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Cognition and emotion: On paradigms and metaphors

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Abstract

The field of cognition and emotion is characterized as the cognitive psychology of evaluative and affective processes. The most important development in this field is the fruitful adoption of cognitive psychology paradigms to study automatic evaluation processes, for example. This has led to a plethora of findings and theories. Two points are emphasized: First, the (often metaphorical) theoretical way of thinking has changed over the decades. Theorizing with symbolic models (e.g., semantic networks), which was prevalent in earlier years, has been replaced more recently by subsymbolic models (i.e., PDP models). It is argued that – despite their still metaphorical character – the latter are better suited to capturing characteristics of emotional processes. Second, the field has adopted the methods of experimental cognitive psychology to develop and refine paradigms as "windows to the mind".

Cognition and emotion: On paradigms and metaphors

The journal *Cognition and Emotion* has just celebrated the first three decades of its existence. It just so happens that these three decades match up to the three decades of my professional life. Thus, looking back means trying to remember how I saw the field in those days and comparing this view to my present view. Both views are of course biased: My view as a young researcher was biased due to my still incomplete knowledge of the field; my view as an older researcher is presumably biased by some of my settled personal opinions (which might be a friendly euphemism for a lack of openness).

I do not consider myself an emotion researcher in the narrow sense. I am a cognitive psychologist with strong interests in the intersection of cognitive psychology and emotion research. I use "cognition and emotion" a bit in analogy to the use of "social cognition" for the intersection of cognitive psychology and social psychology. "Cognition" in this phrase stands for cognitive psychology, its approaches, its theories, and its methods. First and foremost, this means giving high priority to experimental paradigms. Experimental paradigms in cognitive psychology are basic designs that are associated with a replicable, non-trivial effect and with space for variations; they are sometimes considered – a bit expressively – as "windows to the mind". "Emotion" is a placeholder for something broader than emotions in a narrow sense: It stands for evaluative and affective processes in general, for example, automatic evaluation processes.

Cognition and emotion – a flourishing field

On the one hand, today's cognitive psychology is driven by the perspective that cognitive processes are in the service of appropriate actions by an organism in a dynamic world (as compared to cognition in the service of cognizance of the world, as

might have been the case in the early days). Given this perspective, emotional and motivational processes immediately move to the foreground. Thus, in the early eighties, Bower (1981, p. 147) wrote, "… cognitive psychologists have been criticized—perhaps rightly— for ignoring the role of emotion and motivation when they study the operation of some cognitive function like attention, or memory, or thinking." I do not think that such a critique is still uttered these days.

On the other hand, research on emotional processes has utilized cognitive psychology paradigms to answer questions specific to the field. While an attention researcher within basic cognitive psychology might wonder whether certain stimulus characteristics unconditionally attract attention, a cognition-and-emotion researcher might wonder whether threatening content might be one such characteristic (e.g., Öhman, Flykt, & Esteves, 2001; Wentura, Müller, & Rothermund, 2014). Moreover, the cognition-and-emotion field has developed its own paradigms (e.g., evaluative priming; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Wentura & Degner, 2010b; see also below) in the tradition of cognitive psychology. To steal a famous phrase from a different context: "That what belongs together will grow together".

Automatic evaluation processes

A good part of cognition and emotion research deals with the automatic (in the sense of involuntary, non-strategic)[1] evaluation of stimuli, beginning with groundbreaking research by Zajonc (1984), Fazio et al. (1986), and Murphy and Zajonc (1993; for a review, see De Houwer & Hermans, 2010; Musch & Klauer, 2003). A good portion of my own research can be listed under this heading as well. Is it the case that stimuli that

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[1] See Moors and De Houwer (2006) for an extensive discussion of the complexities of the term "automatic".

are positive or negative intrinsically (or by learning) will be involuntarily evaluated as such, and that subsequent behavior will be influenced by this evaluation? This comparably simple initial question has expanded into a set of interrelated follow-up questions that now constitute research fields of their own.

The starting point was the adaptation of paradigms from cognitive psychology known to reflect the involuntary processing of stimulus features to explore automatic evaluation. Most prominent is the evaluative priming paradigm (also known as affective priming), introduced by Fazio and colleagues (1986). I still remember that a colleague made me aware of this article because he had the vague feeling that it matched my interests. Which was true (see below). Evaluative priming involves presenting clearly valenced targets (e.g., words) that have to be categorized as positive and negative. The targets are preceded by the brief presentation of prime stimuli, which are of positive or negative valence as well. Responses are faster in the case of prime-target congruence compared to incongruence, which indicates that the prime valence is automatically processed (see also Herring et al., 2013; Wentura & Degner, 2010b).

But there are also many other paradigms: e.g., the affective Simon task (De Houwer & Eelen, 1998), the color-naming task (" Emotional Stroop"; e.g., Pratto & John, 1991), or the rapid serial visual presentation paradigm (i.e., the "attentional blink" paradigm; e.g., Keil & Ihssen, 2004). If we broaden the scope to include automatic attentional effects (i.e., capturing spatial attention either via valent stimuli or attentional dwelling), we encounter variants of visual search (Hansen & Hansen, 1988; Öhman, Lundqvist, & Esteves, 2001) or cueing (Fox, Russo, Bowles, & Dutton, 2001; MacLeod, Mathews, & Tata, 1986). I can only very briefly sketch the expansion of the aforementioned basic question into a multitude of different fields.

Unconditional evaluation. Might automatic evaluation be conditional on a person's current goals? Spruyt and colleagues (Spruyt, De Houwer, & Hermans, 2009; Spruyt, Tibboel, De Schryver, & De Houwer, 2018) made a good case for conditional evaluation. Note that such conditionalities are in general a hot topic in cognitive psychology since they show that basic processing modules are "cognitively penetrable", that is, they can be modified by top-down settings (see Kiefer & Martens, 2010; Folk, Remington, & Johnston, 1992).

Mental representation. One suggestion to test for the unconditionality of automatic evaluation was to change the target-related task in the priming paradigm (see above) from evaluation to a non-evaluative task, for example, naming the target as fast as possible (e.g., Spruyt et al., 2009). Since Bargh, Chaiken, Raymond, and Hymes (1996) published the first positive evidence for this effect, the pendulum has swung back and forth several times as to whether the effect exists or not (e.g., Klauer & Musch, 2001; Spruyt & Hermans, 2008; Klauer, Becker, & Spruyt, 2016; Spruyt et al., 2018; see Spruyt et al., 2018, for a recent summary). Why was this effect considered so important? Changing the task has more far-reaching consequences than simply discarding an evaluation context. It dramatically changes the paradigm and thereby the basic explanation (see Wentura & Degner, 2010b; Wentura, 2000). Roughly speaking, a priming effect now has to be explained at the level of the mental representation of the valence: If such effects exist, they have to be explained in the same way as the "bread" primes "butter" effects known from basic cognitive psychology (McNamara, 2013). Thus, to explain priming effects found with the altered design one is forced to develop ideas about how valence connotations are mentally represented, given that one arbitrary

positive (negative) conceptual unit facilitates the encoding of any other arbitrary positive (negative) conceptual unit (see Wentura & Frings, 2008; Schmitz & Wentura, 2012).

Application. The question of the mental representation of valence connotations also lies at the heart of the perhaps largest new field of research that has grown out of basic research on automatic evaluation: the indirect measurement of attitudes (e.g., Wittenbrink & Schwarz, 2007; Bar-Anan & Nosek, 2014). This endeavor has even led to the development of new paradigms, most prominently the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) and the Affective Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005). The basic idea here is that if we know that a given paradigm reflects the involuntary evaluation of clearly valenced stimuli, we might replace these stimuli with attitude-related stimuli – that is, stimuli of unknown valence for a given participant – and infer the valence of the attitude-related stimuli from the results. However, inferences of this type are often not (unconditionally) justified. As is often the case in cognitive psychology, a paradigm is more complex than the most face-valid explanation suggests (Wentura & Rothermund, 2007). Therefore, the IAT enriched cognitive psychology as well, with its habit to pose the "could it be otherwise?" question (Proctor & Cho, 2006; Klauer, Voss, Schmitz, & Teige-Mocigemba, 2007; Rothermund & Wentura, 2004). This has led to important methodological refinements (e.g., Meissner & Rothermund, 2013).

Beyond good and bad

To keep things simple, most research on automatic evaluation has proceeded from the assumption that stimuli are automatically evaluated as purely positive or negative (e.g., Pratto & John, 1991). Is this an accurate picture? I do not think so.

In the early days of my career, I was astounded by a simple observation. At that time, I was working in life-span developmental psychology, and specifically on coping processes in old age (e.g., Brandtstädter, Wentura, & Greve, 1993). Thus, my focus was on life satisfaction (and the absence of it) and the vague idea that cognitive paradigms could be used in this field (Wentura, Rothermund, & Brandtstädter, 1995; Wentura & Brandtstädter, 2003; Frings, Wentura, & Holtz, 2007). Therefore, when preparing my first experiments on evaluative priming, I scanned lists of German adjectives rated according to pleasantness, paying particular attention to negative "self-state" adjectives (e.g., *lonely*, *depressive*). Of course, such words were on the list; the top, however, was occupied by words like *brutal*, *mean*, or *cruel*, that is, words describing a bad character, to put it simply. Thus, it was obvious that there are totally different types of "(un)pleasantness".

A taxonomy introduced by Peeters (1983) convincingly identified the difference. The valence of trait adjectives depends on the perspective of the evaluators: whether they evaluate the trait from the perspective of the trait-holder him/herself (e.g., *intelligent*, *lonely*) or from the perspective of someone who has to interact with the trait-holder (e.g., *tolerant*, *brutal*; possessor- vs. other-relevance or self- vs. other-profitability, as Peeters termed it). We were able to show that automatic evaluation processes do indeed exhibit this distinction (Wentura, Rothermund, & Bak, 2000; Wentura, Kulfanek, & Greve, 2005; Wentura & Degner, 2010a; de Paula Couto & Wentura, 2012; Degner & Wentura, 2011). For example, whereas Pratto and John (1991) found that negative social information is attention-grabbing, which they inferred from the slower color-naming of trait adjectives, we found that other-relevant words (negative as well as positive) are particularly attention-grabbing in comparison to self-relevant

words, presumably because they are more directly related to behavior (Wentura et al., 2000). The meaning of this difference is even more obvious if you think of different types of social attitudes: the prejudice against young mean of middle-eastern origin and prejudice against the elderly are of course of different relevance types (Degner & Wentura, 2011; Paulus & Wentura, 2014).

One can expand the "beyond good and bad" hypothesis to stimuli that are directly associated with a variety of basic emotions: emotional facial expressions. If, for example, the initial, fast, involuntary evaluative response to emotional faces is merely a valence distinction, negatively valenced faces should be indistinguishable in experimental paradigms that test for automatic evaluation. We tested this with variants of priming paradigms: For example, the prime and target stimuli were emotional facial expressions and targets that had to be categorized as either happy, angry, fearful, or sad. The primes were presented very briefly and covered by a mask (i.e., were only marginally perceptible, if at all; see Carroll & Young, 2005, for an unmasked version). Nevertheless, priming effects not only reflected the positive versus negative distinction but differentiated within the negative domain as well (Rohr, Degner, & Wentura, 2012; Rohr, Degner, & Wentura, 2015; Rohr, Folyi, & Wentura, in press; Wentura & Rohr, in press). Of course, it still needs to be clarified whether these effects reflect simple semantic ("cold") categorization processes or whether some rudimentary affective emotional processes are at work (see Rohr et al., in press). "Rudimentary emotional processes" – what might this mean? Responding to this question allows me to tackle a further topic that might be addressed by the authors of this special issue.

Changing metaphors – A move in the right direction?

Psychological theories often have a metaphorical touch. For example, we might use a technical analogy to elucidate a specific aspect of psychic reality. Take, for example, the semantic network metaphor (Collins & Loftus, 1975), which has often been used to explain the effects of automatic evaluation: It is a powerful metaphor for understanding the vast interrelatedness of pieces of knowledge and their mutual activation. If one semantic unit is activated (e.g., by a prime), the activation spreads over to related units (e.g., a target stimulus), thereby rendering them more accessible for the next phases of processing. In a highly influential article from the eighties, Bower (1981) adapted the semantic network idea to research on emotions. He added emotion nodes to the semantic network to explain mood-congruent memory effects. This was then (sometimes) used to explain evaluative priming effects (for a discussion see Schmitz & Wentura, 2012).

Why do I call the semantic network a metaphor (and not a theory)? A metaphor compares one phenomenon (A) with another (B) in order to elucidate a not well understood feature of A by means of a similar feature in B (which seems to be better understood). Of course, the comparison is constrained to one aspect. There is always a hidden subtext: "Assume for a moment that concepts are represented by symbol nodes, thus, disregard for a moment the question of how they are generated and how they relate to the outer world and other aspects of the inner world (e.g., feelings, behavioral tendencies)." That is, one aspect of semantic representation is elucidated at the expense of other important aspects. Though the idea of emotion nodes helped promote the insight that emotions have an a priori cognitive-semantic core, it seems better suited to elucidating how we represent an emotional episode from a novel than the *in situ* emotional life of the "owner" of this network.

The metaphors we use have changed over the last few decades. Three developments contributed to this change. First, the development of parallel distributed processing models (PDP; McClelland, Rumelhart, & Group, 1986; Rumelhart, McClelland, & PDP-Research-Group, 1986) gave us an idea of how learning, generalization, and schematic perception processes might work. Second, although PDP networks have nothing in common with real neural networks other than the idea "what happens if a multiplicity of dumb units are highly interconnected", the advent of cognitive neuroscience corroborated this new way of metaphorical thinking (e.g., it is accepted to talk about "cell assemblies code …"). Third, the semantic network metaphor promoted an amodal way of thinking about thinking, which can potentially be criticized as a kind of glass bead game of juggling symbols: The symbol *lemon* is linked to the symbol *sour,* completely detached from what it means to taste something sour (see Pecher, Zeelenberg, & Barsalou, 2003). Therefore, the metaphor of *grounded cognition* (i.e., the integration of modal perceptual processes and abstract thinking; Barsalou, 2008) was liberating. It is a powerful and convincing metaphor, especially for emotion research (Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015).

In this kind of metaphorical thinking, psychic states (such as emotions) are local maxima in a multidimensional space, which is not constrained to inner-brain dimensions, but incorporates bodily and perceptual dimensions as well (see Barrett, Ochsner, & Gross, 2007). Local maxima are established through *constraint satisfaction processes*. That is, in any given situation, some dimensions are fixed at specific values, be they input-related dimensions (seeing a crocodile nearby) or the inner-psychic retrieval of specific thoughts (remembering a horrifying scene from a movie). The network system identifies the best compromise solution given the constraints.

Why do I still consider it a metaphor? Because there is again a subtext, now at a different point in the argumentation. PDP networks are subsymbolic, and so the subtext is: "Assume that this or that part of the activity pattern stands for *X*, with *X* being a *meaningful* unit (e.g., seeing something threatening). Of course, this conceptualization produces massive new problems (see, e.g., Fodor & Pylyshyn, 1988). Thus, despite this new vagueness, why do I consider the new metaphorical thinking an advancement – especially for emotion research? In my opinion, there are several reasons for this.

Holistic meaning. Thinking of emotions as local maxima in a PDP network makes clear that there is no single component (i.e., no subset of dimensions) that deserves to be called, for example, "fear"; it is the holistic pattern that is named this way. Thus, parts of the pattern – e.g., an *X* which stands for *facing something threatening* and a *Y* which stands for *seeing no means to control the threatening object* – are components of the overall pattern and can therefore not be causal of it. However, this statement does not exclude the possibility that there is a typical order of unfolding of the overall pattern (e.g., Scherer, 2001): *X* and *Y* might typically precede *Z,* for example, which stands for physiological responses (see Moors, 2010, 2013, for a more detailed discussion).

Causation and weak constraints. Obviously, fixing some parts of the prototype pattern typically lead to the network's settling into the local maximum, which – as a whole – is categorizable as an emotional episode. However, there might be situations where parts of the network that are typically established as a consequence of *X* and *Y* might be fixed due to other causes (e.g., facial muscle states) and somewhat *bias* the system to settle into a specific maximum (Strack, Martin, & Stepper, 1988). Of course, plausibility arguments tell us from the start that these biases can only be weak, making

their assessment problematic (e.g., Wagenmakers et al., 2016). This relates to "rudimentary emotional processes" (see above): Stimuli might establish parts of an emotion pattern, which might or might not contribute to a "full-fledged" emotional episode depending on other factors: Briefly present a masked picture of a spider to someone with a fear of spiders, and nothing might happen because she/he is sitting in a clean, almost empty (i.e., easy to monitor) lab room; however, the same prime might be the last straw for falling into a panic if the experiment is located in a lab in a dark, dusty cellar full of junk.

Interplay of meaningless and meaningful parts. As previously stated, making the radical move to subsymbolic representations raises a lot of fundamental problems: for example, how can systematic propositional thinking be understood (Fodor & Pylyshyn, 1988; for a discussion, see e.g., Bechtel, 2008)? However, it seems indispensable for better understanding emotions because emotions are characterized by a mixture of semantic and non-semantic components.

Most important questions that still need to be resolved

Taking this new metaphor as a starting point, one can easily identify understudied topics. I see a large gap, or metaphorically speaking, a deep valley between peaks of research activities. One peak is research on automatic evaluation processes with its tendency to simplify evaluation to the good versus bad dichotomy. A second peak is research on emotion prototypes (i.e., anger, fear, disgust etc.) with its perennial discussions about the core components and the role of the semantic kernel of these prototypes. But isn't there a largely unexplored landscape of fine-graded evaluative connotations, of moods, of sentiments, that are associated with persons, objects, episodes?

Take, for example, the difference between the rich affective-connotational world of words (sentences) of your mother tongue compared to the rather impoverished prosaically world of a foreign language. Or take the affective qualities of music which cannot be captured by either simply saying "sounds good" versus "sounds bad" or by saying "it evokes fear, anger, sadness". Music evokes moods, atmosphere (in German *Stimmung*; see Gumbrecht, 2012), affective resonances that are vital for our inner life. The same holds for events, songs, movies, novels that fill and enrich our autobiographical memories and contribute to our sense of personal identity. How can we assess this complex landscape of affective connotations and their psychological meaning?

I see several routes. One is the variation of stimulus materials on an individual or group-based level. For example, we studied the potential of idiosyncratically selected word stimuli to prime emotion concepts and found promising results (Rohr & Wentura, in prep.). A variant is to select materials which should plausibly evoke different connotations in different pre-specified groups, for example, cohort-specific pop phenomena (e.g., songs, stars) for different age cohorts[2] or words in first versus second language for participants with high proficiency in the second language. Proceeding from the assumption that language processing in the mother tongue is affectively "richer" than processing a second language, we studied priming effects in German participants with high

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[2] In a gloss, Treichel (2018), aged 65, wrote about visiting a concert of the sixties band *Procol Harum*, accompanied by a friend and her 13 years old grandson, all along waiting for the famous song "A whiter shade of pale", which was eventually given as an encore. While Treichel describes (with a bit of self-irony) the impact of hearing the song as: "I am more than touched. My life passed by, the fulfilled, but even more the unfulfilled", the bored boy already left the hall.

proficiency in French (Degner, Doycheva, & Wentura, 2012). We found semantic-asso-ciative priming effects (the "bread" primes "butter" effects; McNamara, 2013) in Ger-man and French – thereby corroborating high proficiency in the second language. How-ever, evaluative priming (see above), reflecting spontaneous evaluative connotations, was only found in German.[3]

Another route is to develop experimental paradigms that potentially allow to test for similarities and dissimilarities in evoked connotations. To be more concrete: A po-tentially interesting paradigm is the modality-switch task introduced by Pecher et al., 2003). In the original study, the authors made a strong case for embodied processing of language by presenting noun-adjective pairs (e.g., tea –flavored) to participants and in-structing them to decide whether the adjective can be applied to the noun. Unbeknownst to participants, the sequence of trials was varied. In a nutshell, the authors found that participants verified sentences faster if the same modality (here: taste) was already ad-dressed in the preceding trial (salsa – spicy) compared to a modality-switch (floorboards – creaking). This result corroborated the claim that perceptual qualities are spontane-ously evoked in processing word phrases. This paradigm can be potentially adapted for affective connotations (see, e.g., Oosterwijk et al., 2012).

A third route might be to put more emphasis on the study of the visceral system including the neuro-cognitive study of visceral–somatosensory cortex (see, e.g., Immordino-Yang, Yang, & Damasio, 2016). Pollatos, Herbert, Mai, and Kammer

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[3] Interestingly, French participants with high proficiency in German showed both prim-ing effects in both languages. The difference between the two samples was that the study took place in Germany; thus, the French participants were deeply immersed in German life at the time of recruitment which did not hold at this point of time for the German participants and their immersion in French culture.

(2016), for example, used transcranial magnetic stimulation (rTMS) to inhibit the interoceptive network (to study cardiac and respiratory interoceptive accuracy), a technique which would potentially allow to experimentally study presence or absence of rich affective connotations (but see Coll, Penton, & Hobson, 2017; Pollatos & Kammer, 2017).

Concluding Remarks

Thirty years ago, it was a laudable endeavor to launch the journal Cognition and Emotion. Looking backward on the prospering field of research on cognition and emotion it is now even clearer that it was in fact a visionary act to found a journal that is devoted to the theoretical, empirical, and methodological intersections of two topics that were largely disconnected in the decades before. I look forward to the next decades, which hopefully result in major breakthroughs with regard to the essential questions of psychology in general and emotion psychology in specific, reported in Cognition and Emotion.

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