Emotion and Rationality in Educational Problem Solving: From Individuals to Groups*

Gabriele Lakomski (University of Melbourne)
Colin W. Evers (University of New South Wales)

Abstract

This paper offers a critical discussion of recent work on the role of emotion in problem-solving and decision-making, with particular reference to group processes and group decisions in education and other organization contexts. Based on evidence from neuroscience, we argue first that emotion, rather than being contrary to reason, is a vital constituent of reason and hence essential for good decision-making. Second, we examine a number of computational models that integrate emotion and reason into group decision-making. Although these models possess a number of weaknesses, we think that further developments are both possible and likely, and point to some areas that later models will need to address.

[Key words] emotion, problem solving, neuroscience, group decision making

There is a tradition in the analysis of individual reasoning that sees emotion as something that subverts good reasoning. Thus Weber (1947, p. 96) in his discussion of interpretation in the case of the “concepts and ‘laws’ of pure economic theory”
says “They state what course a given type of human action would take if it were strictly rational, unaffected by errors or emotional factors...” Bertrand Russell, in the last paragraph of his *History of Western Philosophy* (1961, p. 789) summing up his own approach to philosophy, states:

In the welter of conflicting fanaticisms, one of the few unifying forces is scientific truthfulness, by which I mean the habit of basing our beliefs upon observations and inferences as impersonal, and as much divested of local and temperamental bias, as is possible for human beings.

Here the contrast is between good reasoning and emotion. But now consider the case of an individual who is choosing what to eat in a restaurant, but who has no sense of taste or smell. All the food tastes the same. To make a rational choice in Weber’s or Russell’s sense, our individual would need to invoke other criteria, perhaps those based on considerations of nutrition, or diet, or health. But now suppose this individual is completely indifferent to these additional criteria, possessing no preference or affect or feeling about these or any other proposed criteria. At this point the notion of rational choice breaks down. One might as well toss a coin as engage in deliberation.

The most striking empirical evidence for the importance of emotion in good reasoning has come from neuroscience, in particular studies of reasoning where people suffer from lesions in those parts of the brain that control affect. Damasio (1994) provides some case studies. For example “Elliott” had a tumour removed from an area of the brain to do with affect that left his memory, knowledge and intellect intact, while doing enormous damage to his capacity for decision-making. “True, he was still physically capable and most of his mental capacities were intact. But his ability to reach decisions was impaired...” (Damasio, 1994, p.37).

Emotion can compromise rationality, but so can its absence. From an epistemological perspective, affective indifference can truncate the process of searching for a solution to problems because one is indifferent to what is found. And excessive affective attachment to one idea can cause confirmation bias, where all evidence is seen as supporting one viewpoint. When it comes to individuals, what is required is to strike a balance between preference and impartiality. Often this means being procedurally impartial in inquiry – for example, the double blind experiments
in medical research – while having an emotional stake in the result.

This is quite difficult to achieve if our unit of reasoning is the individual, but ironically, may be a little easier when it comes to dealing with emotion in group reasoning. Here’s why. Let us suppose that a person, A, can take up two attitudes to a proposition: an epistemic attitude, ‘ep’, that is indicative of A’s belief in the degree of evidence for the proposition, and an emotional attitude, ‘em’ that is indicative of how emotionally attached A is to the proposition. Thus A(ep, em) symbolizes these possibilities. And there are many combinations. For example, A can think a claim is true but be deeply unhappy about it. Or A can think there’s not much evidence for a claim but would very much like it to be true. And so on. So for each (ep, em) pair, a different epistemic strategy for individual inquiry might be required. However, with groups, we can take advantage of a spread of (ep, em) pairs among the group members.

A spread of different (ep, em) means that the group contains a mix of people with different attitudes toward the elements of inquiry and decision. This means further that a wider range of alternatives will be considered, that a bigger, more critical set of proceedings will occur than if the group immediately settled into an emotional consensus. Of course, too much commitment to divergent views will prevent a decision from being made, especially if the consensus requirement confers veto. One useful procedure for enjoying both divergence and closure is to require a mere majority for consensus, instead of complete agreement. More will be said about such options later within the context of looking at social epistemology in general and models of group decision-making in particular.

There are many contexts in which groups engage in reasoning. Among the most common is the task of groups engaging in finding solutions to problems. Here’s an example that sets the scene for the issues we want to discuss.

Consider the case of the School Board of a coeducational secondary school whose numbers are dwindling. The Board has several options of how to deal with this problem but the suggestion is put forward by the Chair of the Board to amalgamate with a local girls’ school that is in financial difficulties. The majority of Board members believe that rationally, an amalgamation would solve the problem as it would boost student numbers and therefore increase income. Others are less
convinced, as they strongly believe that the hard won gender balance would be lost through the influx of a large number of female students. To maintain gender balance is deemed an important aim and coheres with those members’ values. Nevertheless, even though they have reservations, the minority believe that amalgamation might just work. And there are still others who are not committed to gender balance and also think that other options ought to have been canvassed. But sensing the mood of the meeting, they go along with the general decision to amalgamate hoping it would work to save the school. A decision is reached quickly, and a consensus is achieved. But is it a good decision and what kind of consensus has been reached?

The general problem–solution setting is clear. A decision is made, with varying degrees of emotional commitment, on the basis of some assessment of the plausibility of the suggested solution, the only one up for consideration. Not everyone believes that the best solution has been found, on the evidence, or is emotionally committed to the one adopted. This kind of process issues in a de facto compromise that satisfies a few, and results in a plausible but untested solution. Much decision making in schools and elsewhere is of this kind, and much of it is carried out by groups or teams of educators.

In this paper we want to explore some ideas that are beginning to point the way to making improvements in group decision-making, ideas that take into account both the emotional aspect of group members’ views and their epistemic aspect.

We think there are better ways to structure the problem–solution process that inherently includes emotion and reason in finding better solutions. Or to put the matter slightly differently: we explore some decision procedures concerning how a collection of individuals, such as school boards, leadership teams, and others, can reach better solutions to given problems to which its members are also committed emotionally.

To begin with, decisions are not made merely on the basis of sharing verbal information but also on the basis of some agreement or consensus of how people feel about, or value, the issue to be decided. The sharing of emotion is non-verbal and rarely if ever rises to consciousness (e.g. Damasio, 1996; LeDoux, 1996; Berridge and Winkielman, 2003). It is more the result of what has been called emotional contagion (Hatfield et al., 1993, 1994). This raises many contentious issues, not least of which is one of methodological procedure, with the added difficulty of trying to
aggregate what are initially *individual* value preferences or valences at the group level.

One core issue in this discussion is therefore how such features as emotion and reason or cognition can be brought within the same problem–solution space (for an initial exploration see Lakomski and Evers, 2010). Furthermore, the solution itself needs to be amenable to testing, as groups need to be able to assess the consequences of their actions; this requires feedback mechanisms so that learning from error is possible. When this is the case, we argue, groups may indeed make decisions and find solutions that are both emotionally committed as well as epistemically advantageous. There are some models available that simulate emotional group decision making but they are limited to modelling individual or pair-wise decision–making (e.g. Barnes and Thagard, 1996; Thagard, 2001, 2006; Thagard and Kroon, 2006). We discuss these models and conclude the paper by making some suggestions on how whole group modelling may be attempted more satisfactorily while also noting that this requires some important trade-offs to be made regarding speed of decision making versus quality of outcome.

In order to set the context for the discussion to follow, we first need to make a few comments about where our approach differs from discussions on emotion (and cognition) in the education literature especially. (See our earlier discussion of traditional accounts of decision–making that entertain the classical emotion–reason dichotomy, Lakomski and Evers, 2010).

### Emotions in Education

Early philosophical treatments of emotion notwithstanding (e.g. Dewey, 1895, 1916), the debate about the importance of emotions in education is relatively recent (see Sutton and Wheatley, 2003, for a comprehensive overview; Nias, 1996; Schutz and Lanehart, 2002; Schutz and DeCuir, 2002; Beatty and Brew, 2004; Sutto, 2005; Schutz and Pekrun, 2007; Schutz and Zembylas, 2009), but it is growing. The discussions focus generally (but not exclusively) on emotions as subjective and private experiences of the individual teacher or leader, and their impact on students, educational outcomes, and teacher education programs (but see Zorn and Boler, 2007; also the contributions in the Special Issue on emotions in the *Journal of Educational*
Our main point of difference is that we do not consider the emotions, commonly labelled as fear, sadness, anger, joy, etc., as discrete entities or “natural kinds” (Barrett, 2006a, 2006b; Clore and Huntsinger, 2007, 2009) characteristic of (educational) psychology, as evident in the education literature. Rather, we take our lead from neuroscience where emotions are understood as specific collections of physiological responses the brain activates in response to some stimuli (Damasio, 2000, p. 15). Emotions can thus more fittingly be described as “appraisal–response systems” (Schulkin et al., 2003, p. 20) that are essential to all human problem solving.

We are therefore concerned with the causal analysis of what constitutes “emotion” rather than discrete “emotions” that are discussed in topics such as teachers’ emotions, the emotional aspects of teachers’ lives (Hargreaves, 2000, 2001), emotions in teaching (Nias, 1996), passionate leadership (Davies and Brighthouse, 2010), or emotions and leadership more generally (Humphrey, 2002; Zorn and Boler, 2007). While these are important investigations, we believe that a causal understanding of “emotion” will lead to recasting many of the above issues and challenge the assumption of discrete emotions as natural entities.

The main finding from the cognitive neuroscience of emotion is that the relevant neural circuitry for emotion is to a large extent shared with that which elicits cognitive behaviour. The significance of this result is that decision–making, for example, traditionally considered to be the most rational of activities, does not fragment into “cognitive” or “emotional” components (e.g. Davidson, 2003) as traditionally and most prominently assumed by Herbert Simon (1976), for example, who based his distinction between administrative theory and policy on just this dichotomy (also Kahneman et al., 1999). Importantly, emotion does not “get in the way” of rationality, but is integral to it functioning at all. In other words, how people feel and how they decide are not diametrically opposed features but originate from shared neural circuitry, with emotion playing a subconscious and central part in reaching a decision. This is a finding of considerable consequence, and we take it up again later.

As indicated above, emotions, as understood in the contemporary education
literature, are taken to be commonsense, discrete entities. Useful as a kind of linguistic shorthand for processes unseen, our broader naturalistic view can accommodate such a folk psychological perspective for practical purposes while denying that there are any such natural entities. As “emotion” is so closely interwoven with cognition any partition in the traditional sense is fanciful. Secondly, emotions in education are considered the property of individuals and are not (yet) discussed at the group level. But there is research on affect and the emotions (in the traditional sense) in the discipline of Organizational Behaviour (OB), especially in relation to affect in work groups and decision-making, which has, direct relevance for educators. Drawing on this rich tradition, we next introduce some of its results in the section to follow. As central issues in OB include how emotions transmit in groups, and explicitly, how affect is linked to organizational processes and outcomes, such as decision-making, this research is of considerable interest for education. The intricate links between emotion, cognition and decision-making, as they emerged in recent affective neuroscience, are the topic of a later section.

**Affect and Emotions in Work Groups**

The topic of affect and emotion has a long and complex history in the discipline of Organizational Behaviour (OB) (for comprehensive reviews see Elfenbein, 2007; Barsade and Gibson, 2007; Brief and Weiss, 2002, and Ashkanasy *et al.*, 2000; Fineman, 2000, 2003). The annual series *Research on Emotion in Organizations* (e.g., Ashkanasy, 2003) is testament to the ongoing importance of the topic within the discipline. Despite differences in emphases and approach amongst scholars in the field, there is agreement that group members’ emotional experiences do affect the work group. Of critical importance are the mechanisms by means of which group members are said to transmit or share moods and emotions, based on observational cues as well as nonverbal behaviour. There are a number of implicit and explicit social processes through which members share emotional experiences. Of particular interest here are those that are implicit, such as *emotional contagion*, described as a form of entrainment (Hatfield *et al.*, 1994; Kelly and Barsade, 2001; Barsade, 2002).

What is significant about emotional contagion, or *primitive empathy*, is that it is non
conscious, automatic, as well as “startlingly fast” (Hatfield et al. 1993; 1994). Hatfield et al. (1993, p. 96) define emotional contagion as “the tendency to automatically mimic and synchronize expressions, vocalizations, postures, and movements with those of another person’s and, consequently, to converge emotionally.” And remarkably, people can do this with a “startling number of emotional characteristics at a single instant.” (Hatfield et al. 1993, p. 97). It is in this way that people, whether in dyads or groups, are said to “catch” (Hatfield et al.’s term) the emotions of others. Furthermore, the process can be modified by a range of factors in that some people may be good senders and receivers of emotions while others are not.

In addition to studies that examined affect and its transmission in work groups there are also newer studies that explicitly link affect to organizational processes and outcomes, such as decision-making (e.g. Isen, 1987, 2001, 2004; Isen and Baron, 1991, and Ashby, Isen and Turken, 1999), traditionally considered the quintessential, rational-cognitive, activity that denies values or emotions in its operation (Lakomski and Evers, 2010). In educational administration, Herbert Simon’s theory of decision-making is a well-known example of this perspective.

Insofar as emotion states are hidden from view, people’s accounts of their innermost feelings, or the researcher’s interpretation of self reports and subsequent determination of perceived variance, even when triangulated across many studies, remain after-the-event linguistic constructions of what subjects believed their feelings were at the time. We do not have immediate access to the contents of our minds/brains but reconstruct, or retrofit, a (usually verbal) feeling account plausible for the situation or context in which it was supposed to have been generated (for discussion on words and feelings see Barrett, 2004).

Of fundamental importance in the present context is above all the conception of affect that lies at the core of discussions and to ask what we currently know about affect, or the emotions, as well as their connection to cognition (see Pessoa, 2008, for an extensive overview). In the following we therefore sketch some of the recent results in the scientific research on emotion (and cognition) that challenge traditional understandings.
Emotions, Somatic Markers, and Decision-Making

The resurgence of interest in researching the emotions has produced exciting theoretical, clinical, and methodological advances in our understanding of emotion (LeDoux, 1996; Damasio, 1996, 1999, 2003; Schmidt, 2003; Dalgleish, 2004; Niedenthal, 2007; Gendron and Barrett, 2009), and has given rise to affective neuroscience (Davidson and Sutton, 1995; Davidson, 2000; Lane and Nadel, 2000; Minsky, 2006; Dalgleish et al., 2009). According to this specialized branch of neuroscience there are several issues claimed in the traditional study of emotion that are in need of correction (e.g., Davidson, 2003). Some of these have appeared, or are implicit, in the affect-in-the-workplace as well as the emotions-in-education literatures. Two are singled out, as they are central: the claim that emotions can be studied from a purely psychological perspective, and that emotions are conscious feeling states.

We now know more about the neural circuits of emotion, and we know that they intertwine with those of cognition. Emotion circuits themselves consist of many different subcomponents, and emotion is no longer understood as a single monolithic process (Cacioppo and Gardner, 1999; Berridge, 2003). In this sense, as Davidson (2003, p. 130) puts it, “Anatomy is destiny”. The brain’s architecture and anatomy imposes powerful constraints on psychological theorizing, and these constraints in turn make possible new, and potentially more comprehensive explanations (McGeer, 2007).

The assumption that emotions are conscious feeling states is central to the traditional psychology models in the study of emotion integrally connected to the idea that emotions are discreet entities “with boundaries that are carved in nature.” (Barrett, 2006a, p. 28). It is assumed that subjects can report on their feeling states, implying that the latter are accessible to consciousness. We do know, however, that much of the affect we generate remains non-conscious, and rarely if ever rises to consciousness (e.g., Berridge and Winkielman, 2003). It follows that what we experience and can report hardly represents what really goes on in our brains and bodies. Modern neuroscientific research methods such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), electroencephalography (EEG), electromyographic (Niedenthal, 2007) and direct
neuronal recordings, hold considerable promise in capturing what does go on in our brains. Nevertheless, we remain “stuck” with asking people how they feel, and need additional measures to complement self-reports.

Another issue, which has exercised researchers’ minds, is whether the emotions are adaptive or dysfunctional. Following Darwin’s early work and subsequent evolutionary biology, evidenced in William James’s (1884) as well as John Dewey’s (1895) theories of emotion, contemporary research in affective neuroscience extends this early evolutionary view of emotions as adaptive. There is strong evidence that emotion is fundamentally important for making appropriate decisions for our own lives, and that of others. Indeed, the case is put more strongly in that rational decision-making is impossible without the benefit of the emotions. The most influential argument for this claim is Damasio’s somatic marker hypothesis (SMH) (Bechara, 2004; Bechara & Damasio, 2005. For critical comments see Dunn, Dalgleish, and Lawrence, 2005; Quartz, 2009).

In addition to many clinical studies of subjects with brain injuries, and experimentally well supported by the famous Iowa Gambling Task (Bechara and Damasio, 2005), the SMH proposes that the emotions have a fundamental role in human decision-making, traditionally portrayed as a kind of cost–benefit analysis of likely consequences of different options. The evidence provided by both experimental and clinical studies shows, however, that people tend to make decisions at gut level, driven by hunches and intuition rather than conscious cost–benefit calculations (for discussion see Lakomski and Evers, 2010). As Bechara (2004, p. 30) describes it, SMH “provides a system-level neuroanatomical and cognitive framework for decision-making and suggests that the process of decision-making depends in many important ways on neural substrates that regulate homeostasis, emotion, and feeling.” How this works goes something like this.

You contemplate a bad outcome in connection with a particular response option, let’s say you picture informing your deputy head that he is not getting the paid conference leave he was expecting, and you experience a bad feeling in your gut, the proverbial knot in your stomach. This is an example of how a somatic (soma=body) marker “marks” a body image. It immediately focuses your attention on the negative consequences of your planned action – not supporting the paid conference leave since you consider it unwarranted. The somatic marker serves as a
kind of alarm signal. As you know from previous experience, you may have rejected the action you had planned without giving it a second thought. Or you may not in light of what you think your deputy might say or do.

The point in having such an early warning system, according to Damasio et al., is that it shrinks the pool of available options for selection by eliminating at least one. This does not prevent a subsequent, conscious, cost-benefit analysis but this now proceeds with fewer alternatives to calculate. Damasio and colleagues argue that in this way decision-making is made both more accurate and more efficient. A negative somatic marker sets off a body alarm that gives you a “red light” while a positive somatic experience flashes a “green light”. Importantly, the advantages of positive or negative somatic markers are advantages of rationality in that the pre-sorting they facilitate saves human decision-makers from “combinatorial overload”, that is, by delimiting the potentially endless number of options to crunch through.

A second advantage for rationality is that somatic markers are linked to experience, and this means, they make reinforcement learning possible. Negative somatic markers tend to inhibit action, and hence may stop us from making a bad decision. In this way they might well buy us time for conscious deliberation. If we had not evolved such internal, non-conscious alarm systems, overtly experienced in our gut, by our sweaty palms, or increased heart rates, decision-making would not be possible at all as we would not have any awareness of what to attend to in our environment. In this sense somatic markers bias cognitive processes of decision-making.

If the somatic marker hypothesis is generally correct, then emotions are integral to decision-making and in the wider sense to any problem solving activity. They are part and parcel of all the neural machinery that enables humans to make choices and survive. In this sense emotions are rational (Dolan, 2002; Montague, 2006; Litt et al., 2008).

Given the previous, brief account of the neuroscientific evidence for the emotions, the intertwined relation between emotion and cognition, and the influence of emotion on group processes, the task now becomes one of integrating this knowledge into a plausible, workable, account of the role of emotion in group decision-making and problem solving (Litt et al., 2008; Thagard and Aubie, 2008).
Exploring Some Models of How to Gain Emotional Consensus in Group Decision - Making

There is often a significant gap between what we know about processes retrospectively and how we can use that knowledge prospectively. This is certainly the case with the expanding knowledge that neuroscience is providing concerning the computational processes and their supporting architectures that make for an understanding of the nature of emotion in decision-making. One standard, and powerful, way of diminishing this gap is to engage in the dynamic modelling of these processes. Sufficiently realistic models can then be used prospectively, or in counterfactual situations, as normative guides to practice, or for making predictions. In what follows we begin by examining the sort of modelling proposed by Thagard and Kroon (2006) in their paper “Emotional consensus in group decision making”.

This work builds on an impressive body of research that Thagard and his co-researchers have built up over the years on mathematical models of cognition. These models have been mainly of neural networks of the type called “harmony networks”. In making decisions about theory choice, a typical harmony network operates as follows. Each artificial neuron, or node, represents a hypothesis, with connection weights among hypotheses being used to represent relations of coherence or incoherence. One or more sources of input to the network, representing hypotheses that express data, model empirical support, while the network operates to maximize global coherence by computing a partition on the hypotheses into two groups: those that are accepted and those that are rejected. Two hypotheses are in the same partition if they cohere, and in opposite partitions if they incohere. Finally, the decision about which hypotheses to accept or reject, amounts to whether to assign a value of 1 or 0 as an activation level for a node given that evidence nodes have value 1 and cohere or incohere with other nodes. This assignment is determined by whatever is required to maximise the sum of the weighted product of all adjoining pairs of nodes. (For a detailed account of this sort of model, see Thagard and Verbeurgt, 1998.)

For computing emotional consensus, Thagard and Kroon (2006) build on the basic coherence model, but with important differences. First, whereas in modelling
cognition, an artificial neural network is conceived as modelling processes in a brain, in modelling emotional consensus, the model must look at links between brains. This sort of extension of neural network modelling is not unusual. For example, Hutchins (1995, pp. 243–262) links four networks representing cognition in individuals into an organizational network in order to test various claims about organizational learning. Second, the nodes now take on two types of values: an activation level representing degree of acceptance (they can be 1 and 0 in the partition case, or be of intermediate values), and one representing emotional valence, or degree of emotional attachment to the hypothesis. This is an example of the (ep, em) pairs discussed earlier. In the case of coherence relations, the activation of one node is transmitted to another by weights reflecting inferential affinity. In the case of emotional valences, transmission is achieved by a number of different mechanisms. With contagion, the sender’s valence concerning possible action–representing nodes is transmitted to the receiver. With altruism, the sender’s valence concerning a node representing a goal is transmitted to the receiver. And with means–ends reasoning, the receiver sees a greater attractiveness of the goal.

In applying the model, called HOTCO3, emotional consensus is deemed to be reached when patterns of emotional valences among individuals converge. Unfortunately, the way the model operates, it seeks consensus among pairs of individuals first. That is, group consensus, where it occurs, emerges methodologically out of a sequence of pair–wise convergences. One important consequence of this modelling exercise is that the order in which the sequence of pairs occurs matters, both to the nature of the consensus reached, and also to whether consensus is reached at all. As the authors remark, “... meeting order strongly affects the time needed to reach consensus, as well as whether consensus is reached at all” (Thagard and Kroon, 2006, p.100). Although this model is a significant development in attempts to capture key features of emotional consensus, its account of the dynamics of human interaction and communication needs to be strengthened. The reality of most group negotiation and bargaining situations is far more complex than is represented in a model that assumes pairs, i.e. two individuals, as its base. We hinted at this complexity in the example of the Board members who needed to decide on a solution for the student attrition problem. More on this important point will be said later.
Nevertheless, there is important work that has been accomplished on the nature of contagion in large groups, and how this might be mathematically modelled. The discipline that deals with this topic is known as social network theory, and its associated mathematics is graph theory. Neural networks are graphs – patterns of nodes connected by paths – and so are social networks. A considerable impetus for the mathematical study of social networks was given by the discovery of “small worlds” by Watts and Strogatz (1998). Imagine a network consisting of an array of nodes variously connected to each other by paths. This network can be described, in part, with reference to two important properties. The first is distance. This is the number of paths one can travel along to get from one node to another. The average path length expresses this for the whole network. The second is the clustering coefficient. It comes in two varieties. The local clustering coefficient for a node in an undirected network (one where the direction of the path does not matter) is the number of paths that connect it to its nearest neighbours divided by the total number of paths that could exist between these neighbours. The average clustering coefficient for a network is therefore the average of all these local clustering coefficients. A small world network is one that has the properties of a low average distance and a high average clustering coefficient. (See Evers, 2012, p. 70)

In the context of social networks, the study of contagion focuses on the conditions for the spread of ideas, beliefs, practices, and theoretically, emotions. Modelling transmission through a network, therefore involves examining different conditions for the activation of adjoining nodes. This might consist in a threshold proportion of neighbours that need to be active before a node becomes active (or switched on) and a threshold level of activation that is required to influence a neighbour. Watts and Dodds (2007) undertake such modelling in examining the matter of whether the social diffusion of ideas in a social formation is the result of “influentials” – those better able to cause the adoption of ideas in others – or some other cause. They conclude that:

... the influentials hypothesis is in some important respects a misleading model for social change. Under most conditions, we would argue, cascades do not succeed because of a few highly influential individuals influencing everyone else but rather on account of a critical mass of easily influenced individuals influencing other easy-to-influence people (Watts and Dodds, 2007, p. 445).
It may well be that this kind of small worlds modelling, at least in principle, gives us our best theoretical approximation to date of how emotional contagion, as previously described, works between real biological actors. A further application of social network models, in what is called social epistemology, is to understand the sorts of conditions under which social formations, groups, or organizations learn. While we have not spent time discussing the need for organizational actors to learn, especially when organized in small groups, it is important to make some comments here, albeit briefly. Advocated by Dewey (1916) in what amounted to a defence of (his version of) democracy, there are two central conditions he identified for the growth of knowledge. The first was within-group peer support. The second was between-group diversity. He thought that this would maximise the development of ideas within the context of maintaining diversity in order to prevent ossification and promote innovation. Where these conditions apply, it may well be sufficient for a group to reach a consensus based on the majority of members’ views rather than striving for complete agreement, as we noted earlier.

In organizational group contexts this means establishing conditions that prevent “Groupthink”, a concept initially introduced to organizational theory by Irving Janis in his classic study *Victims of Groupthink* (1972), revised and expanded in 1983. Based on historical case studies, Janis’s basic idea of Groupthink, the act of interpreting evidence, come what may, as being in support of a favoured theory, is technically better known today as confirmation bias. Confirmation bias truncates learning by rendering theories methodologically immune to criticism. Where evident, it leads to what Janis called “defective” decision making resulting in poor policy outcomes. But facilitating new ideas while striving for agreement is essential for organizational growth and survival. This requires conditions and social arrangements that actively foster the freedom to criticize, an idea developed in Popper’s social epistemology (1957). The growth of knowledge “depends very largely on political factors; on political institutions that safeguard the freedom of thought: on democracy” (Popper, 1957, p.155).

In his simulations of organizational learning, Hutchins (1995, pp. 243-262) formulated an instance of this problem by modelling the effect of strong leadership on learning and decision-making. The results were instructive. A social network
containing an individual, who could strongly influence others in their choice of a theory, enhanced the network’s capacity for decision-making but at the expense of its capacity for learning. The leader’s views became the principal source of confirmation bias. On the other hand, in an organization of equals, decision-making became attenuated, but the network was much more resistant to confirmation bias.

Within the literature on social epistemology, the influence of a strong leader is referred to more generally as the “the Royal Family effect”. In a recent paper, Zollman (2007) has undertaken a variety of computer simulations of network learning for a number of different network architectures. We consider two sets of his findings, the first being for three of these architectures, each containing the same number of individuals. The first network is a cycle, with each node joined by a path to only its two adjoining neighbours. The second is a wheel, which is like a cycle except that there is one node at the centre connected to all other nodes. The third is a complete graph, where every node of a cycle is connected to every other node. In doing the simulations, a trade-off, similar to the one noticed by Hutchins, was observed. The cycle was the most efficient learning configuration, followed by the wheel and then the complete graph, and this held up for networks of many different sizes. However, the speed with which the networks reached their results was the reverse. The complete graph was the fastest, followed by the wheel and then the cycle. In general, “the trend seems to be that increased connectivity corresponds to faster but less reliable convergence” (Zollman, 2007, p. 580). In terms of confirmation bias, it looks like the greater the amount of connectivity, the greater is the capacity for a Royal Family to exert its influence. This interpretation seems to be borne out by the second set of simulations.

These simulations examined a variety of network architectures that differed primarily on degree of connectivity: five that were minimally connected and five that were strongly connected.

An inspection of the five most reliable and five fastest networks suggests that the features of a network that make it fast and those that make it accurate are very different.... Four of the five most reliable graphs are minimally connected – that is, one cannot remove any edge without essentially making two completely separate graphs. Conversely, the five fastest graphs are highly connected.... (Zollman, 2007, p. 583).
Again the basic trade-off was one of accuracy versus speed. The most sparsely connected networks performed most robustly against error, or the effects of getting locked into a false view. The comparison with Dewey’s social epistemology is useful, as Zollman (2007, p. 586) concludes that where accuracy of learning is important, the sort of architecture that works best is one where there are groups of highly connected individuals, but the groups themselves are relatively sparsely connected. This is exactly the architecture of Watts and Strogatz’s (1998) small worlds.

The sorts of trade-offs discussed here highlight a basic challenge in securing emotional consensus in decision-making. If consensus is all that matters, then a large increase in the number of communication links among individuals is the strategy to follow. A “group mind” will emerge more rapidly from this arrangement than from a less connected arrangement. However, securing the quality of the decisions being made counsels fewer connections so that the network exhibits more inertia when it comes to coping with the influence of false views. Under these conditions, consensus may still emerge, but it will be slower to do so. (Evers, 2012, pp. 70-71.)

So what is the best architecture for a decision-making group, and set of procedures to follow that yields the best decisions? Since answers will vary according to factors that figure in choosing an appropriate trade-off for speed and accuracy, some general perspective on the problem will help. All epistemic and deliberative decision-making engines (including groups) have to resolve a fundamental issue known as the stability-plasticity dilemma (Grossberg, 1987). The group needs to avoid too much stability, lest it become easily entrenched in one view and hence suffer confirmation bias. It also needs to avoid too much plasticity lest each emerging consensus be washed away by every piece of new evidence or every new argument. Emotional attachment to ideas is clearly a feature of this dilemma.

In view of the limitations of the current formal models for fitting together emotion with epistemic or decision-making progress in-group contexts, what initial practical conclusions can we offer education and other organizational practitioners?
Conclusion

While emotion is constitutive of good reasoning and rationality an emotional consensus and a good decision may not necessarily go hand in hand. The picture of the motivational education consultant comes to mind who has been invited to address the senior school staff on, say, the issue of emotions in education, and who gets the group all fired up about a plan of action. But come Monday morning, the decision turns out to be unworkable. Or, the senior leadership team might have formed a strong emotional consensus to admit more students with special needs as the school already has an enviable record of exceptional caring for such students. However, the additional resources required in terms of space and teaching staff will put severe constraints on the school’s actual ability to add more students with special needs. An emotional consensus, no matter how strongly felt, does not add up to a good decision. These are just some examples of real, everyday decisions schools and their decision making bodies and groups face.

Regrettably, the modelling of both criticism, essential for avoiding error, and consensus, desirable in reaching outcomes as indicated above, is at the moment, beyond current models, as we argued by way of Thagard’s HOTCO3 that is based on pairs not groups. And one’s choice of architecture will be complicated by any differences that are present in securing the kind of global coherence that both emotional consensus and efficient learning and decision-making require. To guide these considerations would require the emergence of models that incorporate both the processing of learning in networks and the propagation of emotional valences. This is at present beyond the reach of computational capabilities.

However, we can nevertheless suggest two essential heuristics that could be adopted. First, decision consequences matter, as we indicated in the introduction, and as is evident in the examples we described. A rapid consensus over a group’s choice of tea is one thing. Deciding to merge with the girls’ school, add more students with special needs, fire the school’s business manager, invade a country, or find the accused guilty or not, are entirely different matters. In these cases you would want well-developed scenarios that could be pitted against each other. An architecture of loosely connected groups of highly connected individuals would help. Or if deliberation is being done in just one group, such as the senior leadership team,
follow Raiffa’s (2002, p. 403) suggestions: “First, generate ideas in isolation ... Second, generate ideas together ... Third, evaluate, criticize, and improve”. For example, get the team members to come up with ideas individually and independently; generate ideas when together as a team, and then discuss the results critically in order to improve the ideas or solutions put forward.

The second heuristic says it is better to have emotional commitment to procedure than to particular outcomes, to the testing of ideas than to the ideas themselves. This means instilling or reinforcing the fundamental importance of open discussion and critique where everyone’s ideas can be voiced without fear or favour, in other words, abandoning what Argyris (1990) called “organizational defense routines”.

As the process of criticism is fundamental to both the growth of knowledge, good decision-making or problem-solving, formal or informal mechanisms for criticism are essential. Here are some heuristics from Wessel’s (1976) Rules of Reason (quoted in Raiffa, 2002, p. 408):

Data will not be withheld because they may be “negative” or “unhelpful”.  
Concealment will not be practiced for concealment’s sake.  
Delay will not be employed as a tactic to avoid an undesired result.  
Dogmatism will be avoided.  
Hypothesis, uncertainty, an inadequate knowledge will be stated affirmatively – not conceded only reluctantly or under pressure.

He gives many more, all designed to promote a group culture of procedural criticism for the impartial testing of ideas. Principals concerned with fostering the nature and quality of group decision-making may well wish to adopt the above principles and strive to make them central to their school’s culture. As we observed earlier, it is still early days in the development of models that can play a powerful prescriptive role in decision-making. We have, however, suggested some fruitful theoretical ways in which the discussion might proceed. We have also given school and other organizational practitioners some suggestions on how to go about enhancing the quality of problem solving and improving group decision-making.
References


Berridge, K. C. & Winkielman, P. (2003). What is an unconscious emotion? (The


*Brain and Cognition*, 52, 3

Schulkin, J., Thompson, B. L., & Rosen, J. B. (2003). Demythologizing the emotions: 
Adaptation, cognition, and visceral representations of emotion in the nervous system. 
*Brain and Cognition*, 52, 15–223.

Springer

*Educational Psychologist*, 37(2), pp. 67–68.


Schutz, P.A. and DeCuir, J.T. (2002). Inquiry on emotions in education, 


inference, in E. Millgram (Ed.) *Varieties of Practical Inference*. MIT Press, 
Cambridge, MA.


*Mind and Society*, 5, 85-104.

cognitive appraisal and somatic perception interact to produce qualitative 

*Nature*, 393, 440-442.

Watts, D. J. and Dodds, P. S. (2007). Influentials, networks, and public opinion 


Correspondence to:

Professor Gabriele Lakomski
Centre for the Study of Higher Education, University of Melbourne
Level 1, 715 Swanston Street, Victoria 3010 Australia
Email: lakomski@unimelb.edu.au

Professor Colin Evers
School of Education, University of New South Wales
Sydney, NSW, 2052, Australia
Email: cw.evers@unsw.edu.au