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Is the ambiguity of emotion multidimensional? The ambiguous valence, activation and origin of emotions

Abstract: Mixed emotions remain a fascinating, yet still understudied phenomenon. All of the previous research has focused solely on ambivalence, studying only the mix of positivity and negativity in emotions (the dimensions of valence). We sum up the already existing knowledge about the dimensional approach to ambivalence and its consequences. Based directly on this knowledge, we introduce a new theoretical model describing ambiguity in four additional dimensions (apart from valence), grouped into two bivariate spaces: origin (dimensions of automaticity and reflectiveness) and activation (arousal and subjective significance). Both of these spaces have never been studied before in the context of ambiguity and mixed feelings. Future implications of the new model are discussed, including any potential impact on the methodology of research and the possible advantages in understanding and describing emotional experiences.

Keywords: *emotions, emotional ambivalence, emotional ambiguity, arousal, subjective significance, origin*

Can people be torn between emotional qualities other than positivity and negativity? As Vaccaro et al. (2020) pointed out, most recent research concerning affective functioning is focused on unidimensional emotional states (with a very clear distinction between positive and negative categories of emotions; Fong, 2006). The ambivalent states are less common than the unidimensional ones (Russell, 2017), but they also seem to be at least as interesting, with their own specifics and potential consequences (Berrios et al., 2015; Oh & Tong, 2022). However, the current research only takes into consideration the ambiguity of valence (e.g. Berrios et al., 2015b; Kreibitz & Gross, 2017; Moore & Martin, 2022; Rees et al., 2013), potentially leaving out all of the other kinds of mixed emotions and oversimplifying the emotional experience; furthermore, there are some discrepancies in the research concerning the consequences of the ambivalence, being either impairing or improving the cognitive functioning (e.g., Hemenover & Schimmack, 2007; Larsen et al., 2003; Branicka et al., 2014). For that reason, we propose a model of three spaces of ambiguity, each created by two dimensions: valence (positivity and negativity,

negatively correlated with each other), origin (automaticity and reflectiveness, negatively correlated), and activation (arousal and subjective significance, positively correlated). Introducing the possibility of ambiguity on different spaces than valence might explain the previous discrepancies in both practice – the results of empirical studies, and theories – recognizing mixed emotions (consisting of two opposite characteristics, negatively correlated with each other) and blends of emotions (consisting of two somehow similar, positively correlated characteristics; Lane et al., 1990); and allow us to more precisely measure the affective states in future studies.

The diversity of emotional states felt by people may be astounding (Davidson & Begley, 2012; Feldman Barrett, 2009, 2017; Wilson-Mendenhall et al., 2015) and – especially in more complex and by that often confusing situations (Grossmann & Ellsworth, 2017) – might lead to feeling more than one emotion at a time (Berrios et al., 2014). The simultaneous experience of two oppositely valenced affects (e.g. positive one – amusement, and negative one – disgust; Hemenover & Schimmack, 2007; Larsen, 2017) is called an emotional



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ambivalence (e.g. Cacioppo, 1999; Fong, 2006; Norris et al., 2010). A good example of an ambivalence might be the situation of longing for someone close, when the negative affect (feeling sad without the presence of this person) is mixed with positive affect (liking this person).

However, an important theoretical distinction to make is the one between the ambivalence (mixed emotions) and blends of emotions (Lane & Schwartz, 1992; Watson & Stanton, 2017), as they both are similar, meaning they are both affective experiences containing more than one emotion at a time (Scherer, 1998; Berrios et al., 2015). However, the core assumption of the ambivalence phenomenon is the co-occurrence of emotions significantly differing in valence (and therefore being qualitatively different, possibly even confusing for the individual feeling it; Hemenover & Schimmack, 2007; Larsen, 2017). Contrarily, blends of emotions – a significantly less controversial phenomenon, strongly rooted in the literature (e.g. Izard, 1972; Oatley & Johnson-Laird, 1996) – consist of simultaneous feelings of a few emotions similar in their valence and, usually, arousal level (e.g. feeling anxious and frightened at the same time; Izard, 1992; Lane & Schwartz, 1992; Vansteelandt et al., 2005; Watson & Stanton, 2017). The arising question – and a serious need in psychology – seem to be describing what could create the difference in these mixed emotions; how we can differentiate one emotion from the other and decide that it is mix of various affects? Can we only qualitatively categorize one emotion and the other, or can we precisely show the quantitative difference?

There is also an ongoing debate concerning the time frame of the experiencing ambivalence in emotional state – whether it is simultaneous (and the emotions are, in fact, mixing and appearing concurrently) or just changes in rapid vacillation (Carrera & Ocejá, 2007; Vaccaro et al., 2020). Larsen (2017) pointed out the possibility of fast changes occurring in the affect, being in fact so quick that an individual cannot subjectively separate the two emotions and reports them as simultaneous. Vaccaro et al. (2020) stressed the fact that the distinction between simultaneity and vacillation could be dependent on the theoretical orientation and constitute an important debate: if the valence is considered to be unidimensional (being a continuous spectrum from positive, through neutral, and to negative; Russell, 1980), than rapid vacillation is an explanation, as the affect must have a single location (it cannot be at the same time the beginning and the end; Feldman Barrett & Russell, 1998). However, separating the valence into two dimensions (one of positivity and one of negativity) and assuming their orthogonality changes the situation entirely. If the positivity is independent from negativity (and vice versa), they might be both active at different intensities at the same time (Larsen & McGraw, 2014), making the hypothesis about simultaneous ambivalence very plausible. Nevertheless, the most recent hypothesis assumes that ambivalence is actually a mix of these two processes – simultaneity and vacillation – having their genesis in different psychophysiological mechanisms (Vaccaro et al., 2020).

Furthermore, it seems that there might be a little bit of ambivalence in states that we so far considered as unidimensional; An et al. (2017) showed that, even when describing six most basic emotions, people successfully and consistently marked them separately on two dimensions of valence, showing their different intensity (e.g. stating that while joy is a generally positive emotion, there might be also some negativity in it; the ratio of positivity and negativity ratings were significantly different between cultures). This result might be good proof that our emotional experiences contain some drastically different qualities in them rather than being a straightforward, single dot on a positive-negative spectrum (Schneider & Schwarz, 2017) – and as such should be studied and understood with methods allowing to capture their full and true variability.

Moreover, as the dual process theories (e.g. Epstein, 2003; Kahneman, 2013; Strack & Deutsch, 2004) find more and more application, also in the psychology of emotions (Jarymowicz & Imbir, 2015), it becomes more and more obvious that the two-categories theory needs some more variation. Namely, it seems crucial to study and describe how those two systems (otherwise called origins or processes) may be mixed and entangled together. For that reason including the origin and activation spaces in the proposed model seem to be extremely important, as it may help to see and understand how the seemingly opposite characteristics are mixed and what they can create in result.

THE CONSEQUENCES OF AMBIVALENCE

Previous studies have employed different methods in order to elicit emotional ambivalence and study its consequences. Mixed affective states were induced by the autobiographical procedure (remembering some ambivalent situation concerning goal conflict; Berrios et al., 2014), scenes from films (e.g. *Life is Beautiful*; Larsen et al., 2001), images (Carrera & Ocejá, 2007; Hong & Lee, 2010), or music fragments (Hunter et al., 2010). A recent meta-analysis of studies concerning mixed emotions showed that effect sizes (for 63 studies in total) ranged from moderate to strong, thus further showing the robustness of the ambivalent affect phenomenon (although it is important to mention that the meta-analysis used studies both with dimensional and discrete approaches to affect, but the effect sizes did not differ significantly between these two types of approaches; Berrios et al., 2015). Therefore, mixed emotions seem to be a coherent and robust (even though still understudied; Fong, 2006; Kreibig & Gross, 2017) emotional experience, and therefore delineating their consequences may be an important issue.

The consequences of ambivalence are usually perceived as utterly negative, as it represents a state of some conflict or dissonance, which people try to avoid (Rothman et al., 2017). It is true that sometimes ambivalence might have a dark side and lead to undesirable outcomes; it can be directly linked by individuals to the feeling of discomfort (Maio et al., 2001; Van Harreveld & Van Der

Pligt, 2009). In previous studies, ambivalence led to generally less favourable attitudes (the effect was observed for the participants with a low tendency to accept and deal with duality; it was explained with the phenomenon of emotional dissonance possibly being an unpleasant experience; Williams & Aaker, 2002), the polarisation of expressed attitudes towards the outgroup (Pacilli et al., 2012), lower accuracy in detecting deception ([citation removed for masked peer review, in review], and was related to the feeling of craving a cigarette (Veilleux et al., 2013).

However – surprisingly – the consequences of ambivalent affect may also be quite beneficial for an individual. Studies have shown that, after the induction of mixed emotions, people made more accurate judgements (compared to the state of unidimensional affect, e.g. the induction of only sadness or happiness) when asked about a weather forecast and when attempting some estimation tasks (Rees et al., 2013). Ambivalence also allowed participants to perceive more unusual relationships between some constructs, understood as improved creativity (Fong, 2006; Kung & Chao, 2019). This plays an important role in the states of high sexual arousal and the feeling of desire (Peterson & Janssen, 2007), and might lead to more adaptive coping (this pattern was only confirmed for the secondary mixed emotional states; Braniecka et al., 2014).

The greater complexity of experienced emotions – and the ability to distinguish, understand, and describe them – is thought to be connected to more advanced emotional awareness (Barrett et al., 2000; Lane et al., 1990; Lane & Schwartz, 1987). Lane and Schwartz (1987) openly wrote about the individual ability to report two qualitatively different emotions experienced at the same time (they call it *blends of emotions*; however, the difference between the emotions is very much underlined). In their theory, this ability is not present until the fourth (out of all five) stage of emotional awareness development (with the fifth being able to report *blends of blends of emotions* – complex patterns of mixed emotions). So, the experience of ambivalence might be an important issue in the sense of individual emotional development. Additionally, the more frequent occurrence of mixed emotions resulted in increased physical (Hershfield et al., 2013) and psychological (Larsen et al., 2003) well-being.

THE DIMENSIONAL APPROACH TO EMOTIONS

In previous paragraphs, we discussed the ambivalence mostly among discrete emotions (e.g. joy and sadness), which is the most accessible at the subjective level of analysis, but had several limitations. The most important is that ambivalence of discrete emotions may be interpreted in terms of limitless different ambivalences, since the number of different emotions represented for example in language is huge (Russell, 1980; 2003). It is also hard to formulate the mechanisms responsible for emotion formation, and thus emotional ambivalence formation, that

would lead to generalisations and the formulation of a theory explaining the ambivalence phenomenon. In contrast to the discrete approach, the dimensional approach was proposed, focussing on some mechanisms underlying each specific emotion (Osgood et al., 1957; Barrett & Russell, 1998; Russell, 2003; Fontaine et al., 2007; Grossmann & Ellsworth, 2017; Wilson-Mendenhall et al., 2015). Those mechanisms are hidden dimensions allowing us to ascribe emotional reactions, like valence, arousal, or dominance. The assumption underlying the dimensional approach is that discrete emotions and subjective emotional experiences result to some extent from the mechanisms such as the degree of pleasantness-unpleasantness experienced, the degree of activation (arousal), or the degree of control that may be involved in emotion (dominance; Bakker et al., 2014; Moors et al., 2009; Russell & Mehrabian, 1977). There still is an ongoing debate on how many dimensions are necessary to describe emotions (Barrett, 1998; Barrett & Russell, 1999; Cowen et al., 2019; Fontaine et al., 2007).

An example of a summary of the dimensional approach to the emotional experience – with the assumption of unidimensional affect – is the circumplex model by Russell (1980, 2003). Russell postulated that there are two basic bipolar dimensions underlying core affect: valence (unpleasantness/pleasantness) and activation (arousal/sleepiness); the middle part of the dimension would be adequate for neutral states. These two dimensions, crossed (with valence being horizontal, pleasantness at the right and unpleasantness at the left; and activation vertical, with sleepiness at the bottom and arousal at the top), created a circular space in which any affective state might be marked by a single location. For example, the state of excitement would be high on the dimension of activation (close to the arousal end) and high on the dimension of valence (close to the pleasant end), overall taking place somewhere in the top right quarter of the model. Both of these intensities of the two dimensions might be marked independently. However, it is important to notice that by this definition it would be impossible to evoke at the same time a state of pleasure and displeasure; the only possibility is to change the intensity of these dimensions moving alongside the one or the other axis. In the light of this theory, Russell (2017) explained mixed emotions as a cold perception of affective quality (seeing how some characteristic of an object can influence the core affect) coming from different objects or as an emotional meta-experience (the feeling that we get after categorising our emotional state; as one emotion may resemble more than one category – even one of the opposite valence – and give an origin to the ambivalence).

An interesting approach to the attitudinal – and, later, also emotional – ambivalence was taken by Cacioppo et al. (1999, 2004) in the theory of Evaluative Space Model (ESM). They postulated that the two opposite – independent from each other – and separate dimensions of positive and negative affect are structured into bivariate space of valence, thus creating endless possibilities of describing an affective state by these terms. With this construct of

bivariate space, it was actually possible to mark a mixed emotion state having some intensity of activation of both positive and negative affect at the same time. The ESM left behind the concept of a straight line and a single dot, and literally created the space for ambivalence.

While critically comparing these two approaches to the structure of affect, it is important to notice that some of the terminology might be similar; some of the terms seem to be confusing and need further description, especially when discussing the sophisticated phenomenon of mixed emotions (Moore & Martin, 2022). For example, as Schimmack (2001) pointed out, the term *independence* of positivity and negativity might be related strictly to the complete lack of statistical correlation between those two, but it could also mean that – despite some correlation existing – changes in one dimension do not necessarily mean changes in the other (e.g., we might be amused and disgusted at the same time, and get gradually more amused while still staying disgusted; Grossmann & Ellsworth, 2017; Hemenover & Schimmack, 2007). This terminology problem might be partially solved by using separate terms of *bipolar* affect (in the meaning of one continuum with two opposite ends) and *bivariate* (in the meaning of consisting of two variables – dimensions independent from each other; Berrios et al., 2015; Rothman et al., 2017). Throughout the text we will be

The second approach seems more adequate to the phenomenon of ambivalence, taking into consideration that, in further studies, there was some relation between positivity and negativity; however, they were not, in fact, perfectly correlated (Diener & Iran-Nejad, 1986). The real and most basic question here – on which the definition of independence will be very much rely on – might not be about the perfect independence, but rather about mutual exclusion: whether there can be a simultaneous activation of positivity and negativity. The unidimensional theories would treat valence dimension as a thermometer, denying such a possibility (Barrett & Russell, 1999; Russell, 2003); the ESM would allow for this co-activation. Stepping away from the bipolar models seems to be the right direction; the neuropsychological data also show the independence of positivity and negativity (Berridge, 2019) and the possibility of simultaneous activation with some minor overlap (Vaccaro et al., 2020). Furthermore, statistical models including the orthogonality and separation of positivity and negativity actually explain more variance in the data than unidimensional models, therefore showing a better fit for the data (Colibazzi et al., 2010; Viinikainen et al., 2010) and constituting a more coherent explanation.

NEW SPACES IN EMOTIONAL AMBIGUITY: ORIGIN AND ACTIVATION

Dimensions

It is important to notice that all of this debate – searching for the true nature of the experience of mixed emotions and its specificity – is focused on ambivalence and therefore concerns only valence as a dimension underlying affect and creating ambiguity. It may be a very

important dimension, taking into consideration the evolutionary perspective and the informative role of emotional states (letting people know whether something is positive – pleasant – and they may approach it, or whether it is negative – unpleasant – and they should withdraw in order to avoid some harm; Russell, 1980, 2003; Clore, 1994; Frijda, 1994). However, it is not the only one. The structure of the emotional experience might be shaped by other dimensions, such as aforementioned arousal (Russell, 1980; Barrett & Russell, 1998), subjective significance (van Hooff et al., 2008; Imbir, 2015, 2016), or emotional origin (Jarymowicz & Imbir, 2015).

Arousal was described by Russell (1980) as a second fundamental (and universal for every emotion) dimension, next to valence. Arousal was defined as an energy – the activity – experienced during emotional experience (Russell, 1980; 2003). Emotional arousal may be responsible for engaging in a particular action and reacting as appropriately to the situation as possible (Imbir et al., 2017). High emotional arousal allows for fast and automatic reactions (it captures the attention and activates simple, biological reactions, such as fight-flight-freeze; Epstein, 2003; Imbir, 2016); however, it may also impair higher cognitive functions (Nigg, 2000; Kahneman, 2013).

Subjective significance is a dimension related to the attitude towards the stimulus (van Hooff et al., 2008; Imbir, 2016). Subjective significance is the perceived importance of an object, very much depending on how the object is interpreted and how it corresponds with an individual's goals and values (Imbir, 2016). A highly significant stimulus would very much correspond with one's aims; therefore, it would be activating, in the sense of putting rational, reflective effort in the potential reaction.

Finally, the dualistic dimension of an emotional origin, i.e. automatic or reflective (Jarymowicz & Imbir, 2015; Jarymowicz & Jasielska, 2012), describes whether the emotion was elicited due to automatic (fast, innate, effortless) or reflective (slow, controlled, cognitive, effortful) processes (Epstein, 1998, 2003; Kahneman, 2013). The dualistic nature of this dimension might be explained with the usage of the heart and mind metaphor, with heart being intuitive, impulsive, automatic reactions (Kahneman, 2013), and mind being deliberative, reflective and cognitively engaging.

All of these aforementioned dimensions may be important for emotional experiences, either through their own influence or through interactions with each other and with valence (Imbir, 2016; Imbir et al., 2017; Imbir et al., 2023; van Hooff et al., 2008). For example, for stimuli of high subjective significance, recognising their valence will be perceived by an individual as more important and should be done faster (as the cost of misjudging it might be high) than for low significant stimuli (Barrett, 2017). This example shows exactly how necessary it is to address the other characteristics of affective experiences that may be responsible for the variability in the patterns of experienced mixed emotions. It seems plausible that, apart from the state of ambiguity on the bivariate valence space

(assuming the aforementioned construct of space created by dimensions proposed by Cacioppo et al., 1999 in ESM) between positivity and negativity, mixed emotions might be differentiated in other spaces, created by opposite dimensions. Two newly proposed spaces, which we stress as especially important in the description of emotional experience, are the emotional origin (created by the dimensions of automatic and reflective origins; Jarymowicz & Imbir, 2015) and the activation (created by dimensions of arousal and subjective significance; Russell, 1980; Imbir, 2015; van Hoof et al., 2008). Both of them might play a crucial role in defining the affective state and its consequences.

As was already mentioned, the *origin* is a dualistic construct by its very nature, with the dimensions of automaticity and reflectivity somewhat opposed to each other (Jarymowicz & Imbir, 2015; Jarymowicz & Imbir, 2010). However, it seems that experiencing emotions of different origins at the same time is an actual possibility, and might contribute to the creation of an affective state as complex and confusing as ambivalence. An example may be the situation in which an individual would be afraid of taking some action (fear, an automatic emotion, being an innate reaction to the stressful, possibly difficult situation), but at the same time being determined, willing, and enthusiastic to try (determination, a reflective emotion, coming up as a result of a cognitive appraisal of the situation and the calculation of possible gains and losses). Getting a promotion at work may be such situation, in which we may feel at the same time both a very basic feeling of being accepted (automatic emotion; Jarymowicz & Imbir, 2015) and much more reflective feeling of pride (reflective emotion, requiring a lot of cognitive effort; Jarymowicz & Imbir, 2015).

It seems that ambiguity in the space between these two dimensions fits right into the dual process theories (Darlow & Sloman, 2010; Epstein, 1998; Kahneman, 2013) and dualistic emotional origin (Jarymowicz & Imbir, 2015), as it accentuates the specific characteristics of both automaticity and reflectivity, the phenomenon of them spontaneously interlacing and creating an ambiguity between the metaphorical heart and mind (Imbir, 2016b). Moreover, ambiguity on the space of origin might be rather beneficial in everyday life. Compared to the state of ambivalence, which might be experienced as unpleasant and force an individual to take some action in order to get rid of it (Van Harreveld et al., 2009), an origin ambiguity might bring all the benefits of both automaticity and reflectivity. Assuming that an individual is aware enough to know their emotions, they might use both the intuitive information from the automatic affect (the so-called *gut feeling*, which has, for example, the undeniable advantage of being a fast response to the situation), as well as the results of a deliberative analysis from the reflective affect (slower, but using the cognitive resources, and therefore some previously gained knowledge, already known schemas, or formulas).

Different kinds of *activation* were first introduced by Watson et al. (1999) as a variation on circumplex models

(Russell, 1980; Watson & Tellegen, 1985); they were for separating positive activation from negative activation, thus not treating activation as a monolith construct, but rather dualistic one, tying it to the systems of approach and withdrawal. The bivariate nature of emotional *activity* was later proposed by Imbir et al. (2017) with theoretical roots in dual processes theories (e.g., Epstein, 1998; Kahneman, 2013); here we would like to continue this thought and further argue about the possibility of activation ambiguity. The bivariate activation space would be created by the opposite dimensions of arousal (more automatic, intuitive, biological even; Epstein, 2003; Strack et al., 2004) and subjective significance (tied to the cognitive reasoning and deliberative analyses of the situation; van Hoof et al., 2008). An example of a situation containing ambiguity on the space of dual activation might be an event of getting some upsetting news – e.g. of not receiving the desired promotion at work. Some of the prototype feelings mixing at that moment could be general, unspecific, and very automatic anger (emotion of very high arousal; Russell & Barrett, 1999; Russell & Giner-Sorolla, 2011), but also a determination to focus, deal with the situation, and find the optimal solution to work towards the promotion in the next year (activation high on the subjective significance dimension: deliberative, controlled and reflective).

The new model: three kinds of ambiguity

Therefore, we would like to introduce a theoretical model that includes the ambiguity – understood as feeling or perceiving two opposite, different characteristics (not only positivity and negativity, but also others) at the same time (mechanism of co-activation) or in a very short time frame (mechanism of vacillation), either in one object or two – in more spaces than one bivariate space of valence. This definition is very similar to the one proposed by ESM model, but it also includes the possibility for spaces other than valence. We visualize this model on Figure 1, showing how the three emotional spaces may be put together and presented in a form of a square pyramid.

Furthermore, we would like to propose the hierarchical organisation of three spaces with valence on the bottom (as in the visualization – the base of the pyramid; Figure 1), and then origin, and activation higher at the model (lateral faces of the pyramid; Figure 1) would be a significantly better fit to describe the structure of emotional experiences in the meaning of affectively ambiguous states. As the valence is most evolutionary and basic dimension (Abele et al., 2008; Barrett & Russell, 1998; J. A. Russell & Barrett, 1999), also the ambivalence should be the most important and easily noticed. The ambiguity on two other spaces may take more time to be perceived, and we predict that because of that they require more introspective effort.

We expected all three that these spaces (and six particular dimensions) will be correlated with each other to some degree (Imbir et al., 2020); however, together they will explain a statistically significant bigger part of the variance in experienced emotions and provide a plausible description of affective functioning with the main impact

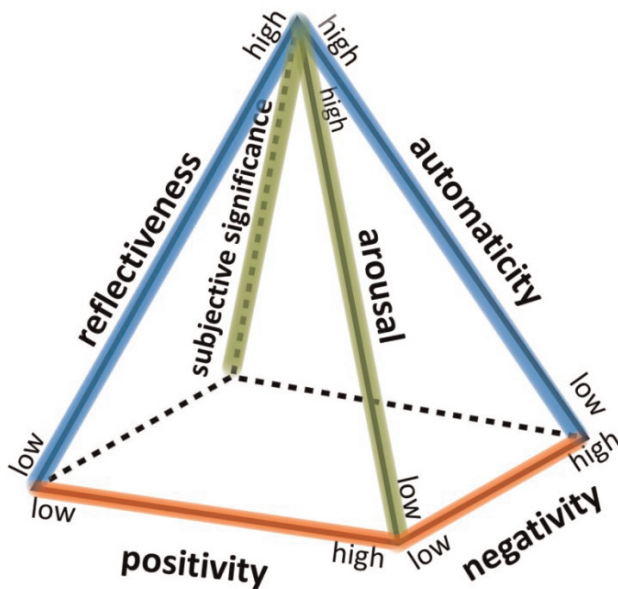


Fig. 1. The visualization of the theoretical model including three ambiguities in a hierarchical order in a shape of a square pyramid: the base of the pyramid is built by the space of valence (base edges: dimensions of positivity and negativity, marked by red color), and the lateral faces are built by spaces of origin (lateral edges: automaticity and reflectiveness) and activation (lateral edges: arousal and subjective significance).

concerning ambiguity and mixed emotions. They could also constitute a way to differentiate the structure of blends of emotions – the emotions that are similar to themselves by their valence (Lane et al., 1990; Watson & Stanton, 2017) – not only by their characteristics (e.g. how arousing is each one of them) but also by their relation to each other (the intensity of ambiguity on emotional spaces). Namely, in our model we would like to distinguish two spaces with negatively correlated, dimensions: valence and origin; as well as one space with positively correlated (Imbir, 2015, 2016; Wielgopolan & Imbir, 2022) dimensions: activation. We predict that this relationships between the dimensions may result in different outcomes (e.g. for perception of that ambiguity or for the cognitive consequences). Using the aforementioned nomenclature of the blends and mixed emotions, we proposed that valence and origin may allow for the description of mixed emotional states, while the activation may enable mapping the blends of emotions.

We expect the dimensions of arousal and subjective significance to be tied to, respectively, automaticity and reflectiveness. This relationship will most likely be seen in the correlations observed in any future research and analyses. However, previous studies have shown that both arousal and subjective significance are separate dimensions with their own separate impact on human behaviour (Imbir, 2018; Imbir et al., 2023) and should be treated as such. Because of that relation, we would expect similar consequences from these two spaces of ambiguity. Namely, it seems that the ambiguity of origin or activation might be a bit overwhelming at first (probably requiring some increased effort to process it), but beneficial in the long perspective – possibly even more than ambivalence.

The reason behind such an assumption is the characteristics of dual process theories: as the two systems have their own specifics, they cooperate, overlap, and exchange the task if needed (Kahneman, 2011), such that by working towards the goal, the individual reacts appropriately to the situation (Strack & Deutsch, 2004b). The two emotional origins might lead to different consequences (Imbir & Jarymowicz, 2013; Jarymowicz & Jasielska, 2012) and have their own specific links to cognitive functioning. There can be four types of emotion-cognition interactions: two within system (automatic emotions influencing heuristic cognition, reflective emotions influencing systematic cognition) and two cross-system (automatic emotions influencing systematic cognition, reflective emotions influencing heuristic cognition; Imbir, 2016). The situation of ambiguity on the origin or activation (very much linked to the origin's dualistic specificity) might be understood as switching between all of these types – thus the aforementioned mixing and overlapping. This might be confusing to an individual at first – creating a feeling of being flooded by different emotions – but rather useful over time, allowing them to choose the best option. We would expect the ambiguity on spaces of origin and activation to influence cognitive functioning, i.e. to elongate reaction times in any decision-making task and lower the certainty of any decision, but also be linked to greater accuracy in those tasks (more detailed judgement, making optimal decisions, considering different parts of a situation). We believe that these relations would be mediated by the intensity of experienced ambiguity; a weak feeling of being torn might not be very much accentuated, but high ambiguity will be significantly influencing. Similarly to ambivalence (Fong, 2006; Kung & Chao, 2019), we believe that ambiguity on the dimensions of origin and activation will increase creativity, but in the understanding of coming up with significantly more solutions to a problem (seeing the situation from many perspectives, noticing a few potential ways of dealing with it). Furthermore, our model was confirmed in some empirical studies with the usage of word stimuli and perceived emotional load in them (Wielgopolan & Imbir, 2023a, 2023b) Wielgopolan & Imbir, in review.

On the basis of the results of the aforementioned studies for words (Imbir, 2015, 2016; Wielgopolan & Imbir, 2022, 2023a, 2023b) we may assess what the relationships between the dimensions would be also for the emotional experiences (not just words only). We present those predictions (alongside with short summary of spaces and dimensions) in Table 1. The most important predictions are the positive correlations for dimensions on two spaces (valence and origin), and negative correlations for dimensions of the space of activation.

A summary of all three spaces and dimensions which are building the spaces. Presentation of the hypothesized relationships between them for emotional experiences (with the '-' sign indicating the negative correlation, and '+' sign indicating the positive correlation).

Our model will allow us to further distinguish emotions ambiguous in various dimensions from blends

Table 1. A summary of all three spaces and dimensions which are building the spaces. Presentation of the hypothesized relationships between them for emotional experiences.

Spaces	Spaces	Valence		Origin		Activation	
	Dimensions	Positivity	Negativity	Automaticity	Reflectiveness	Subjective significance	Arousal
Valence	Positivity	x					
	Negativity	-	x				
Origin	Automaticity	+	-	x			
	Reflectiveness	-	+	-	x		
Activation	Subjective significance	+	+	+	+	x	
	Arousal	-	+	+	-	+	x

of emotions, narrow their definitions and increase the methodological accuracy of further studies, as it would be possible to detect not only affect mixed in the space of valence, but also in the spaces of origin and activation, and therefore to detect even very subtle phenomena of ambiguity, possibly still having a significant impact on cognitive functioning, social interactions, decision-making, and human behaviour in general.

CONCLUSIONS

The phenomenon of mixed emotions is still understudied (Fong, 2006; Vaccaro et al., 2020) and requires some more attention in order to create more coherent models describing affective ambiguity. Although we agree that valence (and, by extension, ambivalence) is important and it brings an individual a lot of information (Clore, 1994; Frijda, 1986), the variability of emotional experiences might be also predisposed and shaped by the properties of other dimensions (Imbir, 2016b). Therefore, studying ambiguity in the spaces between these dimensions seems to be an important and current issue.

The proposed hierarchical model of three affective bivariate spaces of dimensions will allow us to map and understand the structure of emotional experience and its variability more precisely. It will use the biggest advantage of the dimensional approach – generalising the results of any studies on all of the emotional categories with studied characteristics (Barrett, 2017). Furthermore, studying ambiguity on spaces other than valence could be especially beneficial for studying emotions more difficult to evaluate by their valence (e.g. moral emotions, which might be assessed very differently depending on the culture and context; Weiner, 2006), as the dimensions creating spaces of origin and activation might be a better fit and provide a more reliable system of classification. The inter-correlations and interaction effects between particular spaces of ambiguity alone might be an interesting future direction of empirical studies. The multiplicity of spaces also allows us to predict that different kinds of ambiguity might be processed in various ways (e.g., is ambivalence more exhausting than the ambiguity of emotional origin?

Will people be significantly more motivated to get rid of some particular ambiguity, while accepting some other?) and have distinctive effects on individuals, i.e. affect their functioning (for example cognitive efficiency, memory, judgement accuracy) in different ways, specific for each space, and possibly moderated by the intensity of the experienced ambiguity.

The proposed model is also an answer to some of the biggest concerns that have appeared in the literature regarding mixed emotions. The results of the studies conducted so far – although not that many concerning the consequences of ambivalence – might be a bit confusing (showing very different characteristics of ambivalent emotional states, being either beneficial or impairing), and, foremost, being limited to only very specific emotional categories (particular dyads of emotions, such as sadness-happiness or amusement-disgust; Hemenover & Schimmack, 2007; Larsen et al., 2001). Including ambiguity on different emotional spaces (origin and activation) might allow us to systemise the previous results by properly understanding them and mapping exactly how emotions are ambiguous. Is it only positivity and negativity, or is the emotional state mixed in various spaces? One emotional category (e.g. amusement) might have many emotional dimensions underlying it, and be a mix of different intensities of dimensions. If we think about the mixed emotional state containing more than one category (e.g. amusement and disgust), there might be a true multiplicity of different characteristics, some of them being ambiguous in various ways. Our model provides a way to further distinguish the different types of ambiguity, possibly getting to the core of observed effects and explaining them with specific mechanisms of ambiguities on each one of the three spaces. Our approach and the introduced model derive from the main advantage of the dimensional approach (and, at the same time, the biggest flaw of the categorical approach). This will allow us to create a study concerning different types of emotional ambiguity and then generalise the results to many emotional categories.

As the model proposed by us requires further studies, one of the biggest challenges right now (similarly to the

methodological difficulties around that in the case of the ambivalence; Moore & Martin, 2022) will be to prepare an empirical paradigm adequate for measuring emotional ambiguity on the bivariate spaces of origin and activity. Eliciting emotions of different origins might be rather difficult, taking into consideration their various characteristics (Imbir & Jarymowicz, 2013; Jarymowicz & Imbir, 2015), so any experimental procedure should be planned carefully and allow us to compare all of the dimensions. Furthermore, any materials or stimuli used in such studies should also be previously validated and meticulously chosen in order to maximise the chance that they will be a manipulation enabling the measurement of such a subtle phenomenon of emotional ambiguity (c.f. Kreibig & Gross, 2017). Designing such a novel empirical paradigm adequate for measuring ambiguity on two new spaces would allow us to create entirely new possibilities to describe, categorise, and analyse ambiguous affect in any future studies.

Taking into further consideration the subtle nature of the emotional ambiguity phenomenon, it would probably be advised to use intuitive methods to measure it when possible. We postulate moving towards the dimensional approach rather than the categorical approach. The main advantage of the dimensional approach is its simplicity; basic dimensions might be easier for participants to express their feelings and capture even small differences (e.g. the perception of different types of ambiguity in words; Wielgopolski & Imbir, 2022). Because of all that, in any future studies, we would recommend using simple and intuitive methods, such as drawing the process of emotional experience (Carrera & Ocejka, 2007) or indicating the emotional state with a Self-Assessed Manikin Scale (Lang, 1980; Hodes et al., 1985; Imbir, 2016). Any psychophysiological or neuropsychological method (e.g. the EEG measurements; Goyal & Singh, 2015) might be also especially beneficial in that case, allowing us to delineate not only behavioural, but physiological and neurological changes as well.

The main implication of our model is broadening the scope of already existing knowledge, possibly creating an opportunity to explain more variance and build a statistical model better fitted to any empirical data gathered in the field of emotional ambiguity. The field of mixed emotion is definitely in need of new methods, systematic metaanalyses summing up the knowledge, and further studies in different paradigms (Moore & Martin, 2022); however, we would like to argue that it is impossible to take up this challenge without taking into consideration all of the variables. Leaving out the spaces of origin and activation would mean to omit the dimensions giving significant results in previous studies and having their own specific consequences on human functioning (Antosz & Imbir, 2017; Imbir, 2016b; Imbir et al., 2015; Imbir & Jarymowicz, 2013; van Hooft et al., 2008b).

Furthermore, understanding the emotional experience on the proposed additional spaces of ambiguity might also be useful in the light of the theories of emotional awareness (e.g. Lane et al., 1990), the individual patterns

of affective functioning (Davidson & Begley, 2012; Davidson & Irwin, 1999), and its consequences (Fajkowska-Stanik & Marszał-Wiśniewska, 2004). In a more practical meaning, mapping and describing emotional ambiguity might create a base for designing training of emotional competence or help further the potential tools of psychotherapy and clinical psychology.

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