Norwegian University of Life Sciences
School of Economics and Business

MEASURING EMOTION FOR BEHAVIORAL STRATEGY

Glenn Kristiansen

Working Papers No. 14/ 2016

ISSN: 2464-1561

MEASURING EMOTION FOR BEHAVIORAL STRATEGY

Abstract

Emotions and other forms of affect have a central place in the field of behavioral strategy. A major problem is that we do not have any reliable method to ensure comparable positive and negative emotions or affect when assessing their influence on strategic variables. The consequence is biased development of theories that ultimately will polarize strategy researchers. In this article, we suggest alpha brain waves as a physiological correlate to overcome this issue. The benefit of this approach is that the alpha band is sensitive to not only negative emotions, but also to positive ones, by relying on two different psychological mechanisms. This correlate will act as a yardstick when validating emotion measures for the strategy field. We illustrate the benefit of this through three emotion functions.

INTRODUCTION

Behavioral strategy is an emerging and exciting stream within strategy, where emotions have an important place together with other realistic behavioral aspects (Powell, Lovallo, and Fox, 2011). This is natural since emotions and other forms of affect are part of ordinary and rational thinking (Duncan and Barrett, 2007), and not merely a noise in everyday functioning. Yet, little research has been dedicated to the link between emotional life and strategy, with the exception of a few authors (e.g., Delgado-García, de la Fuente-Sabaté, and de Quevedo-Puente, 2009; Huy, 2011; Powell, Lovallo, and Fox, 2011). This means that a focus on emotions and other types of affect is needed to further develop the field of behavioral strategy. In order to do so, researchers face the problem of measuring comparable levels of emotions and affect correctly, which must be addressed already today to avoid accumulating biased findings and theories. Unfortunately, the nearby psychology literature exhibits the same type of problem, which means that strategy researchers need to develop this area themselves.

For instance, even though we know that negative emotions are more easily induced in an experimental setting (Bradley et al., 2001a), management researchers still apply the same duration (time spent on directing emotions in a certain direction) as for positive emotions. This is puzzling since we all know that apples and oranges should not be compared. Rather, we need to assess effects and characteristics based on fair criteria. As an analogy, if an emerging- and developed economy both are growing with 5%, these numbers are of course not directly comparable since the former has a relatively lower size of its economic activity. Despite this common principle, emotions and other types of affect are treated the same concerning the temporal dimension, with the possible result of severely bias any findings and create unnecessary polarization among researchers.

This article presents the neglected problem of equalizing duration when measuring emotions and other variants of affect; in other words, ignoring the notion of comparable emotion levels, which if not addressed will prevent the progress of behavioral strategy. We argue for the use of physiological correlates such as heart rate and sweat activity to obtain the right levels of positivity and negativity to be compared, with special focus on alpha brain waves. To our knowledge, this is the first article focusing on the following question: *How can we obtain comparable affect inductions?*

CLARIFICATIONS

Definitions

Researchers focusing on emotion within or outside the management field do sometimes not distinguish among various forms of affect. The result is again to mix up apples and oranges. Thus, a clarification of such terms is necessary before moving on. The "affect" literature in the field of psychology usually addresses four concepts – affect, emotion, mood and feeling – where this article focuses on emotion and mood. However, this does not mean that our arguments are solely confined to these two types of affect. The four categories of affect, emotion, mood and feeling are borrowed from the psychology field that investigates the structure of "affect" itself (e.g., Cacioppo, Gardner and Berntson 1999; Russell and Carroll, 1999; Watson and Clark, 1992), that focuses on the functions of "affect" (e.g., Blanchette and Richards, 2010; Martin and Kerns, 2011), or which is concerned with how "affect" is influenced by other concepts (Johnston, 2003; Moors, 2009). Of these four "affect" concepts, it seems that researchers mostly agree on how to define and describe mood and feeling. Affect has more disagreement attached to it, while emotion is a highly polarized and discussed concept among researchers. Thus, defining what emotions are, or what they should be, is a very difficult task based on how the emotion literature is currently organized, and a topic not covered in this article.

Even though researchers usually distinguish among the above affective concepts, they disagree on how to define and classify these. For instance, Frijda (2007) argues that mood can emerge in discrete forms and not solely as diffuse background states as are usually assumed. Further, Buck (1999) described the work towards finding an agreed definition for mood and emotion as a "conceptual and definitional chaos." Concerning affect, Murphy and Zajonc (1993) argued that one reason for the struggle towards finding a common ground is due to a lack of definite theories underlying these processes. However, despite these issues many agree on the following definitions:

Affect

Umbrella term encompassing a broad range of feelings that individuals experience, including feeling states, such as moods and discrete emotions, and traits, such as trait positive and negative affectivity… (Barsade and Gibson, 2007: 38)

Emotion

Emotions are focused on a specific target or cause – generally realized by the perceiver of the emotion; relatively intense and very short-lived. After initial intensity, can sometimes transform into mood (Barsade and Gibson, 2007: 38)

Mood

Generalized feeling states that are not typically identified with a particular stimulus and not sufficiently intense to interrupt ongoing thought processes (Brief and Weiss, 2002: 282)

Feeling

Traditionally, feelings have been described as ineffable qualia, as body feelings, or as states of pleasure or pain and felt activation (Frijda, 2005: 473)

In the remainder of this article, the term affect refers to mood, emotion and other types of affect, with special focus on moods and emotions.

IF WE KNEW THE COMPARABLE AFFECT LEVELS

Illustrating Emotion-Duration Adjustments

We now assume that we know the comparable affect levels for all the types of affect we want to compare the effects from. Let say we want to compare how negative and positive emotions among CEO’s influence strategic judgment. To answer this we first of all need to decide what amount of negativity should be compared to what amount of positivity. This is not a trivial issue, but for now we assume that we have the answer (but we address the problem in the next chapter). Based on that, we want to adjust the negative and positive emotion-inductions in order to achieve these known comparable emotion levels. In Table 1, we illustrate this through linear-, exponential- and logarithmic forming of emotion as temporal functions assuming in all cases that negative emotions are easier to induce than positive ones.

TABLE 1
Illustration of Linear and Nonlinear Emotion-Duration Adjustments

Function type	**Linear**	**Exponential**	**Mixed**
(1) Assumed function for positive emotion induction	$Emotion = ARP + \beta_P D_P$	$Emotion = ARP \times e^{D_P}$ (assuming $\eta D_P + \alpha = D_N$)	$Emotion = \omega \times e^{\eta D_P + \alpha}$
(2) Assumed function for negative emotion induction*	$Emotion = ARP + \beta_N D_N$	$Emotion = ARP \times e^{\eta D_P + \alpha}$	$Emotion =$ $\theta \times \ln(D_P - \theta \pm 1)$
(3) Adjusted duration for the fastest emotion condition (assumed to be negative emotion)**	$(\beta_P / \beta_N) \times D_P = D_N$ (Illustrated in Figure 1)	*** $\eta = 1 - \alpha / D_P$ $\eta \times D_P = (1 - \alpha / D_P) \times D_P$ $= D_P - \alpha = D_N$	**** $D_N = \eta \times D_P =$ $= \frac{\ln(\theta) - \alpha - \ln(\omega) + \ln(\ln(D_P - \theta \pm 1))}{D_P} \times D_P$ $= \ln(\theta) - \alpha - \ln(\omega) + \ln(\ln(D_P - \theta \pm 1))$
(4) Adjusted duration for the slowest emotion condition (assumed to be positive emotion)**	$(\beta_N / \beta_P) \times D_N = D_P$ (Illustrated in Figure 1)	$D_P = D_N + \alpha$	$D_P = D_N / \eta =$ $= \frac{\ln(\theta) - \alpha - \ln(\omega) + \ln(\ln(D_P - \theta \pm 1))}{\eta}$

ARP: Affective reference point, i.e. the level of emotions right before induction commences.
ω *: Factor ensuring that the affective reference point for the positive emotion function equals that for the negative emotion function.*
θ *: Factor ensuring that the affective reference point for the negative emotion function equals that for the positive emotion function.*
$\beta_{P|N}$ and η *: Slope parameter for positive emotion induction or for negative emotion induction.*
D: Duration, e.g. number of seconds that emotions are induced in a particular direction.
α *: Parameter deciding the intensity of the emotion function.*
** The emotion variable is assumed consisting of absolute values*

***For the purpose of this illustration, it is assumed that the negative emotion condition is faster and more easily induced than positive emotion.*

***** $ARP \times e^{\eta D_P + \alpha} = ARP \times e^{D_P} \Rightarrow e^{\eta D_P + \alpha} = e^{D_P} \Leftrightarrow \ln(e^{\eta D_P + \alpha}) = \ln(e^{D_P}) \Rightarrow \eta D_P + \alpha = D_P \Leftrightarrow$

$D_P(\eta - 1) = -\alpha \Leftrightarrow \eta - 1 = -\alpha / D_P \Leftrightarrow \eta = 1 - \alpha / D_P$

The parameter α *needs to be estimated empirically.*

****

$$\omega \times e^{\eta D_P + \alpha} = \theta \times \ln(D_P - \theta \pm 1) \Rightarrow \ln(\omega \times e^{\eta D_P + \alpha}) = \ln(\theta \times \ln(D_P - \theta \pm 1)) \Rightarrow$$
$$\ln(\omega) + \eta D_P + \alpha = \ln(\theta) + \ln(\ln(D_P - \theta \pm 1)) \Rightarrow \eta D_P = \ln(\theta) - \alpha - \ln(\omega) + \ln(\ln(D_P - \theta \pm 1)) \Rightarrow$$
$$\eta = \frac{\ln(\theta) - \alpha - \ln(\omega) + \ln(\ln(D_P - \theta \pm 1))}{D_P}$$

The word limit of this article makes it not possible to explain many of the facets of Table 1. Row 1 and 2 contain the emotion functions, in other words, the way we assume positive or negative emotions develop as they are induced. Row 3 shows how to reduce the induction-time for negative emotions to match the comparable positive emotion level. Row 4 presents how to prolong the positive emotion duration in order to match the comparable negative emotion level. The duration-adjustments are easiest to obtain if both the positive and negative emotion functions are linear (compare the columns for rows 3 and 4), and more complex for non-linear emotions.

OBTAINING COMPARABLE AFFECT LEVELS

The Epistemology of Comparable Affect Levels

The duration-adjustment illustrated above is simple in principle. In reality, though, to find the *quantity* of positive affect that equals the *quantity* of negative affect in a given situation is difficult both philosophically and operationally. For instance, how is it even possible to talk about comparable positive and negative emotion quantities (levels), as we know that these are qualitatively different concerning the type of thoughts they bring about. Additionally, even if positive and negative emotions have similar physiological correlates, this does not mean that the emotions are equivalent in any sense since most of brain locations are likely to serve a variety of functions (e.g., Karama, Armony, and Beauregard, 2011; Vogt, 2005). These two issues, in particular, make it difficult to think about and obtain comparable emotion and affect levels, which is necessary in order to identify the correct induction adjustments illustrated in Table 1.

This issue is especially problematic for mood as compared to emotion since it is more diffuse and not attached to a particular object or cause (e.g., Brief and Weiss, 2002), which means that it is not easy to find psychological or physiological correlates to apply as yardsticks. Emotions are more intense and therefore have stronger and clearer physiological correlates through heart, skin, and muscles than moods (Lang and Bradley, 2007). However, various physiological measures do not contain unique affective signatures as mentioned above (Barrett et al., 2007), which means that they cannot reliably trace back to emotions or moods. When that is said, we argue that certain physiological correlates are the best alternative to adjusting the durations of mood and emotion inductions when assessing their effect on strategic variables, since we "only" need to keep track of these physiological measures appearing after affective inductions, not the other way around.

Suggesting Event-Related Desynchronization as a Physiological Correlate

Both emotions and moods suffer from the traditions of using subjective self-reports to measure the quality, discreteness, and valence of their affective states. Although Tomkins (1962) proposed that facial movements could be used to measure specific emotions, Cacioppo, Berntson, Larsen, Poehlmann, and Ito (2000) argued that there are many affective information processes that do not transform into detectable facial actions, which make this measure of valence on the unreliable side. Given these issues, and the fact that positive affect (e.g., emotion and mood) can be quite difficult to induce and measure compared to negative affect, we suggest the use of alpha amplitude as a more sensitive physiological correlate to find comparable affect levels. The alpha band is a common brain frequency in the range of about 8 to 13 Hz (number of cycles per second)[1], and event-related desynchronization (ERD)[2] is the term used for a reduction in band power/amplitude[3] (Klimesch, 2012). Whenever alpha amplitude decreases, the frequency of oscillations increases (since the speed of the charge is assumed constant), which further is associated with improved cellular excitability, especially in the thalamus-cortical systems (Pfurtscheller and Lopes da Silva, 1999). This enhanced alpha-band neuronal activity spreads more easily than for other frequency bands (and more so the lower the Hz is within this band), which means that ERD induces stronger information processing across a larger part of the brain compared to the reference-power level (Klimesch et al., 2007). In other words, ERD leads to more neurons being involved in processing stimuli or information retrieved from memory

---

[1] Researchers disagree about the exact frequency range of alpha oscillations (Bazanova and Vernon, 2013).

[2] Desynchronization means that neurons decrease their synchronous firing with other (Singer, 1993). Following Pfurtscheller and Lopes da Silva (1999), "ERD or ERS [event-related synchronization] is defined as the percentage of power decrease or increase, respectively…".

[3] (Klimesch, 2012: 606) defines alpha amplitude as: "The 'magnitude' of an oscillation, reflecting the distance between the maximal positive- and negative-ongoing points (phase) of an oscillary cycle".

(Pfurtscheller and Lopes da Silva, 1999a). An interpretation of ERD is that an increasing part of the brain is seen as task-relevant compared to the reference power (Klimesch et al., 2007). The more difficult the task is, or the more one attends to something, the more one experiences alpha-ERD (Boiten et al., 1992; Palva and Palva, 2007) – at least up to a certain point. Thus, given that positive affect creates stronger attention through higher motivation towards whatever task at hand (Martin, Abend, Sedikides, and Green, 1997; Martin, Ward, Achee, and Wyer, 1993), and that negative affect creates more focused attention on the perceived problem, both positive and negative types of affect are likely to activate ERD. These are the two psychological mechanisms mentioned in the abstract. We argue further that induction materials such as film clips can be validated for their average effect on ERD, which can be used to identify the affect-functions as illustrated in rows 1 and 2 in Table 1, and ultimately identify correct adjustments to the inductions as illustrated in rows 3 and 4 in the Table.

References

Barrett LF et al. 2007. Of Mice and Men: Natural Kinds of Emotions in the Mammalian Brain? A Response to Panksepp and Izard. *Perspectives on Psychological Science* **2**(3): 297–312.

Barsade SG, Gibson DE. 2007. Why Does Affect Matter in Organizations? *Academy of Management Perspectives*. Academy of Management **21**(1): 36–59.

Bazanova OM, Vernon D. 2013. Interpreting EEG alpha activity. *Neuroscience and biobehavioral reviews*. Available at: http://www.sciencedirect.com/science/article/pii/S0149763413001279.

Blanchette I, Richards A. 2010. The influence of affect on higher level cognition: A review of research on interpretation, judgement, decision making and reasoning. *Cognition & Emotion* **24**(4): 561–595.

Boiten F, Sergeant J, Geuze R. 1992. Event-related desynchronization: the effects of energetic and computational demands. *Electroencephalography and Clinical Neurophysiology* **82**(4): 302–309.

Bradley MM, Codispoti M, Cuthbert BN, Lang PJ. 2001. Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion* **1**(3): 276–298.

Brief AP, Weiss HM. 2002. Organizational behavior: affect in the workplace. *Annual review of psychology* **53**: 279–307.

Buck R. 1999. The biological affects: A typology. *Psychological review* **106**(2): 301–336.

Cacioppo JT, Berntson GG, Larsen JT, Poehlmann KM, Ito TA. 2000. The psychophysiology of emotion. *Handbook of emotions* **2**: 173–191.

Cacioppo, Gardner & Berntson 1999 The affect system has parallel and intefrative processing components: Form follows function. 1999. Journal of Personality and Social Psychology.

Delgado-García JB, de la Fuente-Sabaté JM, de Quevedo-Puente E. 2009. Too Negative to Take Risks? The Effect of the CEO's Emotional Traits on Firm Risk. *British Journal of Management* **21**: 313–326.

Duncan S, Barrett LF. 2007. Affect is a form of cognition: A neurobiological analysis. *Cognition & emotion* **21**(6): 1184–1211.

Frijda N. 2005. Emotion experience. *Cognition & Emotion*. Routledge **19**(4): 473–497.

Frijda NH. 2007. *The Laws of Emotion*. Mahwah, NJ: Erlbaum.

Huy Q. 2011. How Collective Emotions and Social Identities Influence Strategy Execution.

Huy QN. 1999. Emotional Capability, Emotional Intelligence, and Radical Change. *The Academy of Management Review* **24**(2): 325.

Johnston V. 2003. The origin and function of pleasure. *Cognition & Emotion* **17**(2): 167–179.

Karama S, Armony J, Beauregard M. 2011. Film excerpts shown to specifically elicit various affects lead to overlapping activation foci in a large set of symmetrical brain regions in males. *PloS one*. Public Library of Science **6**(7): e22343.

Klimesch W. 2012. Alpha-band oscillations, attention, and controlled access to stored information. *Trends in Cognitive Sciences* **16**(12): 606–617.

Klimesch W, Sauseng P, Hanslmayr S. 2007. EEG alpha oscillations: the inhibition-timing hypothesis. *Brain research reviews* **53**(1): 63–88.

Lang P, Bradley MM. 2007. The International Affective Picture System (IAPS) in the study of emotion and attention. *Handbook of emotion elicitation and assessment* **29**.

Martin EA, Kerns JG. 2011. NIH Public Access **25**(2): 265–279.

Martin LL, Abend T, Sedikides C, Green JD. 1997. How would it feel if...? Mood as input to a role fulfillment evaluation process. *Journal of Personality and Social Psychology* **73**(2): 242–253.

Martin LL, Ward DW, Achee JW, Wyer RS. 1993. Mood as input: People have to interpret the motivational implications of their moods. *Journal of Personality and Social Psychology* **64**(3): 317–326.

Moors A. 2009. *Theories of emotion causation: A review*. *Cognition & Emotion*, 23: 625–662.

Murphy ST, Zajonc RB. 1993. Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology* **64**(5): 723-739.

Palva S, Palva JM. 2007. New vistas for α-frequency band oscillations. *Trends in Neurosciences* **30**(4): 150–158.

Pfurtscheller G, Lopes da Silva FH. 1999a. Event-related EEG/MEG synchronization and desynchronization: basic principles. *Clinical neurophysiology* **110**(11): 1842–1857.

Pfurtscheller G, Lopes da Silva FH. 1999b. Event-related EEG/MEG synchronization and desynchronization: basic principles. *Clinical neurophysiology : official journal of the International Federation of Clinical Neurophysiology* **110**(11): 1842–57.

Powell TC, Lovallo D, Fox CR. 2011. Behavioral strategy. *Strategic Management Journal* **32**(13): 1369-1386.

Russell J a, Carroll JM. 1999. On the bipolarity of positive and negative affect. *Psychological bulletin* **125**(1): 3–30.

Singer W. 1993. Synchronization of Cortical Activity and its Putative Role in Information Processing and Learning. *Annual Review of Physiology* **55**(1): 349–374.

Tomkins S. 1962. *Affect Imagery Consciousness: Volume I: The Positive Affects*. New York: Springer..

Vogt BA. 2005. Pain and emotion interactions in subregions of the cingulate gyrus. *Nature reviews. Neuroscience* **6**(7): 533–44.

Watson D, Clark L a. 1992. Affects separable and inseparable: On the hierarchical arrangement of the negative affects. *Journal of Personality and Social Psychology* **62**(3): 489–505.