

Emotional Dynamics of Cyber Conflict

One of the most challenging aspects of the debates around cyber security and cyber conflict involves translation issues between those on the policy side, who tend not to understand the technical issues very well, and the technical computer specialists, who tend not to be very interested in, or knowledgeable about, any potential political implications of their work. For example, Mark Zuckerberg called the notion that the Russians used Facebook to interfere with the American presidential elections “crazy” in November, 2016. He has since been forced to express regret for that comment, and apologize for the way Facebook facilitated Russian interference, repeatedly. One of the consequences of the gap between coders and politicians in their cross cutting dialogue is that some issues can end up falling through the cracks.

One of the most important of these involves the role of emotions in decision making writ large, and their potential influence on the cyber domain in particular. The public and political uproar around Facebook’s role in Russian interference in elections represents only one recent prominent example of this phenomenon. This neglect poses great peril, since emotional factors are arguably the most essential in driving not only decision making in general, but actual behavior as well, in all areas of life. This is likely even more relevant in the area of cyber conflict because of the chronic strain imposed by the “persistent engagement” that the cyber arena now demands from decision makers. The constant sense of uncertainty, fear, anxiety and foreboding which surrounds these issues heightens the importance of emotional managements in addressing these concerns.

This paper constitutes an initial attempt to begin to understand the influence of emotions on decision making in the cyber realm, although it is necessarily far from complete in its discussion of many of the relevant issues. Several elements of cyber conflict, including secrecy, overlap with other kinds of conflict, while other aspects, such as the speed of computation, present unique and novel challenges. In order to examine the effect of emotion on decision making in the cyber realm, it is important to first briefly discuss the ways in which emotion can affect decision making in general, before turning to the impact of specific emotions on the cyber realm in particular.

The nature of emotion will be discussed in much greater length below, but first it is important to identify which emotions are being addressed. Most psychologists agree that there are seven basic emotions: fear, anger, happiness, sadness, disgust, surprise, contempt. Based on foundational work by Darwin (1998), Ekman (1992) notes that these basic emotions demonstrate near universal recognition of facial expression (Ekman, 1993) as well as distinct underlying physiology which demonstrates a biological basis for them. Note that only one of these emotions, happiness, would be characterized as a “positive” emotion, illustrating the privilege that evolutionary pressures have put on systems which warn of potential dangers, and the value that such alerts must have offered for human adaptation and survival in order to have been so differentially preserved.

In the cyber area, one of the potentially most important, and understudied, emotions relates to the influence of surprise on judgment and decision making. Because cyber issues are characterized by a great deal of uncertainty as well as time urgency, surprise, as well as the more expected reactions of fear, anxiety and anger, is likely to shape the nature of decision making in decisive and often predictable ways.

Because the effect of emotion on judgment and decision making, as well as actions, are not specific to the realm of cyber space, this examination begins with a broader discussion of more recent literature in psychology and neuroscience on the effect of emotion on both choice and action (for the best recent reviews, see Lerner et al., 2014 and Phelps et al., 2015). It then proceeds with a more specific application of the influence of specific emotions on issues in cyber conflict. It concludes with some of the possible political implications that follow from a fuller recognition of the role of emotions in conflict more generally, regardless of domain.

The Role of Emotion in Judgment, Decision Making and Action

As with any discipline, psychology has its fads. The arguable founder of the entire discipline, Freud (2005), was very much pre-occupied with the power of emotions on human behavior, but his notion of emotion was very narrowly circumscribed to drives toward sex and aggression, and, later, in an attempt to understand the carnage of the First World War, an attraction to death. Because later psychologists reacted against the overly restrictive simplicity of this characterization, and were attracted to, and influenced by, the behavioral models presented by Skinner (1953) in particular, the role of emotion in psychological investigation largely went into abeyance until the 1960s. When counter-culture reactions to the Vietnam War spawned the human potential movement, psychologists such as Carl Rogers (1995) and Rollo May (2009) brought emotions back into the study of psychology in a more positive and holistic, if clinical, way. However, the technology of the time did not allow for a way to open the ostensible black box of the human brain. As a result, behavioral studies attempted to ascertain the workings of the human mind, and so the cognitive revolution came to hold sway in the coming decades, reaching its apex with the Nobel Prize winning work on Prospect Theory developed by Amos Tversky and Daniel Kahneman (1979) in the latter parts of the 20th century. Around this time, developments

in functional magnetic imaging technology were starting to allow for an entirely new kind of access to brain processing, and a renewed interest in emotion accompanied the astronomical increase in dependence on MRIs for psychological inquiry, not least because the early and enduring findings consistently revealed the way the brain vastly privileges emotional over abstract information in both speed and influence. This does not imply that the earlier work on cognitive bias was wrong in any way; rather, the work on emotion complements the earlier work to provide a more comprehensive view of human decision making processes.

As a result of MRI technology, in concert with concomitant theoretical shifts into more evolutionary modeling, the psychological literature on emotion has burgeoned since the turn of the century. As Lerner et al. (2015) show, the scholarly literature on emotion and decision making alone doubled between 2004 and 2007, and doubled again between 2007 and 2011. In addition, work on emotion increased by an order of magnitude between 2001 and 2013 as a share of all work on decision making. As Lerner et al. (2015) state, “Indeed, many psychological scientists now assume that emotions are, for better or worse, the dominant driver of most meaningful decisions in life.”

This does not mean that this vibrant literature is not characterized by extremely contentious debate. It is. As with any new field, the absence of consensus models in many areas have encouraged a great deal of work and some heated disagreements. But this does not mean that some area of consensus have not emerged. They have. Of course the traditional understanding in western political thought for several centuries has not only privileged rational thought over emotional feelings, but has also tended to understand these experiences as distinct and independent, whether characterized by the more traditional division between so-called “hot” and “cold” processes (Janis & Mann, 1977), or the more recent instantiation provided by

Kahneman (2011) as System 1 and System 2. But at least since the ground-breaking work of Antonio D'Amasio (2005), showing the dependence of seemingly rational calculation on emotional processing, it has been clear that these processes are not distinct, but rather inextricably intertwined and interactive in nature. This empirical demonstration, of course, fits hand in glove with theoretical models regarding the intrinsic role of emotion undergirding all sorts of cognitive and physiological processes drawn from evolutionary psychology (Cosmides and Tooby, 2000).

Although the current paper can in no way provide a comprehensive review of the literature on emotion, which is far too vast now to cover in any single application, several aspects of this research are clearly relevant to understanding the influence of emotion on decision making in the realm of cyber conflict and thus deserve some explication here. The discussion below begins with a few basic points of widespread agreement, noting important controversies where they exist, and then proceeds to a more specific discussion of the influence of particular emotions, such as surprise, on choice.

The structure and function of emotion

First, while older models which applied work in psychology to political science (Marcus et al., 2000) tended to rely on so-called “valence” models, which presented emotions as largely positive or negative, or restricted emotions to a very few specific ones such as fear and enthusiasm (which the vast majority of psychologists would not even characterize as a basic emotion), the current consensus, relying largely on the neuroscientific work, advocates for “multiple modulatory circuits.” (Phelps et al., 2014). This basically means that emotions are best understood as discrete, separate mechanisms which rely on distinct neural brain circuits. These circuits can overlap and different ones can be recruited in various ways to create emotions for

different purposes, but they cannot accurately be seen as general in the way valence model would suggest, nor can they be properly understood as vaguely positive or negative.¹ Furthermore, and importantly, these specific emotional mechanisms are not distinct from so-called “rational” thought; rather, as D’Amasio (2005) suggested, emotions provide the foundational base upon which all decision making must take place for it to occur at all, much less appear rational in form. In short, emotions are inextricably intertwined into all decision making. Cognition which might appear “rational” on its face simply could not exist without an emotional foundation.

Second, as noted above, most psychologists working in this area see emotions as the prime motivating force in shaping behavior as well as choice. In other words, distinct emotions motivate very particular, specific acts. As Zeelenberg et al. (2008, 21) argue in their feeling-as-doing model explaining the importance of having multiple emotional states at our disposal, “We think that this variety of feeling states exists for the sake of behavioral guidance. The specific emotion felt in a situation indicates a particular problem and prioritizes behavior that deals with this problem. Because different problems require different solutions, different emotions produce different behaviors.” This model offers a forward looking perspective, seeing emotion as something that helps drive action going forward, and thus differs in at least one important way from models which treat emotions mostly or exclusively as informational (Loewenstein et al., 2001), facilitating inferences based on feelings. The feeling-as-doing model argues that emotions serve a very specific behavioral purpose to help people achieve their goals, marshal attention and direct energy toward solving specific problems or achieving particular goals. Informational

¹ Longer term mood states can take on a more general negative character, but background mood states are distinct from shorter term emotional states such as those discussed here. However, the effect of longer term moods on memory are not trivial, and will be discussed at greater length below.

models do not necessarily incorporate the same motivational component into their understanding of the purpose and function of emotion.

One of the interesting things about the neuroscientific and motivational perspectives on emotion is that they converge in their evolutionary understanding of the role of emotions in facilitating decision making (Cosmides & Tooby, 2000). This model interprets emotions as a kind of overall operating system which helps direct various physiological and psychological processes for specific purposes, helping to make quick and effective sense of the enormous amount of information we have to process from the world around us, shaping choice, and guiding behavior. In this way, emotions help individuals figure out which internal and external risks pose the greatest threat, and help determine which resources are needed to respond best to the most pressing concerns in order to maximize the probability of survival. Those responses which proved most adaptive when confronting repeated environmental and social challenges became instantiated in human biology over time through the process of natural selection. From this perspective, emotions are understood to offer time-tested responses signaling the most adaptive psychological and behavioral response to a given situation (Fridja, 1988; Levenson et al., 1994). Thus, emotion saves cognitive load by coordinating an entire suite of automatically triggered physiological and behavioral responses that are designed to respond quickly and effectively to immediate problems or opportunities. Fight or flight instinctual responses can be intuitively understood in this way: anger stimulates the drive to fight; fear encourages flight. Emotions accomplish these objectives not only by prioritizing goals, but also by helping to determine appropriate actions when confronting different but specific kinds of challenge or threat (i.e. it is more important to run away from a fire than to sit down and have a meal). In addition, the specific nature and function of a particular emotion shapes information seeking strategies.

That is, emotions help figure out what kinds of information needs to be gathered when confronting a particular challenge or opportunity. Such strategies can include things like deciding which conceptual frameworks should be applied to a particular problem. For example, if a person is angry, then issues of agency, responsibility, fault, punishment, or rehabilitation will become salient (Lerner & Keltner, 2000). Once revenge is activated, strategies of deterrence are activated and so on (McDermott et al., 2017). These emotional responses also entrain various aspects of perception, memory, physiology, learning and communication as well as action (Cosmides & Tooby, 2000), depending on the particular nature of the environmental or social challenge. Specific emotions will thus activate and employ different but predictable modular suites of response based on what is necessary to overcome a given challenge.

Third, emotions should not be understood as heuristic processes in the same way that the Kahneman and Tversky judgmental biases are represented (Lerner et al., 2015). Although emotions evolved to allow humans to respond in a quick, automatic, and largely efficient manner to challenges which have repeatedly confronted humans over time, they can sometimes induce greater reflection and deeper processing, as is most often the case with sadness. In this way, emotions are not always bad in the way they have often been represented. Neither are they always good. Rather, their influence can improve or degrade decision making based on the specific emotion and the particular context in which a given decision must be made. Problems arise when the effect of emotions are unconscious or unacknowledged, and thus their influence on decisions can go unrecognized. In addition, problems can emerge when emotions are misaligned with the specific nature of the challenge being confronted; for example, when someone responds with more anger than a situation demands, that emotional response can serve to inadvertently escalate a crisis.

Emotions can also pose challenges to a decision maker when they are undesired. Unwanted emotions can prove particularly nefarious because they are so very difficult to excise; effort alone rarely works to expunge their vice grip over attention (Hartley & Phelps, 2010). Recent revelations about the ubiquitous nature of sexual harassment, for example, serve to illustrate how many men find it impossible to restrain sexual response in professional settings.

Finally, it must be noted that one of the most important functions and roles of emotion results from the profound, immediate, automatic and effortless way in which it facilitates social communication (Pieters & Raaij, 1987). Anyone who has listened to a baby cry knows the power and automaticity of the emotional pull to do whatever it takes to make the baby feel better and thus stop crying. Emotion lets others know what we need, and what we can offer. The accuracy and efficiency of this form of communication is all the more universal and powerful for its often non-verbal aspect. Crying does not have a language; we all know what it means across cultures. The cross-cultural recognition of basic emotional expression demonstrates the universality, utility, effectiveness and efficiency of emotional signaling (Ekman, 1993); the same certainly cannot be said for logical, rational arguments which are highly constrained and circumscribed by language, culture, custom and power differentials. Immediate, clear and universal emotional signaling serves a very valuable purpose which facilitates cooperation more quickly and effectively than anything invented by humans, and for good reason. Cooperation offers one of the most important advantages that humans have over most other animals; our ability to develop an automatic form of non-verbal signaling to provide effective and immediate social communication fostered and facilitated the foundation for such interdependence, and ultimate domination of the planet.

The influence of emotion on decision making

As noted above, although traditional understandings tended to rely on dual role notions of emotion and reason, as represented by hot and cold processing models, the modular system advocated by evolutionary models appears more consistent with the neuroscientific investigations of these phenomena. As Phelps et al. (2014) write:

Although the prevalent view of emotion and decision making is derived from the notion that there are dual systems of emotion and reason, a modulatory relationship more accurately reflects the current research in affective neuroscience and neuroeconomics. Studies show two potential mechanisms for affect's modulation of the computation of subjective value and decisions. Incidental affective states may carry over to the assessment of subjective value of the decision, and emotional reactions to the choice may be incorporated into the value calculation. In addition, this modulatory relationship is reciprocal: Changing emotion can change choices. This research suggests that the neural mechanisms mediating the relation between affect and choice vary depending on which affective component is engaged and which decision variables are assessed.

There are several very important aspects of this brilliant summary worth further discussion. First, incidental affective states, including long term moods completely unrelated to the question or problem at hand, can decisively influence the content of the choices people make, often completely outside their awareness. This is similar to the phenomena Kahneman and Tversky (1979, 1984) documented in terms of the effect of framing on choice; the order of presentation of options alone significantly influence the content of the choices people make. In the realm of emotion, the same is true but the effect is rendered by transient or background emotion rather than word choice. But specific emotions can nonetheless affect the substance of choice in similarly unconscious ways.

Although older work examined the effect of mood on memory, indicating that current mood influences the relative accessibility of past events that were mood-congruent (Bower, 1981), more recent work has extended this approach to examine the effect of mood on various kinds of risk taking behavior. Here again, Phelps provides the most succinct summary:

Numerous studies have shown that moods also influence risky choices. For example, sad moods can increase preferences toward high-risk options, whereas anxious moods bias preferences toward low-risk options (Raghunathan & Pham 1999). Consistent with this concept, fear results in less risk seeking and anger results in more risk seeking (Lerner & Keltner 2001). Finally, positive moods can exaggerate the tendency to overweigh losses relative to gains (i.e., loss aversion) in risky gambles (Isen et al. 1988), and some of these effects of mood on risky decisions may vary by gender (Fessler et al. 2004).

These factors can influence choice in all kinds of ways, but for our purposes, one of the most important may be the way that mood can influence choice through a process known as affective priming (Winkelman, 2005). This simply means that an emotional cue, even one as simple and ubiquitous as an emoji, can shift the content of choice, often below our awareness. In this way, emojis and other subtle forms of emotional manipulation, constitute a form of passive intervention, often affecting millions of people. It is easy to see how this can happen since the same words can mean different things depending on the tone in which they are delivered; a remark that might seem hostile becomes humorous if followed by a smiling face. The idea here is that an emotional cue can influence a choice by shifting the appraisal of the event or subject under consideration, as well as its relative value. Introspection can make sense of this seeming anomaly; if you are very sad, even something that might ordinarily seem valuable like food quickly loses its appeal. This example may seem extreme, but similar dynamics occur with less intensity when incidental or background emotions influence the assessment of options and their relative value to a decision maker.

This area of so-called appraisal tendency is where the neuroscientific literature most closely aligns with the social psychological approach to the influence of emotion on decision making. The basic consensus notion is that moods, or more discrete emotions in the case of appraisal theory, carry over into an evaluation of various choices, options and decisions. In other

words, the mood or emotion, more than any objective assessment of the probability or utility of the choices, can influence the value attached to each option. Clearly, this process can make decision making easier if we only need to refer to an instinctual sense of how we feel to make a choice; we do not have to do the extra cognitive work to make a deliberative decision.

This characterization should hold up to the mirror of introspection as well for anyone who has tried to make a decision on an abstract problem while preoccupied with overwhelming worry about a sick relative. The problem, much less the choices, just don't seem to matter much relative to the worry, the ostensible difference between options shrinks, and the relative difference in possible outcomes don't appear to have much value relative to the overwhelming sense of worry and anxiety. In such cases, the decision made will have little to do with the objective content of the choice, but everything to do with the incidental emotional state in which the decision is rendered. And, remember from above, this does not mean emotion is destructive. Indeed, it is fulfilling its primary function, which is not economic. Rather, this emotion is serving its larger purpose; it is designed to force individuals to focus on those larger factors that over long swaths of human history proved most important in facilitating human survival. And this will almost always privilege the maintenance of social networks, which remain key to cooperation and survival, over any abstract problems or threat. Specific emotions like fear or anger may feel maladaptive in any current moment, or interfere with some particular decisions, but the example above regarding a sick relative shows how they still serve a larger purpose: the health and well-being of close relatives is much more important for our personal survival than any seemingly abstract problem. Because of how emotion privileges that which is most important for our long term survival, and not what is most important for our immediate professional concerns, even intellectual awareness of the misalignment between historical and

current pressures will do little to overcome the endogenous somatic power of instinct, particularly under conditions of stress or time urgency. This also means, of course, that a problem that appears abstract, but which may in fact affect our survival, such as decisions related to weapons of mass destruction, may not receive the attention they objectively deserve. This is where the misalignment of emotion and threat can prove counter-productive in the opposite direction.

The second best known, most studied, and most relevant of the incidental states besides mood that can affect decisions is stress. Of course in the past, stress may have come in the form of animals, predators or more direct physical threats from the environment, and indeed we are once again increasingly confronting the kind of climate threats that would have also proved deadly to our ancestors. But, in more modern circumstances, enormous numbers of humans bathe daily in a kind of overwhelming psychological stress that is absolutely endemic, threatens optimal decision making and, when continuing, can threaten health. This stress has a hormonal basis and output in cortisol levels, among other things, which directly affect brain functioning. And the longer stress persists, the more it leads to negative health outcomes and burnout, making individuals less attentive to decision making in general (Sapolsky, 2004).

Although many of the stress models come from animals, systematic patterns have been witnessed in humans as well. Stress can come in many forms from acute to chronic, and individuals hugely vary in their individual capacity for operating under stress, or for remaining resilient in the face of it. Most of the work on the effect of stress on human decision making looks at how stress affects the calculation of immediate versus long term choices. In general, stress causes people to focus much more on immediate outcomes and discount future

possibilities. Stress also makes people more ego-centric, and less generous. Once again, Phelps et al. (2015) offer the most succinct summary of this literature:

Several studies have examined the impact of stress on tasks of risky decision making, although the nature of these findings varies depending on a number of factors... the impact of stress on risky decisions may depend on the level of risk (von Helversen & Reiskamp 2013) and may interact with gender (e.g., Preston et al. 2007, Lighthall et al. 2009). As this series of studies indicates, there are likely several decision and individual difference variables that will need to be disentangled to determine how stress may influence different aspects of risky decisions. The only brain-imaging study on stress and risky decision making to date (Lighthall et al. 2012) used a task in which participants earn points for inflating virtual balloons but must “cash out” before the balloon explodes or risk losing their points. Consistent with earlier findings (Lighthall et al. 2009), this task demonstrated a gender interaction: Males were more risk seeking, and females less risk seeking, following the stressor... Limited research in other decision-making domains has examined the impact of stress. Studies of intertemporal choice have found that stress exaggerates the tendency to discount future rewards in favor of smaller immediate rewards (Kimura et al. 2013) or that this effect depends on the level of perceived stress (Lempert et al. 2012). Studies of moral decision making find that stress decreases the likelihood of making utilitarian judgments in personal moral decisions (i.e., inflicting harm to maximize good consequences; Youssef et al. 2012) and correlates with egocentric moral decisions (Starcke et al. 2011). Finally, stress results in more prosocial decisions (i.e., more trust and less punishment) but less generosity as well (von Dawans et al. 2012, Vinkers et al. 2013). Most of these studies hypothesize that their findings could be attributed to the impact of stress on executive control and PFC function, although direct evidence of diminished PFC involvement due to stress is lacking.

Thus, mood and stress provide the main ways that incidental background emotions can influence the evaluation of options, as well as decisions. But as Phelps indicated in the overall summary which started this section, the second major way in which emotion can influence decision making occurs after choice, in reaction to it. So the first issue relates to how emotions affect choice prior to decision making, but the second relates to the reciprocal effect of choice on emotion, which can then exert an influence on subsequent choice sets, since few decisions are truly isolated, and instead involve many additional sequential choices. In other words, we make a choice and how well or badly that choice turns out, and how we feel about it, will then influence the next choice we make. It thus becomes easy to see how positive or negative cycles

of decision can cascade. Importantly, the fact that we know that decisions can influence our choices means that our choices can be influenced by this anticipation; we are, for example, not going to want to make choices that we know will make us feel bad, and we may go out of our way to avoid making the kind of decisions which appear to offer no good outcomes, even if some are worse than others, at all.

The bulk of both the experimental and neuroscience research on emotion and decision making clearly show that emotion influences choice in systematic, powerful and often predictable ways. In short, emotions provide crucial, if often unconscious, cues that help in assessing the value of various choices. This means that if an emotion is changed for an unrelated reason, the decision that follows may also change without any commensurate shift in the probability or utility of options. A big promotion at work might induce risk seeking in an unrelated domain as result of happiness. But manipulating emotions externally by artificial means, particularly longer term moods, typically involves the use of drugs with side effects which may themselves influence decision making in inappropriate ways. Moreover, changing background stress levels, which can exert such a decisive incidental influence on choice, particularly in a crisis, is not always easy, simple or straightforward.

The vast majority of people experience emotions as reactions to external environmental factors over which they have no control, but in fact psychologists, and spiritual leaders among others, know that this not necessarily true. Rather, emotions are just as often things we do to ourselves as things that result from external events precisely because emotions are influenced by how we interpret the events we experience (Sherer, 2005). The world is often a construct of our own imagining, but then we react to it as though it reflects a shared reality. Emotions help us impose meaning on events, but specific reactions are not inevitable nor preordained. Emotional

reactions are rarely fixed, and cognitive emotion regulation, using various psychological strategies or meditation practices, can impose an element of control over the reactions we experience to external events (Hartley and Phelps, 2010; Lutz et al., 2008). Some of the mood manipulation techniques employed by experimentalists, from movies and mood music to candy, can work quickly and with great flexibility, but require thought and effort. This means they will not happen automatically, but also raises the possibility that external actors can manipulate decision makers, at least in the short term, without their awareness by manipulating their mood. This can happen quite easily by raising an issue known to upset or calm a decision maker in an entirely different domain, and watching the effect of incidental emotional arousal bleed over in a way that can decisively influence the response to an unrelated choice. And all of this can happen without the decision maker's conscious awareness of the manipulation.

Exacerbating Factors; Uncertainty and Emotional Contagion

Given that it is best to conceptualize the role of emotions as distinct to both the particular circumstance as well as the specific choice in light of the above discussion, it will be most productive to examine the influence of specific emotions on decisions rather than discuss vague general valence models or approaches. But before doing so, two additional orienting factors should be considered because they shape the environment in which cyber conflict in particular is most likely to occur.

The first factor relates to the impact of uncertainty on choice. Uncertainty is uncomfortable in any decision environment, even for the most routinized and risk-less choices imaginable. However, not all kinds of uncertainty are created equal. Slovic (1987) showed that some forms of risk are more upsetting to people than others. Specifically, people find so-called "dread" risks that are not well known, and thus considered a possible harbinger of worse

unknown things to come, to be much worse than those which are well known. The factors which characterized risks which were considered to be the most feared read like a laundry list of those which typically characterize cyber risks: “uncontrollable, global catastrophic, not equitable, high risk to future generations, not easily reduced, risk increasing, involuntary.” This means that the same or even lower objective level of threat from a probability standpoint will be widely understood and perceived, by both laypeople and experts, as constituting a worse, more dreadful, threat, than the same probabilistic threat posed by an older, better understood technology such as nuclear or chemical weapons.

This may prove particularly problematic in potentiating divides between the mass public and the concerns they have about cyber threats, and those national security threats considered most serious from a kinetic perspective by experts. The mass public may consider financial crimes and other forms of cyber-crime or cyber exploitation, or the increasing incidence of fake news and manipulation of the public through platforms such as Facebook, as posing the greatest threat to public welfare, whereas national security experts are likely much more concerned with securing the electrical grid or other major forms of national infrastructure, from foreign or hostile interference. Thus, the relevant public debates and concerns could easily come to center on emotionally based perceptions. If the greatest threat is posed by public discontent which risks open revolution, then perhaps manipulating public opinion on line does risk a greater threat to public safety and security than the dependability of public utilities. These questions may not be answerable, but make clear that the management of uncertainty itself when attacks on the internet could come at any time and we are in a “constant state of near ambush” becomes a critical goal in and of itself. One of the ways to potentially think about how to transform uncertainty into a more positive force is by considering the ways it might spark curiosity and

opportunity, as well as anger, depending on the nature of the context in which it exists, and the geopolitical decisions which require its mitigation.

The second factor relates to the issue of emotional contagion. More than in any other area, social media, facilitated by and through the internet, including international platforms such as Twitter and Facebook, allow for emotions to be transferred across millions if not billions of people (Kramer et al., 2014). The outrage on the internet is clearly evident every day, but fear and other strong emotional responses such as sadness or disgust could just as easily be communicated depending on circumstance. The reason this differs from other ways that information has been transferred in the past is both because of its immediacy and its scale. Transient emotions might not hold across the months or years it would take for something to get into print media, but emails and images can cross the globe in seconds on the internet, allowing millions of people to foster and sustain emotions that might otherwise peter out if more time occurred between send and response.

In addition, because of the reach of the internet, ideas and information no longer lie in the domain of elite, vetted discourse. Regular people can reach as many others as presidents on social media, allowing for unmediated forms of communication that circumvent the ability of leaders to shape or control. Authority becomes decentralized and devalued. This may be good or bad for democratization, depending on one's perspective, but the normative value is less significant here than the immediacy and scale of potential emotional effects. And indeed, if something ever happened to the internet itself so that it could not function as people have come to expect, it is not just that businesses would be instantly paralyzed, but the ground game would change immediately as well. If people are not able to be on their phones 24/7, they would both be very, very angry and upset and also have a lot of time on their hands that they used to put into

their phones. And they will mobilize to get their phones and communication platforms back because otherwise they would not know what to do with themselves. Such has become the hyper-connected, but technologically mediated, modern world. Everyone wants to be in constant, albeit mediated, contact all the time. The question is whether enough people retain enough social skills to be able to mobilize sufficiently in large enough numbers to effect change without the aid of technology.

Specific emotions: the influence of surprise, fear and anger

What emotions are most likely to affect discourse and decision making in cyber space, and how are those emotions likely to affect decision makers confronting conflict? There are many emotions that might influence decisions in the realm of cyber conflict, but, as noted just above, it is important to realize that elite decision makers may not be the only players in this drama should larger public effects resulting from such conflict become evident. Much work has been done on the effect of fear and anger in general, and this work is fairly well known (for a review, see McDermott, 2001). Lerner & Keltner (2001) found that anger makes people more optimistic and risk-seeking, while fear make them more pessimistic and risk-avoidant. In this way, angry people are more like happy people than fearful ones. However, certainty and control diminished the effect on these emotions on risk-taking, meaning that the risk reaction tendencies were more pronounced when the situations were more uncertain and less controllable.

One of the important things to recognize about fear and anger is that they do not simply represent inevitable or transient responses to particular situations. Rather, individuals differ systematically in their basic trait levels of fear (Hatemi et al., 2013) and anger (McDermott & Hatemi, 2017); these trait levels thus constitute individual variance in the incidental effect of these background mood states on decisions about specific issues. And most individuals remain

unaware of their tendencies in this regard, and are much less likely to be attuned to the trait based differences among and between them, making such influences even more endemic and insidious. In other words, most people think that others would and should respond to a given threat exactly as they do, without appreciating the way in which individual differences in background temperament can profoundly affect the threshold level at which a given individual experiences fear or anger. Some individuals are naturally more courageous or quick-tempered than others.

As intimated above, emotions serve a purpose, communicating and signaling needs, desires and intents. Anger, for example, signals a desire for others to change their behavior in favor of the angry person (Sell et al., 2009; Fisher & Roseman 2007) in order to right some real or perceived injustice (Solomon, 1993) As a result, anger produces more concessions in negotiations (van Kleef, 2004) and more cooperation in bargaining (van Dijk, 2006).

Interestingly, recent work has indicated the physically strong men (and beautiful women) are more prone to anger, and are more aggressive and more likely to support interventionist foreign policy plans and proposals (Sell et al., 2009). Sell et al., (2009) suggest that physically strong men have traditionally been able to exert their influence over others by inflicting costs, (and beautiful women have been able to do so by conferring benefits), in such a way as to force others to regard their welfare more highly than that of others. As a result, such individuals come to see anger and confrontation as an effective conflict resolution strategy because it has often operated in their favor against less formidable or attractive rivals. Additional work has shown that the human face has evolved to enhance cues of physical strength (Sell et al., 2014), and that people have developed very sophisticated adaptations for recognizing physical strength in male voices regardless of language (Sell et al., 2010). Other work also finds support for the notion that

angry people are more likely to support aggressive foreign policy choices, and also showed that dispositionally angry individuals are more likely to make utilitarian choices in morally complex decision making (McDermott and Hatemi, 2017)

Anger is particularly important because of the incidental effect it can exert on decision making. Angry individuals are more prone to blame others in another situations even if those others have nothing to do with the source of the anger (Quigley et al., 1996). Because this most often happens without awareness, it can prove particularly problematic in diplomatic negotiating and bargaining situations where compromise is often required to achieve a successful result.

By contrast, people who are fearful are less likely to take risks and are less optimistic in their judgment about the expected outcome of their choice, whereas people who are angry are more likely to take risks; this too has a gendered component, with men more prone to anger and women more likely to experience fear (Lerner and Keltner 2001; Gault & Sabini, 2000). This is at least partly because fearful people experience less control and less certainty and thus see more risk than angry people, who tend to believe that negative events are more under the control of other people who they can force to change (Lerner and Keltner, 2000). It may also result partly from the fact that angry people, like happy ones, do not cognitively process things as deeply (Tiedens & Linton, 2001). Sad moods also predispose individuals toward more risk taking choices, while anxiety induces lower risk taking; this is likely because these mood states affect temporal salience, with sad individuals having a hard time envisioning a positive future, whereas anxious individuals can't escape obsessing about possible events in the far off future. Indeed, the motivational purpose of anxiety reduction may reside in its efforts to reduce uncertainty (Raghunathan & Pham, 1999).

This raises an important consideration regarding attribution as well. Angry individuals tend to attribute causation to individual action, whereas sad individuals tend to attribute causation to situational factors (Keltner,1993). This profoundly affects not only who or what is held responsible and accountable for outcomes. It also decisively influences what actions are judged to be most likely to fix the situation going forward. Lerner et al. (2015) summarizes these differential effects nicely:

Anger scores high on the dimensions of certainty, control, and others' responsibility and low on pleasantness. These characteristics suggest that angry people will view negative events as predictably caused by, and under the control of, other individuals. In contrast, fear involves low certainty and a low sense of control, which are likely to produce a perception of negative events as unpredictable and situationally determined. These differences in appraisal tendencies are particularly relevant to risk perception; fearful people tend to see greater risk, and angry people tend to see less risk.

Emotions of course are intrinsically social; indeed, one of their primary functions is to communicate. This means that different emotions mean different things coming from different people. For example, anger directed at oneself can induce fear when originating from a more powerful person or it can generate more anger in return when coming from someone lower in power (Lieleveld, 2012). In either case, it tends to elicit a desire for retaliation (Wang 2012).

One emotion that has been less explored, and is less well known, but may be equally influential in the area of cyber decision making, is the role of surprise. Early work by Plutchick (1994) showed that surprise in combination with fear generates alarm, whereas fear in combination with joy spurs guilt. Note that this analysis illustrates another very important aspect of emotion: often emotions do not exist in isolation but rather blend with other thoughts or emotions to produce predictable, if more complex, effects, often known as secondary emotions.

Oftentimes, surprise is the emotion which follows a choice rather than one which precedes it. Zeelenberg et al. (2008, 18) describe this experience evocatively in a way that aligns with Phelps et al. (2015) second characterization of how emotions affect decision making:

Emotions are also present after we have decided. After having made a choice and before the outcomes are known we are often in state between hope and fear. Sometimes we are eager to learn the outcomes of our decision, expecting the best. Other times we avoid this information as we fear the worst (Shani & Zeelenberg, 2007; Shani, Tykocinski & Zeelenberg, 2008). When the outcomes materialize, they may again be a source of emotion, such as elation, happiness, surprise, regret and disappointment (Mellers, 2000; Zeelenberg et al., 1998). These emotions influence how we evaluate our decision outcomes, and thus our well-being. When others are involved in our decisions, or in their consequences, emotions such as empathy, love, anger, shame and guilt may be evoked and play a role during the process. All in all, there is a plethora of emotions that are related to many different aspects of the decision making process.

The reason that surprise is such an important and underappreciated emotion for the investigation of issues in cyber space is because of its role in attribution, particularly in the realm of responsibility. Interestingly, the role of surprise operates in a way that is the reverse of pride. Specifically, surprise scores higher than pride in the assessment of other's responsibility but lower in certainty. As Lerner et al., (2015) describe the implications,

These differences suggest that pride will produce an appraisal tendency to attribute favorable events to one's own efforts, whereas surprise will produce an appraisal tendency to see favorable events as unpredictable and outside one's own control. These differences are likely to be relevant to judgments of attribution; pride increases perceptions of one's own responsibility for positive events and surprise increases perceptions of others' responsibility for positive events, even when the judgment is unrelated to the source of the pride or surprise.

This discussion highlights a few crucial points for broader consideration. As with the earlier point raised by Plutchik's work, surprise, like fear, does not operate in isolation. The effect of surprise can differ, for example, based on how prideful a given decision maker is in general, or how proud he or she is of a particular decision, or how responsible the person feels for an outcome based on a prior decision. Second, predictable outcomes, which do not generate

as much surprise, will be more likely to be seen as within a decision maker's realm of control; in addition, such predictable outcomes are more likely to be seen in the case of positive, as opposed to negative, outcomes. These effects occur, at least in part, because of the appraisal tendencies discussed above.

Surprise also appears to have some predictable effects on risk taking behavior.

Employing a formal model, Koszegi & Rabin (2007) have shown that the predicted risk aversion in loss is mitigated when such losses are anticipated, and thus can, at least in part, be insured against. This means that when a decision maker takes on anticipated risk knowingly, risk aversion in the face of subsequent loss is diminished. Further, Koszegi & Rabin (2009) show that surprise can affect consumption, such that people increase immediate consumption in the face of surprise gains, and delay planned decreases in immediate consumption following surprise losses. Interestingly, Ely et al., (2015) show that surprise holds value in and of itself for many people, particularly in the realm of entertainment. Their notion is that the noninformational value of surprise could also be used to motivate more people to take an interest in politics and political outcomes. Although the amount of uncertainty surrounding a given situation can increase or decrease over time, they note that the amount of surprise is related to the difference between past beliefs and current or future updates on those beliefs.

Applications to the cyber realm

The extensive discussion of emotion above may seem a bit abstract, but each of these features have important implications for understanding the consequences of the “persistent engagement” which now characterizes cyber conflict in the most recent official documents. Persistent stress is not good for any living being, and, as noted above, leads not only to negative health consequences and burn-out, but inevitable declines in concentration and ability to focus on

the task at hand. The emotions and exacerbating conditions discussed above, from fear and uncertainty to emotional contagion and chronic stress, can impact decision making in the realm of cyber in all the ways discussed above.

First, because specific emotions trigger particular actions, the specific nature of the emotion that characterizes a particular threat will matter and have consequences for the development and outcome of any given threat. For example, if the relevant players are anxious about outcome, they are likely to take lower risk options, perhaps missing important opportunities or opening themselves to unnecessary vulnerabilities. If they are afraid of what the other side will do, actors are more likely to be risk averse, which can lead to the same negative outcomes. But these options are still superior to decision makers who act in anger, making more risk seeking choices, encouraging unnecessary escalation by the other side.

Because emotions are contagious, once an emotional tenor is set, it is likely to infect the entire team, suggesting that at least some prominent actors might best be kept physically separate from the larger team, or only brought in after conditions have escalated or changed. In addition, chronic stress itself is likely to influence the perceived time horizon and make decision makers discount potential future rewards in favor of smaller immediate ones. This foreshortened time horizon will only be exacerbated by the speed of the internet. This means that before a crisis, decision makers need to seriously consider when automatic responses to particular stages of escalation might be appropriate, and when to structure human intervention so that automaticity alone does not drive decision making through algorithms that may be not entirely appropriate or responsive to a given situation. In particular, such scenarios should be gamed prior to an actual crisis so that decisions about when and how intervention in a real crisis should involve human interactions, which may provide important delays in response cycles.

Second, because emotions serve as a motivating force for action, the specific emotion that characterizes a given cyber conflict can influence the outcome in decisive ways. Recall that emotions help people figure out which challenge they confront is most important, what is likely the most adaptive response to it, based on anticipated feeling among other factors, and what kind of information and resources they need to recruit in order to react in the best possible way. Different challenges activate different emotions, thus triggering specific emotional responses along the lines mentioned just above. This means that a cyber attack will evoke a different response than something that appears to be an accident. Unintended damage to a system may provoke less of a response than less damage that was intentional.

In this way, proportionality of response will be important in order to prevent unnecessary escalation. But this may require some serious choices about what constitutes the most important threats. North Korea may hack into Sony, a multi-national corporation based in an allied country, and the United States can respond in a variety of manners, or choose not to respond at all. But that response may well depend on what we understand to be the main target: was it the film *The Interview*, or was it the financial data, or security operations, of Sony? Trying to determine the goal may prove daunting, but will inevitably affect the emotional responses of those subject to the attack. Angry respondents are much less likely to make considered decisions than those who are fearful. This is just as true for those seeking to secure our election platforms as those seeking to protect industrial secrets.

Third, the key problems will emerge whenever there is a misalignment between an emotional response and a threat. Any attack is likely to provoke some degree of perceived threat but the emotional reaction to that threat will determine, to a large degree, the extent to which the

response escalates or mitigates sequential conflict. To the extent that defenders are surprised, they will likely hold others' responsible in ways that would not be as likely if the attacks were at least somewhat predictable, or had occurred before. Again, predictability becomes key to insuring against the tendency toward loss aversion. The key here is to make put procedures in place that mitigate the likelihood of anger in the face of surprise since this will increase tendencies toward risk seeking. Indeed, personality assessments that screen for people with strong emotional regulation ability, and low dispositional anger, can go far in reducing the risk for unwanted escalation in the face of crisis, especially under time constraints.

Fourth, since social communication serves the most important function of emotion, escalation can happen quite quickly through the process of emotional contagion. Indeed, there is likely a biological and physiological basis to this kind of communication, that makes it happen quickly and efficiently, as when female tears lowers men's testosterone, making it less likely that they will physically attack women when they are most vulnerable. Strategies that might help mitigate the degree of emotional contagion include not only physical separation among participants, and screening for particular personality traits, but training in emotional regulation in group contexts. Even simple structural factors like changing the color and design of physical surroundings can affect background mood states.

Finally, there is no questions that background mood and stress levels will influence decision making in a crisis. This will prove particularly detrimental under conditions of chronic stress as would characterize any kind of persistent engagement as imagined by cyber command. Adequate compensation, frequent breaks and vacations, moving people within the unit among various tasks, team-building to strengthen social support within the relevant group, and regular

training and gaming to increase confidence can all help mitigate the negative effects of these factors on performance.

Political Implications

One of the novel challenges of contemplating the nature of conflict in the cyber realm derives from how the speed of computation changes how conflict erupts and escalates. Humans may not be able to respond in real time with the speed that machines can; the technological solution is to develop algorithms to have machines respond for us, and to thus have response patterns baked into the code itself. The fact that humans may not be involved, or may only be partially involved, or involved differentially on one side or the other, should give us pause. Yes, machines may be faster, but perhaps if the only reactions were machine to machine that might avoid mistakes caused by delay. In addition, to assume that code written by humans is devoid of social consequences is naïve at best. Human factors which seem given by God are created by individuals whose goals may diverge substantially from that of users, and indeed users may never even talk to developers. The fact that how we are alerted to incoming texts on iPhones was developed by six guys in their 20s whose main concern was whether they would be unduly interrupted while having sex provides a simple yet dramatic example about how a very limited goal came to control the behavior of billions of people millions of times a day in completely unrelated domains (PBS Newshour, 2017). A more diverse group of people might have infused a different set of goals or values into the relevant design, and this lesson should not be lost on those who trust technological innovation to solve any and all impending threats in cyber space.

If a state needs to respond to a threat in cyber space, it is important to realize that code may be interpreted by adversaries, or even adversaries' codes, in unintentional ways, perhaps not

so different than the misunderstandings that can characterize any other kind of interaction, albeit at faster speed, merely accelerating the impact of potential mis-estimations. So perhaps, as with the doomsday machine in the infamously brilliant film *Dr. Strangelove*, the question is not when artificial intelligence should be used or not used, but rather when and how it can best serve the very human goals and needs of the political and social communities they exist to serve, rather than simply those of the technical community which develops them. “It’s cool” is not a good enough reason to develop an automated strategy to respond to threat. Under what conditions are states and individuals better served by including relevant emotions in real or artificial exchanges, and when would such an inclusion prove distracting? Can we even know in advance, or generalize by category, so as to allow some conditions and situations to be handled by artificial intelligence, or is each situation so unique and context dependent so as to require, or at least suggest, human intervention at decisive points, in order to prevent avoidable escalation or destruction? Or, more simply, if artificial intelligence algorithms are inevitable, then how can we develop and use them to enhance rather than replace human decision making? And, importantly, how can we make them less, rather than equally or more, susceptible to the kind of biases and errors that humans themselves make, even if they do so at faster speed?

In short, this may come down to a question of whether we want humans in the decision making loop in any potential cyber conflict, or instead merely on the loop, and kept aware of decisions being made primarily by artificial intelligence which will likely exclude, rather than include, emotional cues, since there would be no “reason” to include them, nor would they be easy to include in code. Yet in their absence, we had to invent the fully inferior emoji to communicate just those realities.

Greater strides in increased automaticity may mean we can keep humans out of the loop, but do we want to do this? What would a decision making loop without humans look like? Perhaps improvements will be made, but even the best machines can fall prey to the many biases and limitations that afflict humans. Indeed, Google had to shut down its best neural learning network artificial intelligence system after a brief stint because of how quickly it developed racist and misogynistic tendencies (Buranyi, 2017); this does not portend well for the ability of machines to overcome human foibles in any arena save perhaps speed, and some small areas of technical (i.e. mathematical) accuracy. Even attempts to develop a chocolate chip cookie recipe by artificial learning led to the lesson that “our experience highlights the importance of incorporating domain expertise and the value of transfer learning approaches.”(Kochanski et al., n.d.) In other words, the cookies made this way were inedible. Do we want to trust our future to artificial systems that cannot even produce a decent chocolate chip cookie? Such a system may not interrupt people during sex, but without being able to produce a decent cookie, it would not be so useful either, particularly if the future of humanity is at stake.

Emojis aside, code can't necessarily cue emotion. And as should be obvious by now, emotions have an important place in human decision making and serve a crucial function in facilitating cooperation. Evolution developed emotions with enormous computational power over millennia, way more than that even the totality of all our massive computers can achieve. It was developed to aid survival; we seek to compartmentalize, neglect or eliminate it to our peril.

But if we wanted to include emotion in communication or conflict, to signal anything from anger to conciliation, what would be the mechanism by which we could convey this appropriately? Do we strive to create a model that can anticipate and respond to emotional cues, or incorporate them into interaction? How can artificial intelligence, particularly in the realm of

interstate interaction, be designed in such a way as to be able to measure how kinetic and material power is perceived and incorporated into threatening messages in a virtual world? How can it accommodate different cultural contexts, cues, norms and expectations? How do programmers even think about how to embed appropriate emotional signals for interested adversaries to discern? One thing that the literature is quite clear about is that anonymity and deindividuation increase the propensity for aggression (Zimbardo, 1969); anyone with even passing familiarity with on line chat boards intuitively knows this to be true.

Cyber may present a different environment for conflict, but that does not mean that the substance and content of the decisions made regarding conflict itself will necessarily be qualitatively different, even if they occur more quickly. Rather, cyber may simple present a different means and domain in which to perpetuate (or not) other forms of conflict. Theoreticians in this realm should consider whether the speed and deindividuation built into artificial intelligence systems changes the magnitude and consequences of conflict, or mostly its speed and potential for misunderstanding intentions. Cyber certainly changes the pace of decision making so conscious decisions need to be made regarding the pivotal points at which leaders decide to step out of network pace and contemplate the social and material risks at stake in any given conflict. And issues of the intertwined nature of kinetic and cyber power must be addressed as well. As much as bombs may be able to destroy servers, to the extent that their launch depends on servers, interdependence is growing and increasing integration of kinds of systems may make cyber attacks as destructive as material ones at some point in the near future.

As should be clear, the effect of emotion on decision making is not necessarily clear or simple, but it is powerful and, at least in some areas, reasonably predictable. Although the burgeoning wave of current research into the neurological aspects of emotion is likely still in

early days, it is making rapid progress and new findings emerge almost daily. So while any implications must necessarily be tentative, it is worth hazarding a few ramifications of this work for the domain of cyber conflict.

First, while the cyber debate has largely focused on technical aspects of attribution, or policy issues involving surveillance, retaliation and escalation, perhaps the most important component in how decisions will be rendered in the midst of a real crisis has been ignored almost completely, and this surrounds the critical role that emotion can exert on decision making. Emotions matter in shaping decisions in numerous, varied and specific ways. Background mood and stress level can exert an incidental but decisive effect on choice outside of a decision maker's awareness, and on topics unrelated to the emotion itself, and both lean toward tunnel vision thinking and foreshortened decision making which vastly increase the risk of inadvertent escalation. The consequences of decisions can spur a new round of emotional reactions which can, then, in turn, influence immediate or future choice based on anticipation or consequences of past outcomes. Think of how Trump's twitter tirades engender all kinds of outrage and reaction; imagine how much worse things could get among the mass public if the entire internet ceased to function.

Second, these effects are not random. Anger may force immediate concessions in an adversary, while simultaneously sparking a desire for later retaliation, thus creating the blowback effects everyone experiences but too many never see coming in advance. Surprise as well as anger and sadness can critically effect attributions of causality and responsibility, changing who or what is held responsible or accountable, as well as shifting the downstream trajectory of future action. Indeed, plans for retaliation and revenge are critically affected by who is held responsible and how intentional and destructive their attacks are understood to be.

Third, any conflict represents, by definition, a two-way street, where the emotions of each side can affect the other in a game of strategic, albeit emotional, interaction. Problems are most likely to emerge when people do not recognize the effect of emotional tenor and tone on decisions in oneself or the other, and both sides are very unlikely to have much access to that information about the self, much less the adversary. Emotions are contagious, socially and environmentally contingent, fluid and powerful. Indeed, those purposes are embedded into their very function. Although everyone has a great deal of experience of this in their personal, and even professional, lives, few give their influence adequate credence in understanding the effect they exert on the content of high-level choice among decision makers who are, themselves, not only human but statistically much more likely to suffer from the kind of narcissistic personality disorders that heighten prospects for anger in the face of disagreement.

This raises an additional important point. Individuals matter. Who makes a particular decision at a specific moment in time is not irrelevant and does not result in interchangeable outcomes. Each individual possesses a very unique dispositional composition of background mood traits, emotional awareness, capacity for self-regulation, resilience in the face of stress, and reactivity to negative outcomes. How a given leader responds is not random, but rather reflects this entire constellation of personal attributes and character traits, as well as environmental demands. Organizations and institutions can strive to moderate and constrain these responses through incentives and coercion, but leaders can still exert decisive outcomes, particularly in the midst of time urgent crises characterized by secrecy and enormous potential consequences. However, individuals can be trained to more effectively recognize and regulate their emotions; central decision makers who can be taught to at least recognize their emotional states, and

acknowledge the consequences of those states on their decisions and on others, may do more to be able to control unwanted escalation than all the attribution software advances in the world.

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