

Measurement of Affect: From Theoretical and Instrumental Perspectives^{*}

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Affect plays a central role in human experience and is related to different psychological variables, such as memory, coping, personality, and self-esteem. It can be characterized as a state of pleasure or discontentment experienced with some degree of activation. This article aims to analyze from theoretical and instrumental perspectives in the measuring of affect. The affect construct went through some constructing over the decades. For Russell, it can be viewed through his circumplex of bipolar and orthogonal dimensions, called valence (pleasure or displeasure) and perceived activation (high or low). By means of systematic revision, 17 measurement instruments about affect were found, which were based, generally, on the choice of adjectives that corresponded to whatever the individual indicated to be feeling at the moment or in unique scales dedicated to a dimension of the construct. It was observed that the effective field is permeated by several measuring instruments and theoretical concepts, which made the measurement of affective spectrum a challenge in terms of methodology. The lack of a definition both operational and constitutive about the affect concept and its distinctions from mood, emotion and other associated variables compromises the theoretical and instrumental development. A contributing factor for the restriction in this development is the utilization of instruments on account of tradition of use, without identifying the reason for continued use. In utilizing a measuring instrument, researchers must recognize that they are agreeing with its theory and thus understand how their knowledge production can contribute to new studies. Finally, the relationship between affect and other external variables is discussed.

Keywords: affect, measuring, pleasure, mood, emotion, Russell's circumplex

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Introduction

Affect has a central role in human experience, since it provides the "continuous hedonic tone that colors people's lives" (Gray & Watson, 2007). In that sense, the experience of feeling is part of the process of consciousness, as the affective experience is one of the most significant components of mental activity (Panksepp, 2012). Mnemonic references, cognitions, and related feelings are the result of experiences in people's lives (Kahnemann & Riis, 2005). When a decision is made, the affective component about a certain object is remembered and the individual will ask himself "What do I think about this?", "Do I like this?", or "Do I hate this?" (Kahnemann, 2012). Remembering and acting are intrinsically connected to the way people feel something and that can be characterized as affect.

Researches about the affective core involve the affect descriptors, emotions, and mood. As similar as these constructs might be, they must be conceptualized so that their individual characteristics may be identified and measured precisely. The affective core is hierarchically organized: from the more general, such as dimensions of affect, to the more specific, such as specific emotions. This theoretical organization favors the systematic progression of the research (Ekkekakis & Petruzello, 2000).

The field of emotions is permeated from a cognitive perspective and cognitive assessments that conducted before an event have a significant role on the occurrence of emotion (Fridja, 1988; Lazarus, 1991; Scherer, 2005). Emotions are complex episodic events evoked by specific objects such as people, conditions or events and affective feelings. Emotions last seconds or minutes, are intense and are usually linked to a specific time (Gray & Watson, 2007). Mood is a broader concept than emotion in terms of duration and frequency, as it can last hours and days (Gray & Watson, 2007). Mood can also be characterized as more diffuse and global, without a specific reason and with low intensity (Fridja, 2009; Ekkekakis, 2012). Thus, affects are not necessarily or consciously connected in a direct manner to specific objects, although they are resulting from them (Barret & Russell, 1999).

Affect: Concept and Dimensionality

Affect, constantly experienced by people, is characterized as a state of pleasure or discontentment felt with some degree of activation (Barret & Russell, 1999). Amongst considered examples of affect are states of pleasure, heartbreak, tension, calmness, energy, and fatigue (Ekkekakis, 2013). Affect is a neurophysiological state consciously accessible, that is a combination of the hedonic, pleasure or displease, and activation, sleepy or activated (Russell, 2003). To be defined in such way, the affect construct went through a few constructions over the decades (see Table 1).

In the 1960s, Bradburn (1969) developed a research about well-being based on two dimensions, positive affect and negative affect. The latter became the basis of construction of PANAS (the Positive and Negative Affect Schedule) (Watson & Tellegen, 1985). In the 1980s, the conceptual and methodological advances about the affect construct were expanded (Russell, 1980; Diener, 1984; Watson & Tellegen, 1985; Thayer, 1989), and these researches were considered as pillars for future studies.

In the 1980s, another strand emerged about the understanding of affect, being this one studied by Russell (1980). In his study, the author denominated the dimensions of affect as valence and activation wherein the combinations of these two dimensions, in different degrees, would have affective experiences as a result. This study generated Russell's (1980) circumplex, which had continuity on posterior studies (Barret & Russell, 1999;

Russell & Barrett, 1999; Yik & Russell, 2001; Russell, 2003; Yik, Steiger, & Russell, 2011).

Throughout the decades, there have been changes relating to the concept of affect, but the biggest changes can be seen on what once was regarded as mood and it's been recognized as affect. Like every construct, it is ideal to have a theory that supports its conceptualization and comprehension. Russell's circumplex (1980; 2003) fills that roll. Its dimensions are bipolar and orthogonal, being called "valence (pleasure or displeasure) and perceived activation (high or low)". The different affective experiences are conceived through combinations of these two dimensions, in different degrees. This model was identified as ideal for the constructions of measurement instruments, since it has worked in the dimensional perspective of affect (Ekkekakis & Petruzello, 2000; Ekkekakis, 2013).

Table 1

Author	Year	Concept	
James A. Russell	1980	The stimuli need to be interpreted and become significant in such a way that what comes to be the affective experience is the interpretation of the event, not the event itself. The affection only occurs as a final result of the cognitive process.	
Lisa Feldman Barrett & James A. Russell	1999	Affective feelings are not necessarily and consciously directly linked to specific objects, although they are resulting from them.	
James A. Russell & Lisa Feldman Barrett	1999	The affect is constantly experienced and is characterized as a state of pleasure of discontentment. The affective core refers to conscious elementary processes of pleasure and activation, can have many causes and is always present in people's lives.	
Michelle Yik & James A. Russell	2001	It's something momentary or at least short term, about consciously accessible feelings.	
James A. Russell	2003	The affective core is a neurophysiological state that is accessible by the emotion of feeling well or unwell, energized or weakened. The affect by itself or combined with other psychological processes, refers to feelings, moods and emotions. Includes subjective experiences such as fear, anger and other emotions, commonly called primitive and universal	
Elizabeth K. Gray & David Watson	2007	The affect has a central role in human experience, given that it provides a continuous hedonic tone that colors people's lives.	
Jaak Panksepp	2012	The feeling experience is a part of the conscience process, as the affective experience is one of the most expressive components of mental activity.	

Concepts on Affect in Russell and Colaborators (1980-2012)

For Russell (1980), the affect can be seen though his circumplex (see Figure 1). The valence dimension is a psychological evaluation process, something that codes the environment. It can give a good or bad, useful or harmful, compensating or threatening meaning to the stimulus in a given moment (Barrett, 2006). The activation is the dimension of experience which corresponds to the mobilization or dispended energy, in other words, it's represented by a "continuum", since the low activation, represented by sleep, until the high activation, represented by excitement (Barrett & Russell, 1999).

In the creation of the circumplex, two tasks were applied in university students. The first task contained 28 stimuli-words, described as words or sentences that people would use to describe their moods, feelings, affects, or emotions. The subject should aggregate each word in one of eight categories (excitement, misery, pleasure, depression, activation, contentment, suffering, and sleepiness). On the second task, it was asked that the subject allocated the eight categories around a circle, the subject was told that words in opposite directions described opposite feelings and words close to one another described similar feelings. There were found eight words demonstrated on the circumplex: pleasure (0°), excitement (45°), activation (90°), suffering (135°), discontentment (180°), depression (225°), sleepiness (270°), and relaxation (315°) (Russell, 1980).

Affective states that were close to each other represented a similar combination of valence and perceived activation, whilst affective states positioned diametrically far from each other, differ in terms of valence and activation (Russell, 1980; Barrett & Bliss-Moureau, 2009). Thus, the four variables allocated diagonally are not, but helped define the quadrants in space (Russell, 1980).



In testing all proposed models of affect, it was identified that, as much as such models were different in terms of names, in terms of construct, they were complementary, not distinct. The four models analysis (Barret & Russell, 1998; Watson & Tellegen, 1985; Thayer, 1989; Larsen & Diener, 1992) demonstrated that all constructs were represented simultaneously in a two dimensions space and the evaluated constructs were close to each other in the circumplex (Yik, Russell, & Barrett, 1999).

Based on all models, combinations of dimensions generate six categories, being them positive affect with high activation (euphoric, excited), positive affect with moderate activation (gratifying, satisfied), positive affect with low activation (serene, calm), negative affect with high activation (upset, suffering), negative affect with moderate activation (miserable, unhappy), and negative affect with low activation (lethargic, depressive) (Carroll, Russell, & Barrett, 1999). Posteriorly, Russell's circumplex (1980) was also adapted (see Figure 3) (Russell, 2003), due to further new research (Barret & Russell, 1998; Carroll et al., 1999; Yik et al., 1999).

Thus, it is suggested by current literature that, measuring instruments, related to affect, be created through a dimensional perspective (Ekkekakis & Petruzello, 2001; Ekkekakis, 2013) and through the circumplex's structure (Barret & Russell, 1999).

The Affect and Its Relations With Other Variables

Researching about affect, the temporal distance between the memory and the date when it is remembered is shown as an intervenient variable to be controlled. The temporal distance of the occurrence of an event enables it to be categorized by abstract elements, while temporal proximity from its occurrence causes the subject, when representing it, to recall it in more detail. Evaluations of affect close to the target situation tend to be more reliable. It's been identified that temporal gaps were more evident in unpleasant emotions, in other words, in memories that involved anger, sadness, and tension (Miron-Shatz, Stone, & Kahnemann, 2009).

Within the framework of studies on "coping", strategies associated with the need for the individual to deal directly with the source of threat or challenge, have been found to produce positive affective experiences. Strategies related to focusing on emotion and behavioral disengaging produced negative affective experiences (Ntoumanis & Biddle, 1998).

It's been evidenced in an experiment with patients during a colonoscopy that those who suffered some discomfort at the end of the procedure reported a less pleasurable experience than the patients that had an unpleasant experience throughout the entire process. Even though an experience was good in all its temporal extension, if something aversive happened in the end, the memory of the experience was considered aversive as a whole, it was attributed to it a meaning of discontentment (Redelmeier, Katz, & Kahnemann, 2003).

The act of giving good or bad meanings to the experiences is also influenced by personality. Based on the structure of positive and negative affects, it has been evidenced that traces of personality, such as extroversion, socialization, and openness were positively related to positive affect. While negative affect was correlated positively to neuroticism traces and negatively to socialization (Endres & Simon, 2010). With the valence and activation dimensions, the neuroticism trace was correlated with the pleasant-unpleasant axis (Yik & Russell, 2001), in other words, with the valence dimension, characterized by the attribution of good or bad meanings for the experiences.

The life satisfaction, hope, optimism, and self-esteem constructs showed positive correlations to the positive affect. The negative affect was correlated negatively. These results suggested that people who experienced positive affects more frequently are also the ones who were more satisfied with their lives, expressed more positive expectations of the future and had higher self-esteem. People who experienced more

negative affects tended to be more unsatisfied with their lives, had more negative expectations in relation to the future and reported lower levels of self-esteem (Zanon, Bastianello, Pacico, & Hutz, 2013).

Measurement Instruments on the Affect

Through this review, 17 measurement instruments on the affect have been found. The instruments found were generally based on the choice of adjectives that corresponded to what the subject indicated to be feeling at the moment or on unique scales dedicated to a dimension of the construct (see Table 2).

The Semantic Differential Measures of Emotional State (Mehrabian & Russell, 1974) aims to measure the emotions through three dimensions: pleasure, activation, and dominance. The dimensions are evaluated through six scales with nine points, happy-unhappy, pleased-annoyed, stimulated-relaxed, excited-calm, controlling-controlled, and influential-influenced. The instrument's semantic differential was a new approach to the affective field, even though inicially this instument was used to measure emotions. This approach has brought a boost for dimensional models to be used in future affect research, unlike the other models that used each emotion as a dimension.

Table 2

Measurement Inst	ruments on	the Affect
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Instrument	Author	Year
The Semantic Differential Measures of Emotional State	Mehrabian & Russell	1974
Self-Assessment Manikin	Lang	1980
Affectometer 2	Kammann & Flett	1983
MAACL (Multiple Affect Adjective Check List)	Zuckermann, Lubin, & Rinck	1964/1983
FAS (Felt Arousal Scale)	Svebak & Murgatroyd	1985
AD ACL (Activation and Deactivation Adjective Check List)	Thayer	1986
Positive and Negative Affect Schedule	Watson, Clark, & Tellegen	1988
Affect Grid	Russell, Weiss, & Mendelsohn	1989
FS (Feeling Scale)	Hardy & Rejeski	1989
Exercise-Induced Feeling Inventory	Exercise-Induced Feeling Inventory	1993
PANAS-X (Positive and Negative Affect Schedules-Expanded Form)	Watson & Clark	1994
PANAS (Brazilian version)	Giacomoni & Hutz	1997
PAAS (Physical Activity Affect Scale)	Lox, Jackson, Tuholski, Wesley, & Treasure	2000
PANAS para children (Brazilian version)	Giacomoni & Hutz	2006
I-PANAS-SF (International Positive and Negative Affect Schedule Short Form)	Thompson	2007
Empirical Valence Scale	Lishner	2008
PANAS for Teenagers (Brazilian version)	Segabinazi, Zortea, Zanon, Bandeira, Giacomoni, & Hutz	2012

Note. Table 2 on the paper has already been published, and the reference is: Crispim, A. C., Archer, A. B., Cruz, R. M. (2014). Methodological issues about affect: A systematic review about assessment tests of affect. *International Journal of Education and Social Science*, *1*, 118-126.

SAM (the self-assessment manikin) was built with the same structure as the semantic differential measures of emotional state (Mehrabian & Russell, 1974), with three dimensions named as valence, activation, and dominance. These dimensions are also tested in relation to some stimulus or event (Lang, 1980).

The difference in this instrument consists on the representation of the scales through pictures, aiming to make it applicable worldwide without the need to translate the scale. Each scale-item has the picture of a doll displaying expressions that can range from happy to unhappy (happiness-unhappiness), from a face with closed eyes to a picture of a doll shaking (activation-sleepiness), and the picture of a small doll to a big doll (submission-dominance). This model is also based on the semantic differential (Bradley & Lang, 1994).

Investigating SDMES (the semantic differential measures of emotional state) and the SAM (Bradley & Lang, 1994), the instruments' dimensions were correlated. Both instruments were applied with stimuli obtained from the international affective picture system (Lang, Ghman, & Vaitl, 1988; Lang, Bradley, & Cuthbert, 1997). The items from the SDMES were correlated by a matrix of main components and three factors emerged, as foreseen by the theory of the instrument. The second step was correlating the mean scores by factor in each stimulus. The dimensions of valence and activation demonstrated good correlations between the two instruments (r = 0.94 to 0.97). However, the dimension of dominance obtained correlations considered weak (r = 0.18 to 0.23).

With the demand of measuring well-being, the affectometer 2 (Kammann & Flett, 1983) is characterized as an instrument of over 40 items with the positive affect and negative affect dimensions. Thus, the level of well-being is measured as the positive feelings outweigh the negative feelings. The 40 instrument items were built based on a pool of items empirically created, characterized by phrases and adjective-items. For the measurement, the participant was asked how often he experienced a particular feeling: "Not at all", "Occasionally", "Some of the time", "Often", and "All the time". The two dimensions have shown a correlation of r = -0.66 and the instrument as a whole has shown alpha = 0.95. In correlating these two dimensions with the results of BDI (the Beck depression inventory), the positive affect was negatively correlated (r = -0.74) with the results and the negative affect was positively correlated (r = 0.83), strengthening the convergent validity of the instrument.

MAACL (the multiple affect adjective check list) has brought a different perspective for the measuring of affect, measuring each affective state as a separate factor. Initially, the factors of the MAACL were anxiety, depression, and hostility (Zuckerman, Lubin, Vogel, & Valerius, 1964). The depression factor scale was made based on the application of items from the scale in neuropsychiatric patients and in the opinion of judges who classified the responses into "severe", "moderate", "mild", and "not observed". The anxiety factor scale obtained previous studies (Zuckerman, 1960) and had 21 items. The hostility scale was constructed with 132 items, utilizing 21 anxiety items, 40 depression items, and 71 items relating to hostility. Among 71 items, 28 were anchored to the hostility factor.

Studies with the MAACL continued (Zuckerman, Lubin, & Rinck, 1983) and two new factors have emerged of the 132 items, positive affect and search for sensation. These factors were seen after the use of factor analysis with varimax rotation, wherein the rotated factors explained from 47% to 51% of the common variance. On account of the anxiety, depression and hostility factors obtaining strong correlations (r = 0.32 to r = 0.62), they were reassembled dysphoria scale. The high correlation between positive affect and search for sensations (r = 0.44 to r = 0.56) generated PASS (positive affect scales with search for sensation). Instrument's confidence indexes on the test-retest were considered good (r = 0.8), with the exception of the search for sensation scale. The dysphoria scales and PASS demonstrated r = 0.9 or higher, indicating good reliability indices. On the same proposal by Russell (1980), the affect grid (Russell, Weiss, & Mendelsohn, 1989) was created. It's an instrument that follows the dimensional model with only one item. Its dimensions are pleasure—displeasure and activation—sleepiness. The instrument's item is characterized by a 9×9 grid, which has the allocated components like in the Russell's circumplex (1980), being the horizontal dimension related to valence and the vertical dimension related to activation. In search of evidence of convergent validity, 60 students, divided into three groups, were asked to answer the scale. The first group answered the scale with the 9×9 grid, the second group answered the scale with a circular format and the third group answered the scale on a single item format. Significant correlations were found, with r = 0.89 to 0.95.

AD ACL (the activation and deactivation adjective check list) is a multidimensional instrument that aims to access momentary activation states. It has 20 items, with a four-point scale and two dimensions: energetic activation, which includes fatigue; and tensioned activation, which includes calmness. In their descriptions, the authors report that the dimensions are associated with activation characteristics, such as physiological changes and humoral states (Thayer, 1986). Its structure resembles the PANAS structure, but the AD ACL captures low activation states. However, it's recommended by Ekkekakis (2013) that the AD ACL be used with caution because of problems concerning the type of scale used and the non-measurement of that affect in a global fashion (Ekkekakis, 2013).

FAS (the felt arousal scale) (Svebak & Murgatroyd, 1985) was built differently from what was being made, but following the dimensional models perspective. This scale is part of an instrument called TSM (Telic state measure), but it's used separately in the affect researches. The FAS aims to measure the perceived activation and for that, utilizes a single item with a six-point scale, with one low activation and one high activation. Evidence of convergent validity was seeked by Ekkekakis, Hall, Van Landuyt, and Petruzzello (2000), and it was found to have correlations r = 0.45 to 0.70 with (SAM)e r = 0.47 to 0.65 and with the affect grid scale of activation.

FS (the feeling scale) is a similar scale to the FAS. It's a single item scale with an 11-point variation, -5 to +5. The verbal anchors are on number 0 (neutral), +5 (very good), +3 (good), +1 (relatively good), -5 (very bad), -3 (bad), and -1 (relatively bad) (Hardy & Rejeski, 1989). The same way as the FAS, the FS was tested with a valence scale of the SAM and obtained correlations of r = 0.51 to 0.88 (Ekkekakis, Hall, Van Landuyt, & Petruzzello, 2000). Altough the FAS and the FS weren't initially developed with the intent to measure affect, recent findings (Ekkekakis, Parfitt, & Petruzzello, 2011) indicate that the scales used in conjunction can dimensionally measure affect, as proposed by Russell (1980).

Similar to the FS and the FAS, EVS (the empirical valence scale) was constructed. This scale is based on the valence dimension of the affect and it's constituted by a single scale (item) that ranges from "the most unpleasant imaginable" to "the most pleasant imaginable". Its construction was realized since the FS and the FAS only have numbers on the item and due to that fact could have a bias about the meaning of such numbers for each individual. On the EVS, the scale's describers were allocated according to studies conducted between values placed on the scale and which category participants attributed to it, thus being a recent instrument that has potential for measuring the affect valence axis (Lishner, Cooter, & Zald, 2008).

EFI (the exercise-induced feeling inventory) aims to access feelings that occur in conjunction with peaks of physical activity. It has four factors named as revitalization, tranquility, positive involvement, and physical exhaustion. The EFI has 12 items, characterized by descriptors as calm, fatigued, enthusiastic,

energetic, and happy. The respondents must answer to the instrument thinking about how they feel at that moment and mark, on a scale of 0 to 4, how much they feel a specific descriptor. The subscales demonstrated good internal consistency and shared the expected variance with its constructs (Gauvin & Rejeski, 1993). Although promising, the EFI is not a much utilized instrument. In methodological and conceptual criticism to the EFI, it was noted that substantial shortcomings found in its theoretical core and deviations in established guidelines could lead to important implications on its validity data (Ekkekakis & Petruzello, 2001).

PANAS (the positive and negative affective schedule) was based on Watson and Tellegen's theory (1985). Its internal consistency index is considered significant, with $\alpha = 0.90$ for the positive affect and $\alpha = 0.84$ for the negative affect. A factor analysis was done to verify construct validity. Two factors emerged from this procedure, responsible for 87.4% of the common variance. The positive affect reflects how much the individual feels excited, active, and alert. The negative affect reflects suffering and aversive mood states, such as anger and contempt (Watson et al., 1988). However, it is observed that both dimensions of this instrument only cover high activation pleasant and unpleasant affective states (Barret & Russell, 1999).

PANAS-X (the positive and negative affect schedules-expanded form) was developed to access emotional states more specifically. The PANAS-X is an extended version of the PANAS: Its dimensions stay the same, but the instrument has 60 items. The PANAS-X's goal is to measure mood with 11 new subscales: fear, sadness, guilt, hostility, shyness, fatigue, surprise, cheerfulness, self-confidence, attention, and serenity (Watson & Clark, 1994). Also based on the PANAS, I-PANAS-SF (the international positive and negative affect schedule short form) was built. This instrument has ten items and maintains both dimensions concerning positive affect and negative affect (Thompson, 2007).

PAAS (the physical activity affect scale) came from the combination of the EFI with SEES (the subjective exercise experiences scale) on account of both instruments having factors in common. The PAAS was initially made with the SEES's psychological suffering subscale and all of the EFI's subscales. Exploratory and confirmatory factor analysis supported four components, named positive affect, negative affect, fatigue, and tranquility. Lastly, 12 adjective items were left (Lox, Jackson, Tuholski, Wasley, & Treasure, 2000). When evaluated the invariance of the instrument in samples of physically active and not active participants, the PAAS has demonstrated invariance results in these samples (Carpenter, Tompkins, Schmiege, Nilsson, & Bryan, 2010). Despite referring only to affect in the exercise, contradictions are found in its items once they were taken from scales such PANAS, POMS, and STAI (state-trait anxiety inventory), which are not specific instruments in the field of exercising (Ekkekakis, 2013).

The use of dimensional models such as Russell's (1980) and Watson and Tellegen's (1985) brought such benefit as a larger coverage about the affect's universe, organizing a synthesis of the phenomenon and accelerating the development of knowledge on the field. Thus, instruments such as the PANAS continue to contribute for a better understanding of affect. However, so knowledge continues to advance, new instruments with different theoretical models are needed, so that other perspectives are also studied.

Conclusion

The affective field is permeated by several measuring instruments and theoretical concepts, which made measuring of the affective spectrum a challenge in methodological terms. It's important to note the possible

derivations associated with the use of affect terminology and measuring instruments made to evaluate such construct.

The absence of a definition both operational and constitutive about the affect concept and its distinctions from mood, emotion, and other associated variables undertake the theoretical and instrumental development (Scherer, 2005; Ekkekakis, 2013). A contributing factor to the restriction in such development is the use of instruments for the account of traditions of use, without identifying the reason for the continued use (Ekkekakis, 2013). In utilizing measurement instruments, researchers must recognize that they are agreeing with the theory behind it and thus, understand how their production of knowledge can contribute to new studies.

The relationship between affect and other variables displays an interesting scenario for the study of affect. Identification of how affect varies in the most diverse situations will enable an understanding of possible "triggers" about how it happens, thus complementing the vision of the construct as a whole.

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