviors and situations that have good cost/benefit ratios is critical in managing biological resources effectively. Emotion efficiently provides information about the number of problems we need to solve, what resources we need to deploy to solve them, and at what level of effort. Social context, in turn, exerts a powerful influence on our emotional responses. In this way, too, the social regulation of emotion economizes our interactions with the world.

Conclusions

Relationships increase health and well-being (House, Landis, & Umberson, 1988; Robles & Kiecolt-Glaser, 2003; Uchino, Cacioppo, & Kiecolt-Glaser,1996; Uvnas–Mober, 1998). With its emphasis on economy of action, Bayesian decision-making, and the social regulation of emotion, SBT offers novel ways to think about *how* relationships produce these benefits, with implications not only for basic theories of social functioning, but also for how we understand the role of social relationships in clinical psychology and medicine. For example, SBT may be useful for understanding the frontolimbic dysfunction and emotional dysregulation that characterize borderline personality disorder (Hughes, Crowell, Uyegi, & Coan, forthcoming). Johnson (2007) has developed an interpersonal approach to psychotherapy that is efficacious not only for treating relationship distress, but also for utilizing social resources to regulate emotional responding during treatments for post traumatic stress disorder (Johnson, 2002), breast cancer (Naaman, Radwan, & Johnson, 2009), eating disorders (Johnson, Maddeaux, & Blouin, 1998), and chronic illnesses in children (Clothier, Manion, Walker, & Johnson, 2002). Evidence suggests that holding the hand of a nurse or volunteer during cataract surgery can significantly decrease patient anxiety, and possibly even the complications that can arise when patient anxiety is high (Astbury, 2004). Thus, socially mediated emotion regulation may be effective in a variety of therapeutic settings, and across a diversity of life challenges, adjustments and illnesses.

But new research is pointing toward an even wider variety of ways in which simple social proximity and interaction impact how humans function in the world. For example, higher frequency of physical touch among professional basketball players early in the season predicts better late season performance, even after adjusting for player status, preseason expectations and early season performance (Kraus, Huang, & Keltner, 2010). Moreover, the best predictor of 'collective IQ' is not the average IQ of a group, but rather the sensitivity of a group's members to social information (Woolley et al., 2010). From the perspective of SBT, each of these findings is attributable to the way social resources help to conserve vigilance, regulation and other executive processes such that the PFC can either impose less interference with motor and perceptual activity (in the case of players in the NBA) or devote its resources to solving other kinds of abstract and analytical problems (in the case of collective IQ).

Ultimately, resource management, prediction, and proximity to social resources appear to be so fundamental to human life that any psychology that ignores the impact of these factors will likely be limited in important ways. Moreover, increased attention to the role of social networks and relationships in the study of basic human psychology and behavior is likely to promote increased dialog and collaboration between psychology and many other disciplines, from sociology to anthropology, economics, epidemiology, biology, neuroscience and medicine. We certainly endorse this sort of cross-disciplinary interaction, and with this paper hope to have contributed at least modestly to this possibility.

Acknowledgment

Short Biographies

Lane Beckes' research explores affective, attachment, and prosocial processes in interpersonal relationships from an integrated perspective. He incorporates ideas and methods from traditional social psychology, social neuroscience, and evolutionary psychology in his scholarly pursuits. He has published papers on these subjects for *Psychological Science*, *Behavioral and Brain Sciences*, *Biology and Philosophy*, *the Oxford Companion to Emotion and the Affective Sciences*, as well as chapters in *Prosocial Motives, Emotions, and Behavior: The Better Angels of Our Nature*, and *The Self and Social Relationships*. Current research includes explorations on emotional learning in relationships, the social regulation of emotion, and the neural correlates of interpersonal bonding and emotion. He currently holds a research assistantship at the University of Virginia in the Psychology Department. He received a BA in Sociology and Psychology, and a PhD in Social Psychology, both from the University of Minnesota.

James A. Coan's research emphasizes the social regulation of emotion, with a strong emphasis on the neural systems that both affect and are affected by social relationships. He is particularly interested in how humans and other social animals utilize emotional behavior (facial expressions, proximity, touch, verbal communication) to regulate emotion in themselves and each other. He is co-editor of the *Handbook of Emotion Elicitation and Assessment*, and is currently an Associate Professor at the University of Virginia, where he directs the Virginia Affective Neuroscience Laboratory and is a member of the Neuroscience Graduate Program. He was a recent recipient of the Janet Taylor Spence Award for Early Career Contributions from the Association for Psychological Science, and an Early Career Award from the Society for Psychophysiological Research. He received his BS in Psychology from the University of Washington, and his PhD in Clinical Psychology from the University of Arizona.

Endnotes

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[1] The French enlightenment philosopher Maupertuis originated the concept of an economy of action suggesting it as a basic principle of physical systems. Although he meant for it to apply to nonliving things, several scholars credit Maupertuis with laying an intellectual foundation for work done by Mendel and Darwin in genetics and evolution (cf. Glass, 1968; Mayr, 1982; Bowler, 2003).

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