Complexity Sciences:

Theoretical and Empirical Approaches to Social Action

Edited by

Manuel Lisboa and Dalila Cerejo

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CHAPTER VII

REASONING ON EMOTIONS: DRAWING AN INTEGRATIVE APPROACH

ANA FERREIRA

1. Introduction

Social action is preceded by a decision-making process that connects the past, present and future, allowing action to proceed in the absence of knowledge about what is still to happen. Among others, Barbalet proposes that both rationality and emotions are critical for social action, since the uncertainty that distinctively marks these processes prevents strictly rational costs/benefits calculations. Barbalet's theoretical perspective on emotions states that these are subjectively experienced and behaviourally expressed, simultaneously presenting cognitive, dispositional and physiological components. While underlining the insufficiencies of stringent disciplinary studies, this view remains to be empirically addressed. Along these lines, António Damásio et al.' work reveals interesting clues. The authors showed that socially imprinted non-conscious physiological variables are available to actors upon uncertainty, allowing unconscious decision-making when rational and conscious analysis is impossible. These physiological modifications can be perceptible or not to an external observer, depending, first, on which physiological system they trigger and, second, on the specific output of that system.

To start addressing the interdependence of these systems and the emergent properties, we'll follow a systems approach that should unravel how embodied decision-making processes are framed by social, cultural, psychological and physiological systems and their intra-systemic and inter-systemic roots and connections. Not by precluding knowledge specialization but, rather, crossing socially-constructed disciplinary boundaries, we aim to gather a deeper understanding of social action.

2. From the feeling of rationality to an ecological rationality: The unity of rationality and emotion

The general understanding of emotions as pure irrational states and in a clear antagonist position to the rationality, inheritor of the Enlightenment thought, survived the time when René Descartes stated that existence was not rooted in the body but, rather, on permanently reconstructed thoughts through the exercise of methodical doubt – "*I doubt, I think, therefore I am*" clearly separates *res cogita* and *res extensa* (Descartes, 2006[1637]). But the most known Cartesian aphorism also underlines the virtues of autonomous and individual thought, critical for the exercise of a rationality that would drive individual social actors to action, holding them accountable for its trajectory, and thus delocalizing the world and others' influence in the construction of the self (Barbalet, 1998: 57).

Still, this generalized understanding of an opposition between rationality and emotion far precedes the 17th century, with Plato, for instance, mirroring this relation in his Phaedrus' chariot allegory (Platão, 2000). This metaphor illustrates the dichotomy between rationality and emotion, which appear not only as separate phenomena but also antagonistic, and further establishes the inferiority of emotion and the imperative of its control by rationality (Zhu & Thagard, 2002:20).

If the superiority of humans as a species, culture or subjects lies in the exercise of rationality, the only possible path to the "age of majority" (Kant, 1797:11), Charles Darwin, in his book *The expression of Emotions in Man and Animals* (1872), questions the superiority of the "*rational human beings*", presenting a group of emotions – today understood as primary innate emotions and among which we can find anger, fear, surprise and sadness – as similar to the ones experienced not only by other cultures but also, and in the line of his work on the evolution of species (Darwin, 1859), to the ones experienced by different species (Darwin, 1872). This view is in strict opposition to the constructivist perspective whereby emotions are pure social constructions with an exclusive origin in culture, and according to which the societal members would learn with other members the "*emotional language*" in terms of vocabulary, behaviours, answers and shared meanings (Gordon, 1990 *apud* Turner & Stets, 2005:2).

As such, if one follows a dichotomist approach, rationality would put us in a leading position in inter-species, inter-culture or inter-personal hierarchies, while the Darwinian emotions would fade away inequalities. According to Darwin (1872), these emotions would have been kept in the genetic pool of different species due to the added value that their innate presence confers in terms of fitness.

But the supremacy of the individualized rationality of the Enlightenment thinkers was only truly questioned when William James, in 1884, in response to the question "*What is an emotion?*" refuted the widely accepted dualistic Cartesian dogma. James, and one year later, Carl Lange (Lange, 1922 [1885]), undertook the study of the interactions between *res cogita* and *res extensa*, and established a new paradigm on the role of emotions in human action. The James-Lange theory suggests that, in opposition to the leading paradigm of its time whereby *i)* the perception of an event would induce *ii)* the establishment of an emotion in the mind that would result in *iii)* a bodily sensation, the authors suggest that the perception of a specific event would rather lead to physiological modifications and action, and that an emotion is the feeling of these alterations (James, 1884:189-190). From a physiological standpoint, the Jamesian emotion corresponds to the group of somatic transformations that follow emotive stimuli. One of the main contributions of the work by James and Lange that we have just described is the notion of the embodiment of emotions (an emotion is the feeling of the bodily modifications), and how the conscious perception/experience (of the emotions) follows changes of physiological variables, later called *somatic markers* (Dalgleish, 2004: 583; Damásio, 1995). But still, William James goes far beyond defending only an emotional embodiment by suggesting, provocatively, a "*feeling of rationality*", physiologically imprinted and consciously perceived by social actors through somatic mechanisms similar to the ones involved in the recognition of emotional stages (James, 1879). In this way, James precognized what only much more recently started to be unravelled: the continuity of emotive and rational processes.

The emphasis attributed to the embodiment of emotions, and, for what was previously exposed, to the embodiment of rationality, will be yet another great legacy of William James. Today, an extended version of his theory, with several feedback and/or feedforward physiological mechanisms and/or social inputs, modulating the emergence and development of emotional stages, is largely accepted (reviewed in Dalgleish, 2004:583). This view establishes an interaction between social and biological dimensions and opens the door for a social construction of embodied emotions (reviewed in Turner & Stets, 2005).

The perspective of Jack Barbalet fits this type of rationale precisely. For this author, emotions are subjectively experienced and behaviourally expressed, simultaneously presenting cognitive components (images and projections of the "I" in the future), dispositional components (disposition to act based on those images) and physiological components (presenting muscular, respiratory and cardiovascular outputs). This vision rejects, in the path of the James-Lange theory, the Cartesian dualism, suggesting instead an embodiment of social action and consequently an interdependence of the social, cultural, psychological, and biological systems.

Along these lines, the work developed by António Damásio et al. in the 1990s is a valuable contribution. The authors, grounded in the work of Nauta ("*Interoceptive markers*") (1971) and Pribram ("*Feelings as monitors*") (1970), developed the somatic Marker hypothesis, according to which physiological reactions, i.e., somatic markers, tag previous emotional experiences, launching a signal that maps the types of events and experiences that have had emotional triggers in the past. These somatic cues are available to actors upon uncertainty, allowing, first, that an unconscious decision-making process proceeds when a rational and conscious analysis of a situation is impossible, and subsequently allowing for the development of a specific action (Damásio, 1995:178-250; Bechara et al., 1997; Bechara & Damásio; 2004).

More specifically, Bechara, Damásio et al. have shown that the decision-making process follows the responses from the body (somatic) assimilated by the actors in previous similar occasions but are not conscious to them (Bechara et al., 1997). These markers *guide* the choices made by the individuals who, initially, refer to their decisions as being *intuitive*, as *hunches*. Thus, what the authors show is that in uncertain/ambiguous situations, it is the emotions that, rooted in our body, allow for the progression of decision-making and action, constituting a response that, even unconsciously and consequently tagged as *irrational*, is, in reality, central not only to our survival (as in the case of the expression of primary emotions, such as fear) but also to social interaction.

What the somatic markers hypothesis shows is that first, there is an embodiment of emotional states that not only precede consciousness but also helps the decision-making process, and second, that these somatic markers can be either innate, pre-organized, as, for example, in the case of fear (e.g., fear of objects with undefined edges), or learnt during the course of social processes, as in the case of anxiety (e.g., the anxiety that one feels prior to an academic or professional evaluation). What is also important to stress is the empirical validation of the regulation of innate mechanisms by superior cognitive processes, such as the ones involved in learning. These neurosciences studies establish, once again, a connection between strictly biological dimensions and a possible role for their social regulation.

Beyond the somatic maker hypothesis, and with a direct relevance to the main focus of our discussion, Damásio discriminates emotional categories – deep emotions, primary emotions and social emotions – each presenting differentiated physiological inscriptions that would have resulted from evolution (Damásio, 2003).

Briefly, deep emotions are the result of the unpredictable overlap of regulatory processes of our body. These include the momentary metabolic adjustments but also the reactions that continuously occur as a response to external situations. Enthusiasm and lassitude are examples of this emotional type (Damásio, 2003:61-62).

Fear, anger, disgust, surprise, happiness and sadness are considered primary or innate emotions, thereby being inscribed as pre-organized physiological reactions that emerge when specific characteristics of external or internal stimuli are detected (Damásio, 1995:146). Engelen et al. extend this characterization, underlining that primary emotions are i) necessarily pure, that is, their occurrence cannot involve the concomitant manifestation of any other emotional stage; ii) universal (experienced by all social groups), presenting distinctive facial and bodily expressions that are easily detected, and that developed based on an innate physiological programme that is accompanied by significant bodily alterations; iii) immediate and short-term; iv) develop in the initial stages of the ontogenic development and disappear in later stages of the life course, particularly in cases of neural degeneration; and, finally v) in spite of involving some cognitive processes, such as perception and the processing of stimuli, these emotions are induced without the involvement or the need of an image of the self or the formulation of thought (Engelen et al., 2009:26-28).

Social emotions, according to Damásio, also present some generalizable physiological characteristics, resulting from the combination of simple or complex mental evaluative processes, with dispositional responses directed to the body and the brain (Damásio, 1995:148). Engelen et al. suggest that the development of this emotional type involves superior cognitive capacities (such as associative and propositional capabilities) and, simultaneously, less intense and less immediate body stimulation than in the case of primary emotions. Furthermore, social emotions require a representation of the self and can have primary emotions as their components (shame, for instance, can result from the fear of doing something wrong). These emotions are far more modifiable by culture (one example is the inexistence of the concept of "arrogant" or its linguistic expression in some cultures) and, in opposition to primary emotions, develop in the latter stages of ontogenic development and are lost in early stages of dementias (Engelen et al., 2009:40-42). Sympathy, embarrassment, jealousy and pride are examples of social emotions.

Damásio further distinguishes emotions from feelings, the latter understood as the juxtaposition between somatic alterations and mental images that trigger the emotional cycle, and being the only emotional stages that are rationalized (consciously) by the subjects (Damásio, 1995:159). Once we consider, like Damásio, that the emotional process is unified, we won´t follow his distinction between emotions and feelings and we will use, like Jack Barbalet, the term emotion for both conscious and unconscious emotional stages.

For what was previously exposed, one can state that an emotion (whether deep, primary or social) is the group of somatic modifications triggered by the response of a particular sub-system of the central nervous system, to the specific content of a present or past perception, real or unreal, referring either to an object or a situation that an actor has come across (Bechara & Damásio, 2005:339). The physiological modifications triggered during the course of these emotional responses can either be perceptible or not to an external observer, depending first on which biological system it triggered, and second on the specific output of that system. While some of the direct modifications of the skeletal-muscular system, such as facial expressions or vocal tone, can be examples of the first type, i.e., perceptible modifications, others, such as the levels of circulating hormones or neurotransmitters, as well as the heart rhythm, are unavailable to *the eye* of the most experienced investigator. In addition, while internal modifications, externally undetectable, are not, a priori, voluntarily modifiable, resulting from the action of non-motor brain regions on the autonomic (para)sympathic and endocrine systems, the externally perceptible modifications, are generally controlled by sub-cortical regions, that, in spite of being automatic, their occurrence and intensity can be consciously modulated. Visible modifications, partially modulated by culture and associated social norms, have a particular important role in social interaction since they communicate to others specific information regarding the situation in which they are involved (Engelen et al., 2009: 38).

What is also important to underline is that, within the biological system, we are facing a highly regulated action of interconnected, and often overlapping, diverse set of systems. These range from the pivotal nervous system, with its two main subsystems, central and peripheral, to the endocrine system, with its primary glands lying within the central nervous system and importantly establishing connections with all major organs and body cellular tissues, to the immune system, responsible for

Table 1. The endocrine system: Major glands, secreted hormones and respective functions. Glands are responsible for the production and release of hormones

GLAND	MAJOR HORMONES	MAJOR FUNCTIONS
Hypothalamus	Regulatory Hormones; Antidiuretic Hormone; Oxytocin	Regulation of homeostasis; pituitary gland; hunger; thirst; sleep; wakefulness and most involuntary movements; Connects endocrine and nervous systems
Pituitary	Stimulating Hormones; Growth Hormone; Luteinizing Hormone; Prolactin; Antidiuretic Hormone; Oxytocin	Regulation of other endocrine glands; Regulation of growth, metabolism and regeneration
Parathyroid	Parathyroid Hormone	Regulation of calcium
Thyroid	Thyroid Hormone; Calcitonin	Regulation of metabolism; body temperature and growth
Thymus	Thymosins; Thymopoietin	Resistance to pathology
Adrenal Glands	Epinephrine; Norepinephrine; Cortisol; Aldosterone	Emergency reactions; Regulation of metabolism; water balance and blood pressure
Pancreas	Insulin; Glucagon; Somatostatin	Digestion; Regulation of blood glucose levels and metabolism
Ovaries	Oestrogens; Progesterone	Female reproductive system and secondary sex characteristics
Testes	Androgens	Male reproductive system and secondary sex characteristics

our body defence mechanisms, among others (Vander, Sherman & Luciano, 2001). Intra-systemic and inter-systemic communication is therefore of the utmost importance, a role that is mostly performed by the concerted action of neurotransmitters and the messengers secreted to circulation by the endocrine system, the hormones (see table 1) (Vander, Sherman & Luciano, 2001).

Emotions are thus dependent on the "specific social context and the correspondent cultural models of interpretation and behaviour; the biography and psychological structures of an individual, the innate physiological processes anchored in human biology ("biological reactions") and their subjective perception" (Röttger-Rössler & Markowitsch, 2009: 3-4). As such, considering emotions as the result of a dialectic system of interactions that develops over time (Röttger-Rössler & Markowitsch, 2009: 4; Engelen et al., 2009: 30), we find ourselves, as William James suggested over 100 years ago, facing a continuity of rationality and emotion.

3. Between nature's gifts and social constructions

Over the last two decades, mainly laboratorial and animal studies have begun to address how the embodiment of emotions can regulate decision-making processes and action. These studies have established firm connections between the nervous, endocrine, cardiovascular and immune systems, and simultaneously corroborate Damásio's somatic marker hypothesis (Damásio, 1995; Bechara et al., 1997; Bechara & Damásio; 2004). In spite of the relevance of this work, it encompasses some handicaps: 1) laboratorial tests, such as the Iowa Gambling Task or the Game of Dice, intend to mimic real world decision-making processes but are performed in laboratory settings; 2) animal studies use animals as *models* to study the mechanisms underlying a specific event but the specificities of the systems involved, as well as their interactions, can be, and often are, different from human systems. Even if one disregards the above-mentioned down points, another criticism that one might pinpoint in many neurosciences studies of decision-making is that these studies have mainly focused on individual decisions. They do not replicate the highly complex interactive social environments in which we live and in which most of our decision-making processes take place (reviewed in Rilling & Sanfey, 2011).

For the purpose of this paper, we will refer to social decision-making as decisions made in social contexts, where they are intimately dependent on self and others and simultaneously affect both self and others (reviewed in Rilling & Sanfey, 2011: 24). These social decisions share some components with individual decisions, such as psychological conflicts, for instance the ones derived from emphasizing either self-interest or, on the contrary, others' interests; short- or long-term rewards and, finally, the conflict between emotion and rationality (reviewed in Rilling & Sanfey, 2011: 24).

Just as in the case of individual decisions, social decision-making processes have also been studied under laboratory conditions using a wide variety of neurosciences methods that have allowed the assessment of the brain regions involved in these processes.

Since the interactive scenarios are difficult to recreate in laboratory settings, social decision-making has been mainly studied, once again, in the context of laboratory games that were based on approaches used in experimental economics. In what concerns the study of social decision-making, interactive games such as the Prisoner's Dilemma, Trust Game, Ultimatum Game and Dictator Game have assumed a relevant position. Specifically, reciprocal exchange and trust has been widely studied with the Prisoner's Dilemma (which summarily models decisions to trust) and Trust Games (which models decisions to trust and reciprocate trust). The Ultimatum game models responses to fairness and the Ultimatum Game models altruism. Even when researchers introduce variations to the initial game models (such as playing multiple rounds of the same game or introducing non-anonymous interactions), they are intended to recreate in a more precise manner social decision-making processes. Still, we are studying social decision-making processes under experimental laboratory scenarios.

In spite of all the mentioned handicaps, neural structures such as the prefrontal cortex, the dorsal anterior cingulate, the anterior insula, the ventral striatum and the amygdala have been shown to be differentially involved in the above-mentioned social decision-making processes. These systems were shown to be differentially modulated by neurochemicals (e.g., serotonin, oxytocin or testosterone) by still-unknown mechanisms (reviewed in Rilling & Sanfey, 2011).

Even though these studies do give us valuable inputs into the physiological basis of social decision-making, they are still preliminary and further testing of the proposed neural models is necessarily required for their validation. Possible extensions of these studies would be to replicate them in *spaces* outside the laboratorial confinement and verify the validity of the proposed models in non-western cultures, which, typically, are not monitored in these investigations.

The few studies that have addressed decision-making processes in *real world social behaviour* that we are aware of mainly look at biological footprints in addicted individuals during gambling in casinos. These studies give us valuable insights into the mechanisms involved in these processes but are nonetheless referring to non-physiological situations (reviewed in Clark, 2010).

One study that simultaneously addresses social and biological dimensions involved in social decision-making in real world social behaviour was developed in 2008 by Coates et al. In this study the authors focused on the role of endogenous steroids in economic profit and risk on a London city market floor, characterized by high frequency trading (Coates & Herbert, 2008). Previous studies had established testosterone, a steroid hormone produced by the endocrine system, as an inducer of the so-called winner effect in a wide variety of sports (from wrestling to soccer, from tennis to chess). The mechanism at stake involves a positive forward feedback loop whereby individuals with higher basal levels of testosterone have an increased probability of winning the competition. If victory does occur, then circulating testosterone levels will further rise and subsequently enhance the individual's chances of winning the next sportive event (reviewed in Coates et al., 2010). The hypothesis that Coates et al. established rests on this exact mechanism. The authors hypothesized that traders would likewise exhibit a competitive (economic) behaviour and thus higher levels of testosterone would be associated with above-average profits. What the researchers found was that, like the testosterone association with competitive behaviour in sports, above-median morning levels of circulating testosterone were associated with increased traders' daily profits in the market floor. Importantly, this group also reports that traders that had been performing this job for longer periods of time presented further increased profits in the market to the same above-median levels of testosterone. These results suggest that a learning process might be involved in the regulation of this specific somatic marker that opens the door to a social regulation of the biological system (Coates & Herbert, 2008; reviewed in Coates et al., 2010). The authors suggest that testosterone acts directly in the central nervous system structures involved in attention, persistence and confidence, thereby building a physiological environment prone to economic competitiveness and efficiency, and subsequently to profit.

The second endogenous steroid the authors looked at was cortisol, a hormone that has been shown, both in laboratory and animal studies, to be increased in situations of uncertainty, novelty and lack of control, all known landmarks of economic trading (reviewed in Coates et al., 2010).

Coates et al. likewise show that the volatility of the markets is indeed associated with increased circulating levels of cortisol, establishing once again an association between an economic variable and a biological output.

Along the lines of Damásio's somatic marker hypothesis, Coates et al. established for the first time that a decision-making process in a real-world situation is associated with specific somatic markers, thereby establishing a connection between the social system and the (multi-component) biological system.

Furthermore, if the markets were traditionally regarded as the utmost example of rational behaviour, what this study indeed suggests is that the actor's interpretation of what is happening in the markets is highly related to biologically and socially embedded emotional patterns that shape an individual's perception, decision-making and action. Coates et al. establish that in a "real life" decision-making situation, the traders' levels of two somatic markers are indeed associated with economic variables, undoubtedly establishing a connection between the biological and social systems (Coates & Herbert, 2008).

Contrary to what could be suggested at first sight, the take-home message from this study is that if social action is indeed the result of the interaction of a diverse set of systems that intervene in a differentiated manner, then modulating one variable, that being biological, i.e., testosterone or cortisol, or belonging to any other system, should not modulate social action in a specific direction or lead us to a better understanding of what underlies one's action.

What this study also reveals is that pure disciplinary studies, firmly established within socially constructed disciplinary borders, won't give us a broad understanding of the dimensions underlying, first, decision-making and, subsequently, social action.

4. Emotional embodiment and decision-making: What we can learn from previous studies

In this paper we have presented studies showing that emotions do have a physiological expression and are indeed socially constructed. Moreover, the cultural settings in which social action takes place will also have an important role in emotion construction (Engelen et al., 2009: 44; Turner & Stets, 2005). This is why we can easily find examples of emotions that present a universal character and others that are specific of a given culture (reviewed in Röttger-Rössler & Markowitsch, 2009). It is interesting to note that even in the case of universal emotions, their intensity and expression, one's capacity to recognize them, the somatic reactions that they induce, the situations that lead to their expression and the way that each one of us regulates them are indeed culturally framed (Engelen et al., 2009: 44).

Many questions remain, however. What are the mechanisms mediating the involvement of these, generally regarded as separate, systems? How do they communicate with each other? What are the messengers involved in these processes and what is their contribution to decision-making and social action? What is the contribution of each of these systems to action? In what concerns the biological system, and according to the somatic markers hypothesis, other (sub)systems, besides the one specifically evaluated in the Coates et al. study, i.e., the endocrine system, must be involved in this process. But which ones, and how? What about the cultural or the psychological systems? They too should participate in shaping human action. What is their role?

To start answering some these questions, Robinson et al. proposed a path to methodically investigate the interaction between the biological and social systems. The authors proposed a provisional mapping of physiological markers that they thought relevant for emotional processing in social interactions (Robinson et al., 2004). Independent of the accuracy of the delineated hypothesis, only to be confirmed or negated through an empirical investigation, what this paper truly establishes is a path that allows a direct look that should lead to a better understanding of the interactions between different systems, and specifically between somatic markers, emotion and action (Robinson et al., 2004). More important than the (in)correction of the presented hypothesis, or accuracy of the specific parameters proposed by the authors for a future empirical study, this proposal takes the first steps towards the understanding of the relation between specific somatic markers and the social construction of emotions in an interactive social setting. In the future, it should allow for an extensive understanding of the interactions among the different systems and the role of emotions and rationality in decision-making and subsequent social action (Robinson et al., 2004:109).

What we would like to further emphasize is that the scientific reports mentioned do not allow for the establishment of a causal relation between biological and social outputs (or any others one might set off to investigate, i.e., cultural or psychological) in decision-making and action. However, they do lead us to postulate, similar to the hypothesis of Robinson et al., that human action is the result of an interaction among different systems. If this is indeed the case, then only a systems approach, one that integrates knowledge from diverse fields and sciences that have been long separated, can lead to an understanding of the contribution of emotional, social, cultural, biological and psychological patterns to action.

Several challenges will be faced in this path due to the heterogeneity of assumptions, the theoretical backgrounds, the specialized concepts, and the research methodologies. A first step will necessarily be the establishment of a common language, a process already started by a research group integrating philosophers, psychologists, physiologists, neuroscientists, ethnologists and sociologists at the Centre for Interdisciplinary Research of the University of Bielefeld and presented in the book *Emotions as Bio-cultural Processes* (Röttger-Rössler & Markowitsch, 2009). The researchers intend to go beyond the reductionist approach subscribed by some social scientists that defends a radicalization of the subjectivist's models, whereby all processes are uniquely the result of a social construction, as well as the Neodarwinian approaches of molecular biology strictly based on evolutionary and genetic notions (Lyon, 2009:205). Therefore, emotions and their social and somatic constitution, linking socially detached dimensions, perform a particularly relevant role. The study of social action integrating social, cultural, psychological, and biological dimensions will necessarily resort to a systems approach integrating knowledge from diverse disciplinary backgrounds that are indeed inseparable in our daily social lives.

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