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Ph.D. THESIS SUMMARY

INVESTIGATING RELATIVE AND ABSOLUTE ACCURACY OF EMOTIONAL PREDICTIONS, THEIR CORRELATES AND IMPLICATIONS

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*Notes.*_____

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(2) All the Tables and Figures are numbered within the corresponding chapter or subchapter of the thesis.

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Keywords: response expectancy, affective forecasting, prediction, emotion, accuracy

CHAPTER I. THEORETICAL BACKGROUND

1. Introduction and research topic

The predictions individuals make regarding their future emotions and their relationship with actual emotions have been studied in two distinct lines of research using two different denominations. Thus, in the clinical psychology field they have been investigated as response expectancies, while in the social psychology domain they were addressed as affective forecasts or emotional predictions. In this chapter, we define these two concepts and present the state of the art regarding research on the accuracy of predictions regarding future emotions, portraying similarities and differences found among the two aforementioned domains. Further, we state the relevance of this field of study and what impact novel research regarding emotional predictions could have on the subject

1.1 Response expectancies

Response expectancies are defined as expectancies regarding nonvolitional outcomes (Kirsch, 1985). Nonvolitional outcomes refer to outcomes which are presumed to be outside of human volition (i.e. involuntary), such as pain, relaxation, distress, or physiological responses. In this line of research, emotional responses are also considered non-voluntary, meaning that there is no voluntary decision prior to or intentionality regarding emotion generation. As such, predictions regarding future emotions fall in the category of response expectancies in this line of research.

In the available research concentrating on response expectancies of future emotional responses, a large majority investigated distress in different clinical settings such as emotional upset prior to radiotherapy (Sohl et al., 2012), distress prior to surgery (Cristea et al., 2011; Motgomery & Bovbjerg, 2004; Montgomery, Schnur, Erblich, Diefenbach, & Bovbjerg, 2004), and fatigue after surgery (Montgomery et al., 2010), or even in non-clinical contexts such as exam-related distress (Montgomery, David, DiLorenzo & Schnur, 2007) or emotional distress in a pain inducing situation (Sullivan et al., 2001). One notable example of research examining response expectancies for future affect focuses on public speaking anxiety (Visla, Cristea, Szentagotai-Tatar, & David).

The theory regarding response expectancies proposes not only that they go in the direction of and are comparable to nonvolitional responses, but also that there is a causal connection between expectancies at t_1 and nonvolitional outcomes at t_2, and therefore by changing expectancies one can produce a change in outcome (Kirsch, 1990). This is important in the therapeutical context, where it has been shown that response expectancies mediate the role of hypnotical interventions for breast cancer surgical patients on post-surgery outcomes (Montgomery et al., 2010), and the role of irrational beliefs on public speaking anxiety (Visla et al., 2013). These research findings support the assertion that response expectancies have am unmediated effect on subjective experience (Kirsch, 1985).

The relationship between response expectancies and nonvolitional outcomes is generally investigated in existing studies by assessing the association between expectancies and outcomes through correlational methods. A recent meta-analysis concerning the association between response expectancies and side effects of cancer treatment showed there is a medium effect size for this association (Sohl, Schnur & Montgomery, 2009). Results are similar in individual studies investigating the association between response expectancies and their respective emotional states (Montgomery et al., 2007; Visla et al., 2013). Thus, response expectancies can be considered moderately accurate in this paradigm.

Not many investigations have targeted predictors of response expectancy accuracy, however. Some hypotheses have been generated by the original theory, such as those regarding *strength of the expectancy*, *temporal proximity to the event* of the response, and *familiarity with said event* (Kirsch, 1985; 1990). Firstly, stronger expectancies are believed to generate more accurate responses. Secondly, expectancies which are temporally closer to the event they are targeting are said to bring about more similar nonvolitional outcomes. Lastly, increased familiarity with the event is considered to influence the accuracy of response expectancies, through the feedback loop mentioned earlier. Meta-analytical research supports this last claim, asserting that previous experience with the treatment moderates the relationship of expectancies with outcomes in the case of side-effects related to cancer treatment, such as pain, fatigue, nausea and vomiting (Shol et al., 2009).

1.2 Affective forecasts

A different line of research originating in social psychology started investigated predictions individuals make on future emotions by the name of *affective forecasts* (Gilbert, Pinel, Wilson, Blumberg & Wheatley, 1998) and further on being also termed *emotional predictions* (Gilbert & Wilson, 2009). Affective forecasts represent predictions individuals make regarding their future emotions, and have been investigated in a large array of life events such as medical decisions (Sieff, Dawes & Loewenstein, 1999), performance at intelligence tests or exam results (Buehler & McFarland, 2001; Dunn, Brackett, Ashton-James, Schneiderman & Salovey, 2007; Greitemeyer, 2009), accommodation (Dunn, Wilson & Gilbert, 2003), romantic relationships (Hoerger, 2012; Hoerger & Quirk, 2010; Gilbert et al., 1998), sporting events (van DijK, Finkenauer & Pollman, 2008;), or general elections (Gilbert et al., 1998; Levine, Lench, Kaplan & Safer, 2012).

The novel idea that this domain has brought about is that individuals' affective forecasts are generally biased, and that they produce errors in predicting their future emotional states by overestimating intensity and duration of these future emotions, especially negative ones (Gilbert & Wilson, 2007; Loewenstein, 2007; Wilson & Gilbert, 2013). There are several mechanisms presumed to produce these biases. First of all, individuals seem to disregard other information regarding future context than the event they are making the prediction for, a bias termed focalism (Wilson et al., 2000). Another term used for this type of error in affective forecasting is "impact bias", referring to the mistaken magnitude of the impact the event has on one's future affective states (Gilbert, Driver-Linn, & Wilson, 2002).

Immune neglect is another source of erroneous prediction in affective forecasting (Gilbert et al., 1998). Immune neglect refers to the propensity of individuals to disregard the "psychological immune system", in other words the sequence of operations in one's cognitive system that alleviates negative emotions related to certain events or helps in adjusting to trauma. Immune neglect might also be influenced by deceptive recollections of past events. The literature shows that individuals have erroneous reactualizations of past experiences, which lead to mistaken forecasts based on these inaccurate memories (Wilson, Myers, & Gilbert, 2001; 2003; Klaaren et al., 1994). This recollection failure is also termed retrospective impact bias, as it refers to the mistaken magnitude of the impact the event had in the individual's past (Wilson et al., 2003).. Therefore, this provides a feedback loop which reinforces future inaccuracy in affective forecasts.

Moreover, the way individuals remember the past can influence predictions made for the future by only recalling the temporally closest or the most available instances of similar events, which need not be (and usually aren't) the most typical ones (Gilbert & Wilson, 2009; Morewedge, Gilbert, & Wilson, 2005). Lastly, the existence of contextual differences

between the time of prediction and the time of experiencing emotion has also been considered a factor which influences accuracy in emotional prediction (Gilbert & Wilson, 2009). Similarly, several factors which cannot be controlled such as physiological states may influence predictions of future emotion.

The methodology used in the affective forecasting line of research usually involves computing mean differences between emotional forecasts at t_1 and experienced emotions at t_2 or later times, however many studies also report the association between forecasts and affect through means of correlation. However, as studies usually find differences between forecasts and emotional states, the emphasis is set on reporting and discussing these differences, and predictions are consistently labeled inaccurate. The implication is that individuals may choose less beneficial courses of action in light of these inaccurate predictions, and thus may benefit from improving the accuracy of their predictions. There is no theoretical causal link assumed in the affective forecasting paradigm. Two recent meta-analyses assessing differences between affective forecasts and experienced emotions contain similar results in terms of their magnitude (Levine et al., 2012; Mathieu & Gosling; 2012). Both studies found the effect size of this relationship to be significant and medium, showing that in general individuals overpredict their future emotional states.

1.3 Predictors of affective forecasting accuracy

Regarding possible predictors of affective forecasting accuracy, Mathieu & Gosling found several moderators of the difference between forecasts and emotions to be significant: *event valence*, *societal connotation of the event* (referring to a widespread emotional association with the event), and *delay of reporting emotion*. Thus, the magnitude of the difference between forecasts and emotions is larger when the former refer to negative events rather than to positive events. Furthermore, this magnitude is larger when forecasts refer to socially connoted events (i.e. events that society attaches emotional associations to) rather than to non-connoted events. In other words, affective forecasting accuracy is higher when targeting positive, non-connoted events. Lastly, affective forecasts were found to overestimate emotions to a larger degree when emotion was measured with a greater delay rather than immediately reported. This last significant moderator is not surprising when taking into account the retrospective impact bias described earlier in this chapter

Other possible predictors of affective forecasting accuracy have been investigated in studies employing regressional analyses. Thus, individual differences such as emotional intelligence (Dunn, Brackett, Ashton-James, Schneiderman, & Salovey, 2007; Hoerger, Chapman, Epstein, & Duberstein, 2012), coping style (Hoerger, 2012; Hoerger, Quirk, Lucas, & Carr, 2009), attachment anxiety (Tomlinson, Carmichael, Reis, & Aron, 2010), passion (Verner-Filion, Lafrenière, & Vallerand, 2012), and mindfulness (Emanuel, Updegraff, Kalmbach, & Ciesla, 2010), and working memory capacity (Hoerger, Quirk, Lucas, Carr, 2010) have all been explored as possible predictors of affective forecasting accuracy.

However, few predictors from the clinical stage have come into play in affective forecasting accuracy research. One study investigating *psychopathology symptoms* found a dysphoric forecasting bias among individuals with higher symptoms of depression, but not anxiety or hypomania (Hoerger, Quirk, Chapman, & Duberstein, 2012). In other words, individuals with higher symptoms of depression were more inaccurate in predicting a composite of both their negative and positive emotional reactions to an attachment-related event. Another study found higher depressive symptoms to be predictive of inaccuracy in predicting both positive and negative affect, while higher anxiety symptoms were only found to influence negative affect prediction bias (Wenze, Gunthert, & German, 2012). More

specifically, individuals who had more intense symptoms of depression or anxiety overpredicted negative emotions to a higher extent. Conversely, individuals who were higher in depressive symptomatology made more accurate predictions for future positive affect. Nonetheless, investigating more predictors stemming from the clinical domain is warranted. Thus, we further present two of the known mechanisms related to psychopathology, namely rational and irrational beliefs, their role in emotion generation, and the differentiation of emotions into functional and dysfunctional, as explained by the Rational Emotive Behavior Therapy (REBT, Ellis, 1957; 1994) theory.

1.4 The role of rational and irrational beliefs in emotion generation. Functional and dysfunctional emotions

According to the "ABC" model of REBT, activating events (or *A*s) lead to consequences (or *C*s) such as emotions, behaviors or physiological responses only through the path of beliefs (*B*s) regarding these events (although see David, 2003 for an account involving unconscious information processing). These beliefs can be categorized into "cold" cognitions, comprising descriptions of the events and inferences regarding these descriptions, and "hot" cognitions, representing evaluations of these descriptions and inferences (Ellis, David, & Lynn, 2013). Evaluations are the ones that generally determine subjective, behavioral or cognitive consequences, and can be either rational (i.e. logical, with empirical support, pragmatic) or irrational (i.e. illogical, having no empirical support, non-pragmatic). Irrational beliefs have long been associated with psychopathology, and a reduction of irrational beliefs doubled by an increase of rational beliefs represents a part of the standard causal and prophylactic treatment for emotional disorders in REBT (Ellis et al., 2013).

REBT also posits that emotions can be classified into two distinct categories, according to the functionality criterion. Thus, functional emotions (whether positive or negative) promote individual adaptation to the environment and help individuals function and attain their goals. Functional emotions are considered to be largely determined by rational beliefs. Conversely, dysfunctional emotions (positive or negative) block individual adaptation to the environment and obstruct goal attainment, being largely caused by irrational beliefs (David & Cramer, 2010). This conceptualization of emotions in terms of their functionality has not been included in previous studies regarding emotional predictions, to our knowledge.

1.5 Similarities and differences between the two conceptualizations of emotional predictions

As previously discussed, the two lines of research investigating predictions regarding future emotions refer to the same phenomenon, albeit they term predictions differently, do not always use the same methodology and do not maintain the same theoretical assertions. However, up to now no efforts have been made to compare these two lines of study.

The main similar theoretical assertion between Response Expectancy Theory (Kirsch, 1985) and the affective forecasting paradigm (Gilbert et al., 1998) posits that there is a relationship between emotional predictions and experienced emotions. However, the main dissimilar theoretical assumption regards the specific dynamics of this relationship. Thus, response expectancies are regarded as "determinants" of nonvolitional outcomes, in other words there is an inferred causal relationship (Kirsch, 1985; 1997). On the other hand, no causal claim is held in the affective forecasting paradigm, while the relationship between forecasts and emotional states assumes that forecasts overestimate future emotions (Gilbert et al., 1998; Gilbert & Wilson, 2009). This fundamental difference is also supported by differences in methodology. As such, response expectancies are always investigated in association with nonvolitional outcomes, assessing correlations between the two, and are

seldom addressed in another way. Conversely, the relationship between affective forecasts and their respective experienced states is always investigated in terms of differences in means, while sometimes correlations are also reported.

These accumulated differences (causal stance, methodology, similarity vs. dissimilarity) introduce the problem of **accuracy in emotional prediction**. This problem can nonetheless be solved by employing both theoretical considerations and results produced by one meta-analysis investigating affective forecasting accuracy in within-subject designs (Mathieu & Gosling, 2012). Theoretically, the authors proposed a clarification of accuracy in emotional prediction, employing two concepts, namely **relative accuracy** and **absolute accuracy**. Relative accuracy indicates accuracy in predicting emotions relative to the other members of the group, predictions being accurate in the relative sense if individuals who predict more intense emotions result feeling more intense emotions and the other way around. Absolute accuracy refers to the mathematical difference between prediction and emotion, predictions are accurate if individuals experience emotions as intense as they had predicted. Practically, their meta-analysis revealed that relative accuracy is high, while absolute accuracy is low in emotional predictions.

Finally, both paradigms hold the assumption that by adjusting predictions, one may improve future emotional or behavioral outcomes. Accordingly, Response Expectancy Theory (Kirsch, 1985) claims that by modifying the direct causes of emotional states (i.e. response expectancies), this will lead to a modification in said affective states. Likewise, the affective forecasting paradigm (Gilbert et al., 1998) asserts that by adjusting erroneous forecasts, individuals have a better chance of optimal decision-making.

2. Relevance and impact of the research topic

The first theoretical contribution which can be made to the field of emotional prediction regards a better understanding of the phenomenon, together with a clearer conceptualization of accuracy in emotional prediction, by employing the definitions discussed above. An integration of the two fields investigating emotional prediction accuracy could be attempted, by combining results obtained in both lines of research in one single endeavor. Another attempt at bringing together the clinical which the social would be to study relative and absolute accuracy of emotional predictions by targeting clinically relevant emotions, and to distinguish between functional and dysfunctional variants of these emotions.

Another theoretical advance might reside in clarifying already addressed predictors of affective prediction accuracy, as some findings have been contradictory in the literature. Moreover, an additional investigation of predictors derived from the clinical domain could bring about a novel direction in research regarding emotional prediction accuracy. A further understanding of what makes individuals predict future emotions more accurately might also reveal what factors need to be taken into consideration when trying to adjust these predictions (e.g. in a counseling or therapeutical context).

Furthermore, it has long been attested that predictions regarding future emotions shape individuals' decision-making process (Kushlev & Dunn, 2012; Loewenstein & Lerner, 2003), and it has also been assumed that inaccurately predicting these emotions (e.g. by overestimating negative emotions targeting a negative event) might influence these decisions in a negative way. However, surprisingly few studies have actually investigated potential negative consequences of predicting one's future emotions inaccurately. Investigating whether emotional prediction inaccuracy does indeed influence future behavior could provide a useful link for supporting or refuting these claims.

CHAPTER II. RESEARCH OBJECTIVES AND OVERALL METHODOLOGY

Given the theoretical and methodological considerations discussed in Chapter 1, we hereby define our research objectives and the methodology warranted to achieve these aims, comprised in a structured research plan. The **general aim** of this research project is to investigate relative and absolute accuracy of emotional predictions, together with potential predictors of accuracy and implications of accurate and inaccurate future emotional forecasting.

Our first main objective is to establish the degree of accuracy of emotional predictions, as two distinct lines of research provide contradictory information regarding their accuracy. The clinical psychology literature investigating response expectancies posits these expectancies to be accurate, while the social psychology literature examining affective forecasts indicates these forecasts to be inaccurate. We aim to achieve this first through a quantitative review of the existing literature regarding emotional predictions, which takes into consideration both lines of research mentioned (Studies 1a and 1b). Secondly, we aim to replicate findings in the literature regarding accuracy of emotional predictions in different types of contexts, using methods employed in both response expectancy studies (correlational) and affective forecasting studies (differences in means) (Studies 2, 3, and 4).

Our second main objective is to investigate potential predictors of emotional prediction accuracy, stemming both from the clinical and the social domain. Several predictors have been explored to the present point, some regarding individual differences and some pertaining to external factors such as emotional valence or event valence. However, few studies investigated clinically relevant predictors such as mechanisms of change in psychopathology. We aim to rectify this by examining irrational and rational beliefs as potential predictors of emotional prediction accuracy, alongside other predictors already suggested in the literature. We aim to attain this objective by using regression analyses targeting observed accuracy of predictions as a criterion (Studies 2, 3, and 4). Also, our quantitative review investigations might yield new results in terms of moderators of the relationship between predictions and emotions (Studies 1a and 1b).

Our third main objective is to explore possible implications of inaccuracy in emotional prediction. The existing literature on affective forecasting suggests that inaccurately predicting future emotions (especially negative emotions) has detrimental effects in several domains (such as health or economy), but it does not substantiate these consequences. Some efforts have been made to establish a connection between emotional prediction and persistence or performance in cognitive tasks, however none to investigate the relationship between accuracy of prediction and these outcomes. Moreover, disengagement from tasks has been one of the most professed, but not attested, negative effects of inaccuracy in emotional prediction. We aim to accomplish this goal by comparing individuals who prove accurate in predicting emotions to those who prove inaccurate in terms of objective output such as task persistence, engagement and performance (Study 4).

Our studies are intended to be fundamental research studies, targeting the theoretical understanding of the concept of accuracy in emotional predictions, what factors influence it and what are its implications. However, clinical implications to our research may be drawn regarding the investigated predictors in accuracy referring to mechanism of change in psychopathology (i.e. irrational and rational beliefs) and the clinical conceptualization of forecasts and emotions (via the functionality classification).

CHAPTER III. ORIGINAL RESEARCH

Study 1. The Truth about Predictions and Emotions: Two Meta-Analyses of Their Relationship[1]

Introduction

Two main lines of research have studied the relationship between predictions of future emotions and actual experienced emotions, the response expectancy theory (Kirsch, 1985) and the affective forecasting paradigm (Gilbert, Pinel, Wilson, Blumberg & Wheatley, 1998)., albeit they do not always use the same methodology and do not maintain the same theoretical assertions. Differences include inference of causality in the response expectancy theory (while no such claim is maintained regarding affective forecasts) and conceptualization of accuracy. Regarding accuracy, Mathieu and Gosling (2012) proposed a differentiation between relative and absolute accuracy, and found several significant moderators in which regards absolute inaccuracy. One of these was valence of the event, with negatively valenced events having greater inaccuracy than positive events.

This conceptualization goes to support the integration of the two research paradigms, as discrepancies regarding accuracy are given by different definitions and use of the term and not by substantial differences underlying the phenomenon. Research on response expectancies may further benefit from taking into consideration the recurrent finding that expected emotions are not as intense or enduring as they might appear. Conversely, research regarding affective forecasting may benefit from factoring in the consistent conclusion that emotions do tend to follow the general direction of the forecasts, being in the same direction and associated with these forecasts even if distinct. Furthermore, both paradigms support the idea that by adjusting predictions one may improve future emotional or behavioral outcomes. As such, we argue for the need to join the independent results obtained in the literature in a quantitative approach targeting the relationship between response expectancies/affective forecasts targeting future emotional outcomes (henceforth named predictions) and nonvolitional emotional outcomes (subsequently named emotions).

Existing research provides possible moderating effects for this relationship, namely valence of the emotion (Gilbert et al., 1998; Wilson & Gilbert, 2003), familiarity with the event the prediction is made for (Montgomery & Bovbjerg, 2003; Sohl et al., 2009), and valence of the event (Mathieu & Gosling, 2012). As Kirsch (1990) initially suggested, expectancies might also be more accurate if they refer to more specific emotions (such as affects) rather than more general emotions (such as moods) or general distress. Therefore, we also consider investigating specificity of the emotional response as a possible moderator. Kirsch (1990) also regarded distance in time between t_0 and t_1 as a possible factor influencing the accuracy of response expectancies, with expectancies measured more closely to t1 being more accurate. However, time between t_0 and t_1 is seldom reported in a way in

[1]This study was submitted for publication.
Coteț, C. D. & David, D. (2015). The Truth about Predictions and Emotions: Two Meta-Analyses of Their Relationship. Manuscript submitted for publication.
Author contributions: Both authors developed the study concept and contributed to the study design. The literature search, selection of studies and coding procedure were performed by C. D. Coteț. C. D. Coteț performed the data analysis and interpretation under the supervision of D. David. C. D. Coteț drafted the manuscript, and D. David provided critical revisions of data analysis and writing the manuscript

which it can be qualified as a moderator category in studies concerning predictions upon future emotions. Fatigue is a particular outcome which has been studied in the response expectancy literature as a physiological nonvolitional outcome (Sohl et al., 2009). However, it can also be argued that it constitutes a complex emotion (Gibson et al., 2003), or a general measure of distress; we therefore decided to also take fatigue into consideration as an emotional outcome.

General Objective of the Present Investigation

The present research aimed to investigate the relationship between predictions and emotions through a meta-analytical process. We tried to integrate the two lines of research concerning predictions about emotional outcomes and we investigated the role of several literature-derived moderators regarding the strength of their relationship with actual emotions. Additionally, we broadened the category of emotions included in previous research (i.e. by including fatigue). We addressed the association between predictions and emotions, on the one hand, and the difference between the two constructs, on the other, separately, as they are two distinct methods for researching the relationship between predictions and emotions. However, as the distinction resides only at the methodological level, we conducted a single literature search and selection process, and subsequently we assigned each article to one or both of the following meta-analyses. The methodology for the two studies is similar; differences are pointed out where they appear.

Study 1a: The association between predictions and emotions

The specific objective of this study was to quantify the association between predictions and emotions, by a) determining the overall effect size of this association, b) establishing the effect size for specific outcomes, and c) testing possible moderators of the strength of this association.

Method

Literature Search

We conducted an extensive search of the literature using PsycInfo and PubMed databases up to June 2014, using the following combination of key search terms: “affective forecasting” or “emotional forecasting” or “emotional predictions” or “response expectancy”, combined with “emotion” or “distress” or “affect” or “mood” or “fatigue” or “happiness” or “sadness” or “anxiety” or “excitement” or “pleasure”. Several other studies that were potentially relevant were identified via theoretical reviews of the literature and pre-existing meta-analyses (Levine et al., 2012; Mathieu & Gosling, 2012; Sohl et al., 2009).

Selection of Studies

Initial search results combined with other relevant entries comprised a total of 175 articles. After removing duplicates and irrelevant entries, a total of 88 full-text articles were addressed for eligibility. The applied inclusion criteria were as follows: a) studies investigated predictions (in either form of expectancies of forecasts) upon future emotional responses; b) studies contained measures of both prospective (*t0*) and experienced (t_1) emotional responses and c) studies allowed for computing effect sizes regarding the relationship between predictions and experienced emotions (either in terms of correlation or difference in means). We retained a total number of 57 articles comprising 106 studies which corresponded to our inclusion criteria for both study 1a and 1b. Out of these, we retained 34 studies included in 25 articles assigned to study 1a, addressing the association between

predictions and emotions. The PRISMA Flow Chart (Moher, Liberati, Tetzlaff, & Altman, The PRISMA Group, 2009) of this selection process is described in Figure 1.

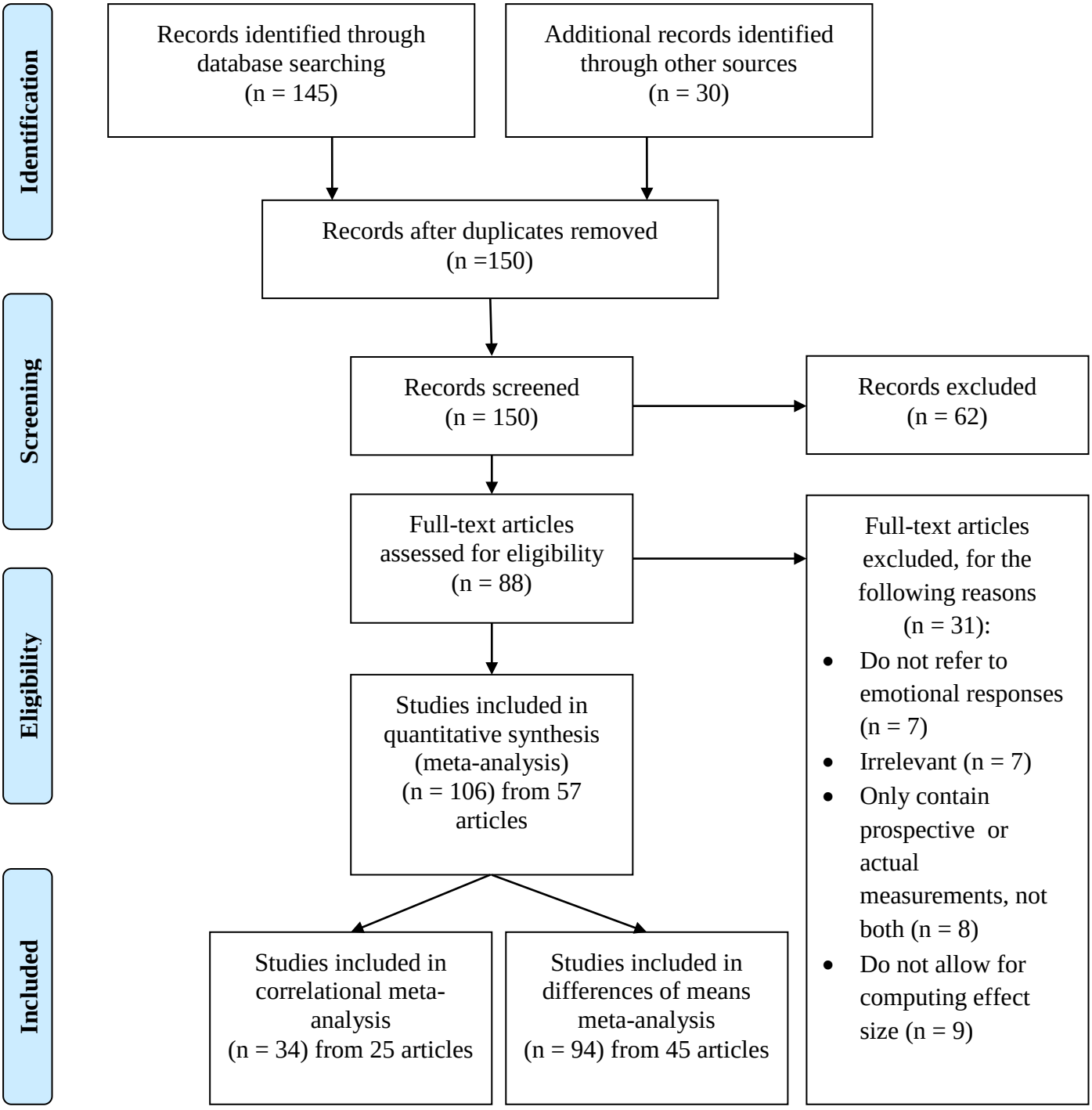

Figure 1. The PRISMA diagram (Moher et al., 2009).

Procedure

For every eligible study we retained the following coding information: study identification data (author, year of publication), outcome (as indicated below), time point (if applicable), data needed for computing effect sizes and a series of moderator variables. We identified three categories of outcomes: positive, negative and mixed emotional outcomes. Specific positive outcomes included: positive affect, positive mood, excitement, happiness, and pleasure. Specific negative outcomes included: negative affect, negative mood, anxiety, distress and fatigue. Specific mixed emotional outcomes included mixed affect and mixed mood. Outcomes labeled as "positive mood" or "positive affect", "negative mood" or "negative affect" represent outcomes reported by authors as means of several distinct positive or negative emotions, respectively. Outcomes labeled as "mixed mood" or "mixed affect" represent outcomes reported as means of several distinct positive and negative emotions combined, a part of which being reverse coded.

All moderators were defined *a priori* and included specificity of emotional response (affect vs. mood vs. distress), valence of emotion (positive vs. negative vs. mixed), valence of event (positive vs. negative vs. unknown), familiarity with the event (familiar vs. unfamiliar vs. unknown), and line of research to which the article pertains (response expectancy vs. affective forecasting). We reported all Pearson's *r* effect sizes and computed them where they were not available, either from existing data (using *p*-value and sample size for correlation) or by requesting original data from the authors. Different outcomes from the same study were reported individually, as well as different time points where applicable. We reported an average effect size per study, combining several outcomes if the study provided more than one. A higher *r* indicates a stronger association between predictions and emotions. Analyses were computed using Comprehensive Meta-Analysis, Version 2.2.046 (Borenstein, Hedges, Higgins & Rothstein, 2005).

Results

Included Studies

Final sample included 34 studies from 25 articles, containing a total of 63 effect sizes. This difference was given by a number of articles which included several relevant studies and targeted different outcomes in the same study.

Overall Effect Size

The overall effect size for the association between predictions and emotions was medium to large and significant, $R = .46$, $p < .001$, $CI = [.40; .52]$. We used a random effects model accounting for the heterogeneity of populations included. In addition, in order for this effect size to become insignificant, fail-safe *N* analysis has shown that a number of 9546 null-effect studies needed to be identified. Expected fail-safe *N* should be larger than $5K+10$ (Rosenthal, 1991), in this case 180, indicating again a robust effect size. The funnel plot showed no signs of asymmetry (see Figure 2). Egger's regression intercept was non-significant ($p > .05$, two-tailed), confirming that smaller studies were not over-represented. Duval and Tweedie's trim-and-fill procedure showed no missing studies to the left or right of the mean. As such, we found no evidence of publication bias overall.

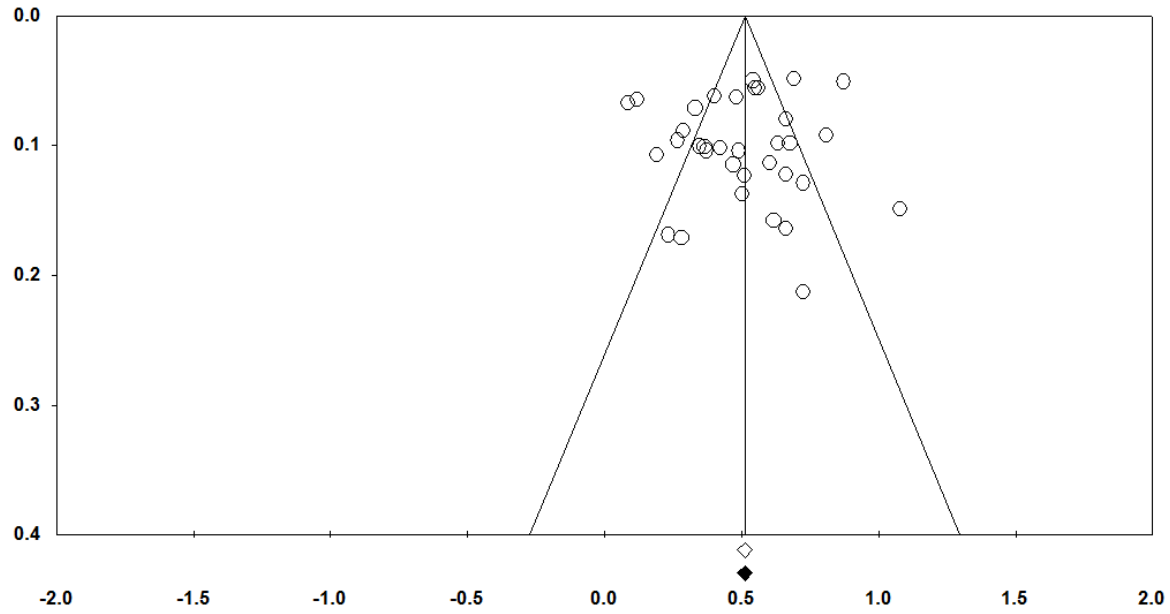

Figure 2. The funnel plot containing observed studies for Study 1a

The overall test of homogeneity was conducted using a random effects model and yielded heterogeneous results, $Q(33) = 227.48$, $p < .001$. Percentage of heterogeneity between studies not due to sampling error was estimated at 85.49% ($I^2 = 85.49$), suggesting high heterogeneity. Individual outcome effect sizes were significant with the exception of excitement, and ranged from .23 to .59. Details are provided in Table 1.

Table 1. *Effect sizes for individual outcomes in Study 1a*

Outcome	*k*	*n*	*r*	*CI*	I^2
Positive affect	3	213	.40***	[.28; .51]	-
Positive mood	2	108	.35**	[.13; .53]	27.41
Excitement	1	38	.23	[-.10; .51]	-
Happiness	6	1150	.35*	[.07; .57]	95.32
Pleasure	2	511	.59***	[.53; .65]	-
Negative affect	4	279	.46***	[.36; .55]	-
Negative mood	1	41	.41**	[.12; .64]	-
Anxiety	1	99	.40***	[.22; .55]	-
Distress	5	423	.51***	[.34; .65]	77.42
Fatigue	3	364	.43***	[.24; .58]	72.81
Mixed affect	7	888	.58***	[.50; .65]	51.17
Mixed mood	4	980	.40***	[.19; .57]	91.76

Note: *p <.05, **p < .01, ***p < .001.

Table 2. *Effect sizes for moderator categories, Cochran's Q test and p-values between categories for each moderator in Study 1a*

Moderator	Category	*k*	*r*	*CI*	Q_b	*p*
Specificity of emotional response	Affect	15	.49	[.40; .57]	3.05	.22
	Mood	10	.38	[.27; .48]		
	Distress	7	.50	[.37; .62]		
Valence of emotion	Positive	8	.38	[.43; .55]	1.93	.38
	Negative	10	.49	[.40; .58]		
	Mixed	11	.52	[.42; .60]		
Valence of event	Positive	5	.56	[.40; .68]	1.49	.48
	Negative	12	.45	[.37; .52]		
	Unknown	9	.47	[.38; .56]		
Familiarity with event	Familiar	6	.48	[.40; .54]	.01	1.00
	Unfamiliar	5	.46	[.17; .68]		
	Unknown	22	.47	[.39; .55]		
Line of research	Response expectancy	8	.45	[.33; .56]	0.03	.86
	Affective forecasting	26	.47	[.39; .54]		

Moderators

Moderator analyses for the overall effect were further conducted in order to establish whether any possible candidate explains the high heterogeneity in the data. None of the tested moderators emerged as significant. Particular effect sizes and *Q* tests for all moderators are reported in Table 2.

Discussion

The aim of this study was to quantify the association between predictions and emotions. We obtained a significant, medium to large effect size of this association overall, a result in line with previous research (Mathieu & Gosling, 2012; Sohl et al., 2009). In other words, predictions are accurate in the relative sense. There was no evidence of publication bias overall and we found evidence of high heterogeneity, but no significant moderators. In conclusion, this meta-analysis supports the integration of the two research paradigms concerning the relationship between predictions and emotions.

Study 1b: The difference between predictions and emotions

The specific objective of this study was to quantify the difference between predictions and emotions, through a similar meta-analytical process as the previous study, by having the aims of a) determining the overall effect size of this difference, b) establishing the effect size for specific emotional outcomes, and c) testing possible moderators of this effect size.

Method

Procedure

Literature search and selection of studies were identical to study 1. From the total number of articles corresponding to the inclusion criteria, we retained a number of 94 studies comprised in 45 articles which addressed the difference between predictions and emotions (i.e. by reporting sufficient data for computing effect size of difference). We retained the same coding information described in the previous study. Specific positive outcomes included: positive affect, positive mood, enjoyment, excitement, happiness, pleasure, and rejoicing. Specific negative outcomes included: negative affect, negative mood, disappointment, distress, regret and sadness. Specific mixed emotional outcomes included mixed affect and mixed mood.

A priori moderators included specificity of emotional response (affect vs. mood vs. distress), valence of experienced emotional response (positive vs. negative vs. mixed), familiarity with the event (familiar vs. unfamiliar vs. unknown), and valence of event (positive vs. negative vs. unknown). After assessing several articles we have also decided to include an *a posteriori* moderator, namely type of design (between vs. within). We computed all Cohen's *d* effect sizes where sufficient data was available (at least *p*-value for *t*-test and sample size). Each outcome in every study was reported individually, as well as different time points where applicable. Further on, we used the study as unit of analysis, by combining outcomes and reporting an average effect size per study. A higher *d* indicates a larger effect size for the difference between predictions and emotions. Analyses were computed using Comprehensive Meta-Analysis, Version 2.2.046 (Borenstein et al., 2005).

Results

Included Studies

Final sample for Study 1b included 45 articles comprising 94 studies, containing a total number of 238 effect sizes. This was due to a large number of articles containing more than one relevant study and addressing several outcomes in the same study. A summarization of studies and coding criteria is provided in Appendix 2.

Overall Effect Size

The difference between predictions and emotions showed a small to medium and significant effect size, $D = .42$, $p < .001$, $CI = [.34; .50]$. A random effects model was used, in order to generalize the findings and accounting for the heterogeneity of populations included. We computed a fail-safe *N* analysis which showed that a number of 17039 null-effect studies needed to be identified for the overall effect size to become null. The fail-safe *N* was in this case also larger than the expected $5K+10 = 480$ (Rosenthal, 1991), indicating again a robust effect size. The funnel plot showed signs of asymmetry (see Figure 4), with several studies showing a greater deviation to the left of the mean. This suggests a possible over-representation of studies showing a smaller effect size for the difference between predictions and emotions. No evidence of publication bias was determined; Egger's regression intercept

was non-significant ($p > .05$, two-tailed). Using Duval and Tweedie's trim and fill procedure, the adjusted effect size for 12 missing studies to the right of the mean is $D = .53$, $CI = [.44; .62]$. Figure 3 presents the funnel plot both without and with imputed studies to the right. As such, we found no evidence of publication bias overall, and taking into consideration possible missing studies, the effect size shifted, but still remained significant.

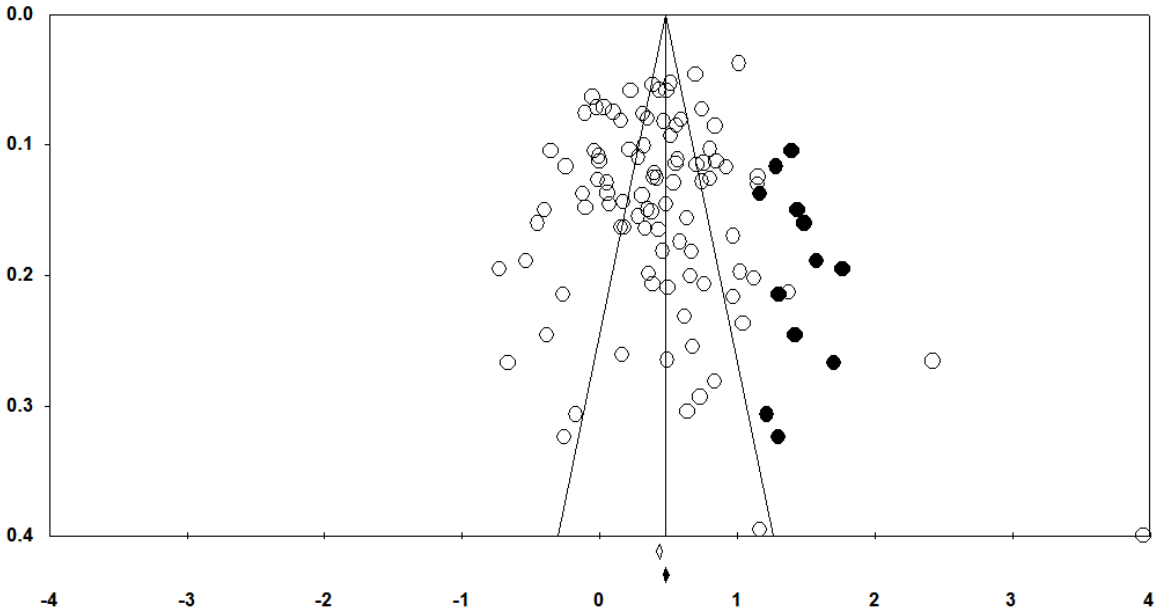

Figure 3. The funnel plot containing both observed and imputed studies for Study 1b.

We computed the Cochrane's Q test of heterogeneity for a random effects model and obtained significant heterogeneity, Q (93) = 1300.76, $p < .001$. Percentage of heterogeneity due to actual variance between studies was estimated at 92.85% ($I^2 = 92.85$), suggesting high heterogeneity. The majority of individual outcome effect sizes were significant and ranged from -.36 to 1.21. Individual effect sizes for each outcome are presented in detail in Table 3.

Table 3. *Effect sizes for individual outcomes in Study 1b*

Outcome	*k*	*n*	*d*	*CI*	I^2
Positive affect	17	1796	.17	[-.05; .40]	89.71
Positive mood	3	234	.34	[-.07; .75]	87.87
Enjoyment	2	93	-.63***	[.-.89; -.36]	0.00
Excitement	1	38	.16	[-.16; .48]	-
Happiness	36	9516	.42***	[.31; .52]	86.51
Pleasure	2	1022	.46	[-.64; 1.55]	99.43
Rejoicing	2	126	.59*	[.01; 1.18]	79.94
Negative affect	25	1976	.21*	[.03; .94]	88.11
Negative mood	3	201	.15	[-.24; .53]	84.35
Disappointment	3	292	.70**	[.27; 1.14]	78.94

Distress	1	190	.54***	[.29; .79]	-
Regret	8	511	.32*	[.03; .60]	74.98
Sadness	2	422	1.21***	[1.00; 1.42]	0.00
Mixed affect	12	1521	.89***	[.55;1.22]	93.73
Mixed mood	3	876	.56***	[.38;.73]	79.78

Note: *p <.05, **p < .01, ***p < .001.

Moderators

Further on, we conducted moderator analyses for the overall effect given the high heterogeneity in the data. Several moderators resulted significant. Particular effect sizes and *Q* tests for all moderators are reported in Table 4.

Table 4. *Effect sizes for moderator categories, Cochran's Q test and p-value between categories for each moderator in Study 1b*

Moderator	Category	*k*	*d*	*CI*	Q_b	*p*
Specificity of emotional response	Affect	62	.39	[.26; .52]	2.24	.33
	Mood	29	.50	[.40; .60]		
	Distress	1	.54	[.29; .79]		
Valence of emotion	Positive	43	.41	[.29; .53]	8.16	.02
	Negative	18	.54	[.35; .72]		
	Mixed	15	.76	[.55; .98]		
Valence of event	Positive	16	.12	[-.05; .29]	16.10	<.001
	Negative	23	.61	[.44; .79]		
	Unknown	20	.45	[.19; .71]		
Familiarity with event	Familiar	21	.58	[.43; .73]	7.08	.03
	Unfamiliar	24	.38	[.18; .58]		
	Unknown	41	.31	[.17; .45]		
Design	Within	47	.19	[.14; .24]	2.71	.10
	Between	42	.53	[.38; .69]		

Discussion

The aim of this study was to quantify the difference between predictions and emotions. A medium to large effect size of this difference was obtained overall. We found no evidence of publication bias overall, and the effect size remained comparable when considering possible missing studies. High heterogeneity was found overall. Some of the tested moderators emerged significant. These results imply that predictions are indeed inaccurate in the absolute sense, meaning that they overestimate the intensity of future emotions in various circumstances, regardless of category of emotion.

We found three moderators for the difference between predictions and emotions, namely valence of emotion, valence of event and familiarity with the event. In which regards the *valence of the predicted emotion*, individuals seem to be more inaccurate in predicting negative emotions than they are in predicting positive emotions. In other words, they overestimate the intensity of both types of emotions, but they overestimate negative emotions more. *Valence of event* also moderated the difference between predictions and emotions, with predictions regarding negative events being moderately inaccurate in the absolute sense, in line with previous research (Mathieu & Gosling, 2012), while predictions for positive events being virtually accurate. Considering *familiarity with the event*, people seem to be more inaccurate in the absolute sense in which regards familiar events rather than when predicting unfamiliar events. This result may be partially explained by the retrospective impact bias (Wilson et al., 2003), which holds that individuals do not learn from past forecasting mistakes (especially regarding positive events). To conclude, this meta-analysis provides a clear measure of the absolute accuracy of predictions regarding future emotions, proving that predictions are indeed inaccurate in the absolute sense, and provides several moderators for the magnitude of this inaccuracy.

General Discussion

The aim of this study was to provide an effect size of the relationship between predictions regarding emotions at t_0 on the one hand (identified as either response expectancies or affective forecasts), and experienced emotions at t_1 on the other hand (identified as either nonvolitional outcomes or experienced emotions). Consequently, we carried out two meta-analyses which thereby targeted the theory underlying response expectancies with regard to emotional outcomes. First, we addressed the relationship between predictions and emotions, and afterwards we addressed the difference between the two constructs. We obtained a medium to large effect size in which regards the association between predictions and emotions, and a small to medium effect size regarding the difference between predictions and emotions. In terms of accuracy, we may conclude that predictions regarding future emotions are accurate in the relative sense, and inaccurate in the absolute sense. In other words, people generally predict the direction and relative magnitude of the emotions they would experience in certain situations quite well, but systematically overestimate the intensity of these emotions.

In addressing the association between predictions and emotions, or relative accuracy of predictions, none of the proposed moderators explained heterogeneity in the data. In addressing the difference between the two, or absolute accuracy, however, several proved significant. Summarizing, individuals seem to a) overestimate negative emotions more than they do positive ones, and to overestimate mixed emotions most, b) overestimate emotions for negative events and not for positive events, and c) overestimate emotions for familiar events more than they do for unfamiliar events.

In which regards the association between predictions and emotions, our results show no difference between response expectancy studies and affective forecasting ones, supporting the integration of the two research domains included. However, we found no response expectancy studies reporting differences between predictions and emotions, such that we could not compare the two lines of research in this respect. In aiming to further clarify the relationship between predictions and emotions, future studies should aim to refer to both types of accuracy of prediction – relative and absolute – by reporting both types of results: association and difference, for comparison.

Study 2. Predictors of Absolute Accuracy in Affective Forecasting: Predicting Emotions Regarding Performance at Exams[2]

Introduction

Affective forecasts represent predictions made by individuals regarding their future emotions; they are also termed emotional predictions (Gilbert, Pinel, Wilson, Blumberg, & Wheatly, 1998; Gilbert & Wilson, 2009). Two meta-analyses show that individuals overpredict future emotions, in other words they expect to feel more intense emotions than they actually feel, with a medium effect size (Levine et al., 2012; Mathieu & Gosling, 2012).

The vast majority of these studies have been conducted in the social psychology paradigm, with a minority being addressed in the clinical field. Thus, one of the most straightforward limitations of these studies, pertaining to their social background is, in our opinion, the lack of a clear delineation among the studied emotions. Rational Emotive Behavior Therapy (REBT, Ellis, 1994) states that emotions can be classified into two categories, namely functional and dysfunctional emotions. Most studies in the affective forecasting paradigm examine predictions regarding positive or negative emotions, but disregard this clinical categorization. One other bias found in previous studies refers to the moment of measuring the emotions, which may be at a delayed time compared to the actual moment of the event the question refers to (for examples see Levine et al., 2012; Hoerger & Quirk, 2010). We argue that delayed reporting of emotions is intrinsically biased (i.e. retrospective bias, Ebert, Gilbert, & Wilson, 2009; Wilson, Meyers, & Gilbert, 2003), thus these reports are not valid representations of actual emotions.

Up to date, little has been found about what makes people (in)accurately predict their emotions. Mathieu and Gosling (2012) concluded that the valence and the societal connotation of the event moderate the relationship between forecasts and emotions, specifically influencing absolute accuracy, but no proposed moderator was found significant for relative accuracy. Other possible predictors of absolute accuracy in affective forecasting which already have some empirical support are emotional intelligence, (Dunn et al., 2007; Hoerger, Chapman, Epstein, & Duberstein, 2012), coping style (Hoerger, Quirk, Lucas, & Carr, 2009), and anxious attachment (Tomlinson, Carmichael, Reis, & Aron, 2010). Valence of the emotion has been proposed since the first studies involving affective forecasting absolute accuracy appeared (Gilbert et al., 1998; Wilson & Gilbert, 2003), and familiarity with the targeted event has been studied in the response expectancy paradigm.

As mentioned before, ir/rationality is a factor that needs to be taken into consideration. Response expectancies have been found to mediate the effects of irrational beliefs on exam-related distress (Montgomery, David, DiLorenzo, & Schnur, 2007) and public speaking anxiety (Vîsla, Cristea, Szentagotai, & David, 2013). Conversely, rationality may be a protective factor for correct emotional predictions, as it is a protective factor for mental health.

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[2]This study was merged with the following one and submitted for publication.
Coteț, C. D. & David, D. (2015). Predictors of Absolute Accuracy in Affective Forecasting. Manuscript submitted for publication.
Author contributions: Both authors developed the study concept and contributed to the study design. C. D. Coteț performed data collection, analysis and interpretation under the supervision of D. David. C. D. Coteț drafted the manuscript, and D. David provided critical revisions of data analysis and writing the manuscript.

Objective of the Present Study

This study had two specific objectives: 1) to investigate relative and absolute accuracy of affective forecasts in a performance-related context, and also 2) to investigate potential predictors of absolute accuracy of affective forecasts. Specific hypothesis we formulated based on the available literature are as follows (numbered in relation to the objectives):

H1.1 Affective forecasts will be positively associated with emotions.

H1.2 Affective forecasts will overestimate the emotions.

H2.1 Higher emotional intelligence will predict higher absolute accuracy of affective forecasts.

H2.2 Negative event valence will predict lower absolute accuracy of affective forecasts.

H2.3 Higher familiarity with the event will predict higher absolute accuracy of affective forecasts.

We will further explore irrationality, rationality, unconditional acceptance and active coping as predictors of absolute accuracy.

Method

Participants

A number of 130 participants (117 women) from the student pool completed initial measures. However, several participants either dropped-out or completed intermediary and final measures in an incorrect day, resulting in a final number of 73 subjects (67 women) with a mean age of $M = 24.01$, $SD = 6.40$ which remained in Study 2.

Measures and materials

Affective forecasts were measured using 9-point Likert scales for each category of emotions: positive emotions (delighted, content, proud, joyful), negative functional emotions (sad, concerned, annoyed, disappointed), and negative dysfunctional emotions (depressed, anxious, angry, ashamed). Items were phrased in the following way: "To what degree do you consider you will feel this way in the day you will find out your grade, in case you will have the expected grade?", "…a grade higher than expected?", or "…a grade lower than expected?". **Emotions** were assessed using the same type of scale, referring to the present moment. Items were phrased similarly: "To what degree do you feel this way right now?"

Familiarity with the event and **event valence** were assessed using several items, for each of the envisioned possible outcomes (expected grade, higher than, and lower than expected grade, respectively). Items were phrased as follows: "Have you ever participated to an exam in which you received the expected grade?" for familiarity and "Should you receive the expected grade at this exam, will this be a positive, negative or neutral event?" for valence.

Irrational and rational beliefs were assessed using *The General Attitudes and Beliefs Scale – Short Form* (GABS-SF – Lindner, Kirkby, Wertheim, & Birch, 1999). The GABS-SF is a measure of rational and irrational attitudes and beliefs. The scale consists of 26 items measured on a 5-point Likert scale, having specific rational and irrational subscale scores, as well as a global irrationality score. Reported psychometric properties include high test-retest reliability and construct validity (Lindner, et al., 1999). The GABS-SF has been adapted for the Romanian population, showing good psychometric properties, with a reported internal consistency of $\alpha = .81$ (David, 2007).

Unconditional acceptance was investigated using the *Unconditional Acceptance Questionnaire* (UAQ – David et al., 2013). The UAQ is a measure of unconditional acceptance, in other words rationality, developed on the Romanian population. It consists of 35 statements regarding acceptance of self, others and life, on a 7-point Likert. It provides a general score of unconditional acceptance, has good concurrent and criterion validity, and high internal consistency, α = .95 (David et al., 2013).

Emotional intelligence was measured using the *Schutte Emotional Intelligence Scale* (SEIS – Schutte et al., 1998). The SEIS is a 33-item questionnaire evaluating perceived emotional intelligence on a 5-point Likert, providing a general overall score. The scale has been shown to have good psychometric properties – internal and test-retest reliability, construct predictive and discriminant validity (Schutte et al., 1998). Internal consistency for this sample was α = .90.

Active coping was investigated using *Brief COPE* (B-COPE – Carver, 1997). The Brief COPE is a questionnaire comprising 14 scales, each consisting in two item, measuring on a 4-point Likert different responses relevant to efficient or inefficient coping. Initial internal consistency index for the Active coping subscale was α = .68 (Carver, 1997), while α Crombach for this sample is α = .56.

Procedure

Participants were recruited through student mailing lists. Each participant had to choose one particular exam, predict what grade they would obtain for that exam, and predict how they would feel should they score exactly as predicted, better, or should they fall short of their predicted grade. Students underwent three parts of the study: 1) t_1 – initial evaluation, including predicted grade, affective forecasts and possible moderators discussed above, prior to the actual examination, 2) t_2 – intermediary evaluation, including predicted grade and evaluation of affective forecasts in the examination day, after having taken the exam, and 3) t_3 – emotions after they found out their grade. All ratings were on-line, and examination and result dates were provided for each student. Students who completed intermediary and final measures with a delay (i.e. not in the provided dates) were excluded from the final sample.

Results

Relative accuracy of forecasts

Initially, all grades obtained by the students were compared with their initial and intermediary predictions, and only the affective forecasts that corresponded to the actual outcome (expected grade, higher or lower than expected) were taken into consideration. Valence of the event and familiarity with the event were matched accordingly to outcome.

Relative accuracy was computed by correlating affective forecasts (at t_1 and t_2) with emotions at t_3. An overall score for forecasts (at t_1 and t_2) and emotions respectively was computed by reversing scores for negative emotions and adding them to positive emotions. Distinct scores for positive, negative functional and negative dysfunctional forecasts and emotions were computed by summing all four scores for each category. Relative accuracy was high for all types of emotion taken into consideration, for both time points. Means, standard deviations, and one-tailed correlations representing relative accuracy are presented in Table 5.

Table 5. *Means (M), standard deviations (SD), and one-tailed correlations (r) between forecasts and emotions*

Time point	Type of affect	Forecast *M*	Forecast *SD*	Emotion *M*	Emotion *SD*	*r*
$t_1 - t_3$ (N = 73)	Overall	77.71	28.36	84.81	21.98	.76**
	Positive	19.96	12.76	21.55	11.08	.78**
	Negative functional	13.07	10.41	10.11	8.14	.72**
	Negative dysfunctional	9.18	7.71	6.63	5.26	.62**
$t_2 - t_3$ (N = 72)	Overall	81.93	24.99	84.81	21.98	.83**
	Positive	20.83	11.68	21.55	11.08	.84**
	Negative functional	11.17	9.54	10.11	8.14	.75**
	Negative dysfunctional	7.774	6.27	6.63	5.26	.78**

Note: ** $p < .001$, * $p < .01$.

Absolute accuracy of forecasts

In order to determine whether forecasts (at t_1 and t_2) differed significantly form emotions at t_3, we used a repeated measures ANOVA procedure overall and for each category of emotions (positive, negative functional, negative dysfunctional). Overall, Mauchly's test indicated a violation of sphericity, $\chi^2(2) = 7.44$, $p = .024$, therefore we applied the Huynh-Feldt correction ($\varepsilon = .93$), results showing that forecasts (at t_1 and t_2) and emotions at t_3 differed significantly, $F(1.86, 132.20) = 7.18$, $p = .001$, with a medium effect size, $\eta^2 = .09$. *Post-hoc* Dunn-Sidak tests show that this difference is given by a significant difference between forecasts at t_1 and emotions at t_3, $p = .003$, predictions being lower than emotions. Since the overall score was calculated reversing the negative items, this means that at t_1 participants significantly underestimated the *positivity* of the emotions they would have at t_3. No differences were found between predictions at t_1 and predictions at t_2, nor between predictions at t_2 and emotions at t_3.

Further, we looked at each category of emotions separately. Positive forecasts and emotions did not differ significantly, $F(2,142) = 1.90$, $p = .153$, however negative forecasts and emotions did so. Negative functional forecasts (at t_1 and t_2) and emotions at t_3 were distinct, $F(2,142) = 7.47$, $p = .001$, with a medium effect size, $\eta^2 = .10$. *Post-hoc* Dunn-Sidak showed yet again a significant difference between forecasts at t_1 and emotions at t_3, $p = .001$, with predictions for negative functional emotions being higher than actual emotions. Regarding negative dysfunctional predictions and emotions, the pattern is similar. Mauchly's test indicated a violation in the assumption of sphericity, $\chi^2(2) = 18.34$, $p < .001$, therefore we applied the Huynh-Feldt correction ($\varepsilon = .83$), results showing a difference in means among the three time points, $F(1.66, 117.72) = 8.20$, $p = .001$, with a medium effect size, $\eta^2 = .10$.

Post-hoc Dunn-Sidak showed forecasts at t_1 were higher than emotions at t_3, $p = .002$, indicating an initial overestimation of negative dysfunctional emotions. In both cases of negative emotions, although no other differences between means were significant than the ones at t_1 and t_3, the trend was linear and descending.

Predictors of absolute accuracy

In order to test possible predictors for absolute accuracy of affective forecasts, we first computed discrepancy scores in absolute values, by subtracting emotions from forecasts, overall and for each emotion category (positive, negative functional, negative dysfunctional), for both time points. Next, we computed two-way correlations between proposed predictors and these discrepancy scores. Valence of event was dummy coded 1 for events regarded as negative and 0 for events considered positive and neutral. No other predictor except valence of event resulted significant. Thus, event valence significantly predicted absolute accuracy of forecasts in case of overall ($F(1, 53) = 8.20$, $p = .006$, $B = 12.31$, $SE = 4.30$, $\beta = .36$, $p = .006$, $R^2 = .13$), negative functional ($F(1, 53) = 8.20$, $p = .006$, $B = 12.31$, $SE = 4.30$, $\beta = .36$, $p = .006$, $R^2 = .13$), and dysfunctional forecasts ($F(1, 53) = 14.27$, $p < .001$, $B = 5.65$, $SE = 1.50$, $\beta = .46$, $p < .001$, $R^2 = .21$) at t_1. However, at t2, event valence significantly predicted only absolute forecast accuracy for negative dysfunctional forecasts ($F(1, 54) = 5.86$, $p = .019$, $B = 2.45$, $SE = 1.01$, $\beta = .31$, $p = .019$, $R^2 = .10$). When computing achieved power, all analyses in this study achieved at least the recommended .80.

Discussion

The aim of this study was to examine relative and absolute accuracy of affective forecasts and absolute accuracy predictors in a specific, performance-related, context. Individuals proved to be highly accurate in the relative sense regarding their forecasts for all categories of emotion, confirming our first hypothesis. Regarding absolute accuracy, individuals generally predicted more intense emotions than they actually felt, however this finding seems to be supported only by their overestimation of negative emotions, both functional and dysfunctional.

We found only one predictor of absolute accuracy, namely the perceived valence of the event. The more negative the event was perceived, the more inaccurate the individuals' forecasts. This goes in line with meta-analytical findings in the literature (Mathieu & Gosling, 2012). However, neither emotional intelligence nor familiarity with the event predicted higher accuracy.

There are some limitations pertaining to the current study. Firstly, the sample was taken from a psychology student population, which may have contributed to the high relative accuracy of forecasts obtained, which was higher than in the literature (Mathieu & Gosling, 2012). Moreover, there was a high drop-out rate, accounted by the fact that only participants who completed the measures in the appropriate days were taken into consideration. This was done in order to overcome previous limitations in the literature. As such, participants who forgot to complete intermediary measures in the day of the examination or final measures in the day they received their grade were excluded.

Study 3. Predictors of Absolute Accuracy in Affective Forecasting: Predicting Emotions Regarding Romantic Encounters[3]

Introduction

Two meta-analyses targeting affective forecasting show that individuals overpredict their future emotions, expecting to feel more intense emotions than they feel when confronted with the situation, with a medium effect size (Levine et al., 2012; Mathieu & Gosling, 2012). Mathieu and Gosling (2012) argue that individuals are accurate in a relative sense and inaccurate in an absolute sense in which regards their emotional predictions. In other words, they overpredict future affect, but predictions do estimate the direction and general magnitude of their affect correctly. However, the majority of the studies conducted on affective forecasting lack a clinical understanding of emotions, such as that stated by Rational Emotive Behavior Therapy (REBT, Ellis, 1994). In REBT, emotions are considered to be either functional or dysfunctional, depending on their underlying causes and their consequences. Several predictors of absolute accuracy in affective forecasting have been studied, event valence, societal connotation of the event and delay of reporting emotion being the first documented to influence the absolute accuracy of emotional predictions (Levine et al., 2012; Mathieu & Gosling, 2012). Other documented predictors are emotional intelligence (Dunn et al., 2007; Hoerger et al., 2012), coping style (Hoerger et al., 2009), or anxious attachment (Tomlinson et al., 2010).

However, clinically relevant predictors have seldom been studied. We propose that irrational and rational beliefs (the primary mechanisms of change in psychopathology as documented by REBT), including unconditional acceptance, are sound possible predictors of affective forecasting accuracy. We seek to address limitations found in previous literature by taking into consideration functionality and valence of forecasts and emotions, by measuring emotion immediately after the referenced event, and lastly by proposing new clinically relevant predictors of absolute accuracy in affective forecasting.

Objective of the Present Study

This study had two specific objectives: 1) to investigate relative and absolute accuracy of affective forecasts in an attachment-related context, and also 2) to investigate potential predictors of absolute accuracy of affective forecasts. Specific hypothesis we formulated based on the available literature are as follows (numbered in relation to the objectives):

H1.1 Affective forecasts will associate positively with emotions.

H1.2 Affective forecasts will be more intense than emotions.

H2.1 Emotional intelligence will predict absolute accuracy of affective forecasts.

H2.2 Negative event valence will predict lower absolute accuracy of affective forecasts.

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[3]This study was merged with the previous one and submitted for publication.
Coteț, C. D. & David, D. (2015). Predictors of Absolute Accuracy in Affective Forecasting. Manuscript submitted for publication.
Author contributions: Both authors developed the study concept and contributed to the study design. C. D. Coteț performed data collection, analysis and interpretation under the supervision of D. David. C. D. Coteț drafted the manuscript, and D. David provided critical revisions of data analysis and writing the manuscript.

H2.3 Higher familiarity with the event will predict higher absolute accuracy of affective forecasts.

H2.4 Higher attachment anxiety will predict lower absolute accuracy of affective forecasts.

Further, we will explore irrationality, rationality, unconditional acceptance and active coping as predictors of absolute accuracy.

Method

Participants

Initially, 148 participants (126 women) completed measures at t_1. They were recruited from the student pool and online discussion groups interested in participating in studies. However, several participants either dropped-out (never completed any phase 2 measures), or completed final measures in an incorrect day, leaving a final number of 91 subjects (79 women) with a mean age of M = 24.89, SD = 7.09. Some of the participants in Studies 2 and 3 overlapped.

Measures and materials

Affective forecasts were measured using the same 9-point Likert scales described in Study 2, however 2 emotions were dropped (annoyed and angry), as they were not considered relevant for the event for which the forecasts were made, leaving a total of 10 emotions. Questions were phrased as follows: "To what degree do you consider you will feel this way in the evening of 14th February, in case you will have a romantic date?", respectively "…in case you will not have…"

Emotions were assessed using the same type of scale, referring to the present moment, as in Study 2.

Familiarity with the event and **event valence** were assessed for each possible event (date or no-date). Items were phrased as follows: "Have you ever had a romantic date on Valentine's Day?" for familiarity and "Should you have/not have a date on Valentine's Day, will this be a positive, negative or neutral event?" for valence.

Some predictors of absolute accuracy from Study 2 were used in Study 3. As such, **rational and irrational beliefs** were assessed using GABS-SF (Lindner et al., 1999), **unconditional acceptance** was measured using the UAQ (David et al., 2013), **emotional intelligence** was assessed using the SEIS (Schutte et al., 1998), and **active coping** was measured with B-COPE (Carver, 1997), all described previously. Internal consistency for the Active coping subscale of the B-COPE for this sample was α = .53.

Attachment anxiety was measured using *The Experiences in Close Relationships-Revised* (ECR-R – Fraley, Waller, & Brennan, 2000). The ECR-R consists of 36 items referring to attachment measured on 7-point Likert scales, providing distinct scores for attachment-related anxiety and attachment-related avoidance. The scale presents good psychometric properties (Fraley et al., 2000; Sibley, Fischer, & Liu, 2005) and an index of reliability α Crombach of α = .91 for attachment-related anxiety and α = .82 for attachment-related avoidance on our sample.

Procedure

Participants were recruited through student mailing lists and online discussion groups, in a procedure similar to Study 2. Students underwent two parts of the study at four different time points: 1) t_1 – initial evaluation, including predicted event (date vs. no-date), affective

forecasts, and possible moderators, 2) evaluation of current emotions in three different days: 14th (t_2), 15th (t_3) and 16th (t_4) February. All ratings were on-line, and only ratings provided in the evenings of each date mentioned above were taken into consideration.

Results

Relative accuracy of forecasts

Initially, we excluded from our analyses all affective forecasts, as well as event valence and familiarity ratings, which did not correspond to the actual outcome (date or no-date). Relative accuracy was computed by correlating affective forecasts (at t_1) with emotions at t_2, t_3 and t_4, respectively. Overall scores for forecasts and emotions were computed by reverse scoring the negative emotions and summing them with the positive ones. Composite scores for each forecast and emotion category (positive, negative functional, negative dysfunctional) were computed. Relative accuracy was high or medium for all types of emotion, for all three time points taken into consideration, for all three time points (Table 6).

Table 6. *Means (M), standard deviations (SD), and one-tailed correlations (r) between forecasts and emotions*

Time point	Type of affect	Forecast *M*	Forecast *SD*	Emotion *M*	Emotion *SD*	*r*
$t_1 - t_2$	Overall	68.40	14.40	71.52	12.29	.71**
	Positive	19.16	10.31	20.74	9.48	.72**
	Negative functional	5.59	4.58	4.88	3.20	.45**
	Negative dysfunctional	4.96	3.57	3.93	2.05	.50**
$t_1 - t_3$	Overall	68.56	12.72	70.15	11.69	.72**
	Positive	17.99	9.29	19.60	9.20	.72**
	Negative functional	5.56	4.68	4.92	3.48	.34*
	Negative dysfunctional	4.40	3.01	3.94	2.38	.32*
$t_1 - t_4$	Overall	67.98	12.22	69.07	11.83	.71**
	Positive	17.67	8.72	18.90	18.90	.77**
	Negative functional	5.14	4.65	4.86	3.16	.56**
	Negative dysfunctional	.452	3.94	4.03	2.74	.44**

Note: *$p < .01$, **$p < .001$.

Absolute accuracy of forecasts

In order to determine whether forecasts (at t_1) were significantly higher than emotions (at t_2, t_3 and t_4, respectively), computed the corresponding t-tests. Regarding the day of the event (t_2), results showed that overall forecasts and emotions differed significantly, $t(59) = -2.34$, $p = .012$, emotions being higher than predictions with a medium effect size, $\eta^2 = .09$. Since the overall score was computed by reverse scoring negative items, participants significantly underestimated at t_1 the *positivity* of the emotions at t_2. When looking at categories of emotion separately, positive forecasts and emotions differed significantly, $t(68) = -1.75$, $p = .043$, with a small effect size, $\eta^2 = .04$, and so did negative dysfunctional forecasts and emotions, $t(68) = 2.75$, $p = .004$, with a medium effect size of $\eta^2 = .10$. In other words, positive emotions were significantly underpredicted and negative dysfunctional

emotions were significantly overpredicted. Negative functional emotions did not differ from their respective forecasts, $t(68) = 1.38$, $p = .086$.

Regarding the day following the event (t_3), overall forecasts and emotions did not differ significantly, $t(60) = -1.34$, $p = .093$, nor did either negative functional forecasts and emotions, $t(71) = 1.13$, $p = .132$, or negative dysfunctional forecasts and emotions, $t(71) = 1.22$, $p = .113$. However, positive forecasts and emotions differed significantly, $t(71) = -1.99$, $p = .026$, with a small effect size, $\eta^2 = .05$. In other words, positive emotions were once again significantly underpredicted. Regarding the day after that (t_4), results showed no significant differences between predictions and emotions, neither overall, $t(54) = -0.88$, $p = .192$, nor regarding any of the categories of emotion: positive, $t(68) = -1.63$, $p = .055$, negative functional, $t(68) = 0.62$, $p = .270$, or negative dysfunctional $t(68) = 1.12$, $p = .134$.

Predictors of absolute accuracy

Similarly to Study 2, we initially computed discrepancy scores in absolute value, by subtracting emotions from forecasts, overall and for each emotion category, for each time point. Further, we calculated correlations between proposed predictors and these discrepancy scores. Valence of event was dummy coded 1 for events regarded as negative and 0 for events considered positive and neutral. We found no significant predictors for the absolute accuracy of overall forecasts, and only two significant ones for the absolute accuracy of positive forecasts. Thus, event valence predicted their accuracy at t_2 ($F(1, 66) = 11.78$, $p = .001$, $B = 7.60$, $SE = 2.21$, $\beta = .39$, $p = .001$, $R^2 = .15$), and rationality predicted their accuracy at t_4 ($F(1, 62) = 5.94$, $p = .018$, $B = -0.53$, $SE = 0.22$, $\beta = -.30$, $p = .018$, $R^2 = .09$).

Next, because absolute accuracy for both negative functional and dysfunctional forecasts had several correlates, we introduced each significant predictor in a hierarchical multiple regression equation, in the order of their theoretical importance. Thus, already documented predictors were introduced first (i.e. attachment anxiety, emotional intelligence and event valence), and newly introduced predictors were introduced second (i.e. irrationality and unconditional acceptance). If one predictor did not contribute significantly to the model, we excluded that particular predictor and re-ran the analysis, for each block. At t_2, negative functional forecast accuracy was predicted significantly by attachment anxiety and event valence, $F(2,60) = 11.78$, $p < .001$. Further, negative dysfunctional forecast accuracy was predicted significantly by attachment anxiety, event valence and irrationality, $F(3,59) = 9.68$, $p < .001$. At t_3, negative functional forecast accuracy was predicted significantly by a model consisting of attachment anxiety, event valence and irrationality, $F(3,60) = 10.15$, $p < .001$. Conversely, negative dysfunctional forecast accuracy was only significantly predicted by attachment anxiety, $F(1,62) = 10.56$, $p = .002$. At t_4, negative functional forecast accuracy was predicted significantly by attachment anxiety in a first step, $F(1,62) = 5.82$, $p = .019$. However, when introducing irrationality in a second step, although the model was significant, $F(2,61) = 5.24$, $p = .008$, only irrationality remained a significant predictor. For negative dysfunctional forecast accuracy, only attachment anxiety resulted as a significant predictor, $F(1,62) = 8.35$, $p = .005$. All coefficients are presented in Tables 8, 9, and 10.

When computing achieved power post hoc, all analyses achieved at least the recommended .80, except the following case: when computing absolute accuracy for positive forecasts at t_1, achieved power was only .64, and at t_2, achieved power was only .71.

Discussion

In this study we examined once again relative and absolute accuracy of affective forecasts and predictors of absolute accuracy, this time in an attachment-related context. Individuals proved once more that their predictions are accurate in the relative sense,

meaning that they foresee the direction and relative magnitude of their emotions, which confirmed our first hypothesis. Regarding absolute accuracy, our findings were different than those in Study 2, in the sense that although forecasts were inaccurate overall for the focal event, this inaccuracy was given by both an overestimation of negative dysfunctional emotions, and an underestimation of positive emotions, disconfirming our second hypothesis. This underestimation of positive emotions was repeated in the day following the focal event, but no other predictions were inaccurate.

Results concerning predictors of absolute accuracy were more complex than those found in Study 2, such that there were several significant predictors. Beyond simple associations, there were a few of our proposed predictors that consistently predicted forecasting accuracy, namely attachment anxiety, event valence and irrationality. Individuals with higher attachment anxiety were in all cases worse at predicting their emotions, confirming one of our hypotheses. Higher irrationality was a good predictor for inaccuracy of forecasts in most cases. Event valence predicted forecasting accuracy for all negative emotions in the day on the event, and for negative functional emotions in the day following the event. This implies that the more negative the situation of not having (or having) a date on Valentine's Day is perceived, the less accurately individuals can predict their emotions, especially regarding that specific day and time that the date should take place

Our second study has a similar limitation to the first one, namely high attrition rate. This may be due to the number of sessions participants had to log on and predict or examine their emotions (4 sessions), and to the specific limitation of filling in these ratings at specific times of the specific dates. Participant ratings which failed to comply with our regulations were excluded from our analyses, further limiting our sample. Secondly, our sample was partially comprised of psychology students, which may have contributed to higher relative accuracy fore negative forecasts than previously obtained in the literature.

Table 8. *Gradients (B), standard errors (SE), and standardized coefficients (β) for multiple regression equations for $t_1 - t_2$*

Criterion	Functional negative forecast accuracy[1]			Dysfunctional negative forecast accuracy[2]		
Predictor	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Step 1						
Constant	-1.26	1.00		-1.20	0.69	
Attachment anxiety	0.06	0.02	.35**	0.05	0.01	.39***
Event valence	5.56	1.40	.44***	3.27	0.96	.38***
Step 2						
Constant				-2.59	0.89	
Attachment anxiety				0.03	0.01	.27*
Event valence				3.42	0.93	.40***
Irrationality				0.04	0.02	.28*

Note: [1]R^2 = .28 for Step 1. [2]R^2 = .27 for Step 1, ΔR^2 = .06 for Step 2 (p = .024). * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 9. *Gradients (B), standard errors (SE), and standardized coefficients (β) for multiple regression equations for $t_1 - t_3$*

Criterion	Functional negative forecast accuracy[1]			Dysfunctional negative forecast accuracy[2]		
Predictor	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Step 1						
Constant	-2.06	1.07		-1.41	0.89	
Attachment anxiety	0.08	0.02	.44***	0.05	0.02	.38**
Event valence	3.58	1.43	.28*			
Step 2						
Constant	-4.38	1.29				
Attachment anxiety	0.04	0.02	.25*			
Event valence	3.75	1.36	.29**			
Irrationality	0.08	0.03	.36**			

Note: [1] R^2 = .24 for Step 1, ΔR^2 = .09 for Step 2 (p = .005). [2] R^2 = .14 for Step 1. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 10. *Gradients (B), standard errors (SE), and standardized coefficients (β) for multiple regression equations for $t_1 - t_4$*

Criterion	Functional negative forecast accuracy[1]			Dysfunctional negative forecast accuracy[2]		
Predictor	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Step 1						
Constant	-0.67	1.12		-1.49	0.97	
Attachment anxiety	0.05	0.02	.29*	0.05	0.02	.35**
Step 2						
Constant	-2.44	1.38				
Attachment anxiety	0.02	0.02	.13			
Irrationality	0.07	0.03	.29*			

Note: [1] R^2 = .09 for Step 1, ΔR^2 = .06 for Step 2 (p = .041). [2] R^2 = .12 for Step 1. * $p < .05$, ** $p < .01$.

Study 4. Absolute Inaccuracy in Affective Forecasting: Is It a Problem?[4]

Introduction

In the line of research concerning affective forecasts, it has been shown that individuals generally overestimate the intensity and duration of future emotional states, especially when they are considering negative emotions (Gilbert & Wilson, 2007; Loewenstein, 2007; Wilson & Gilbert, 2013). Two recent meta-analyses found a significant and medium effect size for the difference between forecasts and emotions, showing that individuals indeed overpredict their future emotions (Levine et al., 2012; Mathieu & Gosling, 2012). Mathieu and Gosling (2012) proposed distinct definitions for relative and absolute accuracy of affective forecasts, and found significant predictors of absolute accuracy in their data, namely event valence, societal connotation of the event, and delay of reporting emotion. However, no clinically relevant predictors have been studied. We propose that rational and irrational beliefs represent systematic individual differences which may predict accuracy in affective forecasting.

We also make the distinction between functional and dysfunctional negative emotions, as theorized by REBT (Ellis, 1994). Affective forecasts have been studied in performance related contexts (e.g. Buehler & McFarland, 2001; Dunn, et al., 2007), even in negative vs. positive feedback conditions to cognitive tasks (e.g. Greitemeyer, 2009), however authors did not conceptualize negative emotions in a manner relevant to the clinical field, in terms of their functionality. Furthermore, the affective forecasting literature has always speculated that mispredicting one's future feeling has large scale implications in several domains, in which concerns decision making (Kushlev & Dunn, 2012; Loewenstein & Lerner, 2003). However, few studies actually investigated these potential detrimental consequences of predicting one's future emotions inaccurately.

One study which examined task persistence and performance specifically concluded that individuals who predicted more intense affect also have higher persistence in a cognitive performance task, which in turn influenced task performance (Greitemeyer, 2009). They also obtained absolute inaccuracy in predicting negative affect after negative feedback in the cognitive task. However, they did not investigate accuracy of forecasting *per se*. Thus, we aim to investigate the role of affective forecasting accuracy on task persistence, engagement and performance.

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[4]Part of this study was accepted for publication.
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Author contributions: C. D. Coteț and E. A. Vereșezan developed the study concept and contributed to the study design. E. A. Vereșezan performed data collection. C. D. Coteț and E. A. Vereșezan performed data analysis and interpretation. C. D. Coteț drafted the manuscript. The study was conducted under the supervision of D. David.
Part of this study was submitted for publication.
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Author contributions: Both authors developed the study concept and contributed to the study design. C. D. Coteț performed data collection, analysis and interpretation under the supervision of D. David. C. D. Coteț drafted the manuscript, and D. David provided critical revisions of data analysis and writing the manuscript.

Objective of the Present Study

The first objective of the present paper was to investigate relative and absolute accuracy of affective forecasts, as well as rational and irrational beliefs as possible predictors of affective forecasting accuracy, in a computerized performance task with negative feedback. The second objective was to investigate the role absolute affective forecasting accuracy has on task persistence, engagement and performance.

Our hypotheses based on the current literature were the following: 1) forecasts will associate positively with emotions; 2) negative functional and dysfunctional forecasts will be more intense than emotions. Concerning absolute accuracy predictors, we explore irrationality and rationality as general predictors, as well as task difficulty as a specific predictor. Concerning task performance, we explore whether individuals with more accurate forecasts have a better or a worse performance than individuals with less accurate forecasts, since none of the available literature indicates a possible direction in order to form a hypothesis. Similarly, we explore whether individuals with more accurate forecasts will be more engaged and will persist more in the task than individuals with less accurate forecasts.

Method

Participants

A number of 104 participants (90 women) from the student pool completed initial measures and participated in the computerized negative feedback cognitive task, their mean age was $M = 20.27$, $SD = 2.20$. Subjects received course credit in exchange of participation.

Measures and materials

The cognitive performance task was constructed using the software OpenSesame (Mathot, Schreij, & Theeuwes, 2012). The subjects were presented with the information that the study was a cognitive task gradually increasing in difficulty. They were also told that most individuals solve 75% of the problems presented correctly. Participants initially rated how they would feel if their performance were better than the average, and then how they would feel if they had a performance worse than the average, consisting in positive and negative (functional and dysfunctional) forecasts. They were told to spend a few moment to imagine in detail how this experiences would be, and then rate their projected feelings accordingly. Afterwards, they were given the instructions for the cognitive task and proceeded to complete 8 items with strings of letters with the missing character (e.g. “b, c, d, f, g, h, j, ?” with the correct answer being “k”). While the first 5 were genuine items constructed to gradually increase in terms of difficulty, the last 3 were mock items, constructed to be unsolvable. This was done in order to make participants believe the items were indeed increasing in difficulty and give credibility to the subsequent negative feedback. The next rating asked subjects asked how difficult they perceived the task to be. Afterwards, participants were invariably given negative feedback regarding their performance, being told that they responded correctly to 37.7% of the answers (approximating 3 answers). Once again, students were told that most individuals solve 75% (corresponding to 6 correct answers) of the task correctly. Finally, negative functional and dysfunctional emotions were rated.

Affective forecasts (both negative functional and negative dysfunctional) were assessed on 5-point Likert scales indicating “To what extent do you consider you will feel the following way:” (1 = “Very little or not at all”; 5 = “To a large extent”), for the following items: sad, concerned, annoyed, disappointed (for negative functional forecasts) and depressed, anxious, angry, and ashamed (for negative dysfunctional forecasts). **Emotions**

(negative functional and negative dysfunctional) were rated on the same scale, in the present tense ("Please indicate to what extent you feel this way right now.").

Task difficulty was assessed by means of a single item ("Please indicate how difficult you found the cognitive task to be."), again on a 5-point scale (1 = "To a very small extent difficult"; 5 = "Extremely difficult").

Irrational and rational beliefs were measured using the GABS-SF (Lindner et al., 1999), previously described.

Task persistence was measured via time spent on the last 3 (unsolvable) items in the cognitive task. We recorded two other time intervals: time spent on the first 5 (solvable) items, and total time spent in the task, though these were not counted as task persistence. **Engagement** with the task was measured through a single item ("Please indicate the degree to which you were involved in the cognitive task."), on a 5-point scale (1 = "Very little or not at all"; 5 = "Extremely"). **Task performance** was measured as a total score of correct items out of 5 possible correct ones.

Procedure

Participants were recruited from the psychology student pool and offered course credit for participation. Students previously completed a set of measures (rational and irrational beliefs), and participated in the computerized negative feedback task, after reading and signing the informed consent. An assistant was in the room with each subject at all times, in order to verify that participants indeed focused on the task at hand and provide answers to any possible questions. Finally, participants were thanked and debriefed, being explained the basics of the study and the fact that their feedback did not pertain to their performance.

Results

Relative accuracy of forecasts

The overall scores for dysfunctional and functional forecasts and emotions were calculated by summing all four scores for each category. Relative accuracy of forecasts by calculated by correlating negative forecasts with emotions, both overall and separately in categories (functional and dysfunctional). Results showed high relative accuracy for negative forecasts overall, and for negative functional and dysfunctional forecasts, however when examining each forecast separately, relative accuracy was medium for most items, except for annoyance, where it was small. All means, standard deviations, and one-tailed correlations can be found in Table 12.

Absolute accuracy of forecasts

Concerning absolute accuracy of forecasts, results ware similar: paired-samples t-tests showed overall forecasts and emotions to differ significantly, $t(103) = 6.58$, $p < .001$, forecasts being higher than emotions with a medium effect size, $d = .53$. When examining negative functional forecasts separately, they were again higher than emotions $t(103) = 11.82$, $p < .001$, with a large effect size of $d = 1.10$, while negative dysfunctional forecasts were only higher than emotions with a small effect size, $t(103) = 4.60$, $p < .001$, $d = .42$. When analyzing forecasts distinctly, results generally showed medium to large effect sizes for the overestimation of negative emotions, with the exception of shame, where there were no significant differences ($t(103) = 1.08$, $p = .141$). Table 12 also presents t-tests for differences in means and effect sizes expressed in Cohen's *d*, corresponding to absolute accuracy of affective forecasts.

Table 12. *Means (M), standard deviations (SD), one-tailed correlations (r), differences in means (t) and effect sizes (d) between forecasts and emotions*

Type of affect	Forecast *M*	Forecast *SD*	Emotion *M*	Emotion *SD*	*r*	*t*	*d*
Overall negative	21.49	7.42	17.81	6.46	.67**	$t(103) = .58$**	0.53
Negative functional	14.55	4.76	9.88	3.68	.57**	$t(103) = 1.82$**	1.10
Sadness	2.69	1.14	2.05	1.06	.42**	$t(103) = 5.52$**	0.58
Concern	2.78	1.21	2.18	1.12	.49**	$t(103) = 5.16$**	0.51
Annoyance	3.41	1.17	2.95	1.24	.25*	$t(103) = 3.19$**	0.38
Disappointment	3.13	1.15	2.70	1.18	.47**	$t(103) = 3.58$**	0.37
Negative dysfunctional	9.48	4.09	7.92	3.33	.58**	$t(103) = 4.60$**	0.42
Depression	2.22	1.31	1.70	1.01	.43**	$t(103) = 4.17$**	0.44
Anxiety	2.58	1.28	2.00	1.08	.48**	$t(103) = 4.85$**	0.49
Anger	2.14	1.18	1.83	0.95	.47**	$t(103) = 2.90$*	0.29
Shame	2.54	1.31	2.39	1.23	.42**	$t(103) = 1.08$	0.12

Note: * $p < .01$, ** $p < .001$.

Predictors of absolute accuracy

Predictors of absolute accuracy were tested by correlating change scores (absolute values of the differences between forecasts and emotions) and predictors (all correlations are presented in Table 13). There were no significant correlations between predictors and change sores for overall forecasts, for negative dysfunctional forecasts overall, or any of the individual negative dysfunctional forecasts. However, task difficulty presented a moderate negative association with negative functional, annoyance and disappointment forecasting accuracy, and rationality presented a moderate negative association with negative functional forecasting accuracy (where accuracy is represented by change scores). In other words, the more difficult individuals perceived the task, the more accurately they predicted their negative functional emotions, particularly annoyance and disappointment. Thus, task difficulty was a significant predictor of annoyance ($F(1, 83) = 7.84$, $p = .006$, $B = -0.44$, $SE = 0.16$, $\beta = -.29$, $p = .006$, $R^2 = .09$), and disappointment ($F(1, 83) = 7.18$, $p = .009$, $B = -0.35$, $SE = 0.13$, $\beta = -.28$, p = .009, $R^2 = .08$) forecasting accuracy.

Table 13. *Two-tailed correlations (r) between predictors and change scores for absolute accuracy of affective forecasts*

Emotion category / Predictor	Irrational beliefs (N = 103)	Rational beliefs (N = 103)	Task difficulty (N = 85)
Overall negative	.04	-.10	-.19
Negative functional	.15	-.21*	-.28**
Sadness	.05	-.06	-.15
Concern	.10	-.04	-.08
Annoyance	.06	-.10	-.29**
Disappointment	-.11	-.02	-.28**
Negative dysfunctional	.04	-.08	-.12
Depression	.10	-.09	.01
Anxiety	.11	-.14	-.11
Anger	.02	.06	-.14
Shame	.10	.09	-.08

Note: * $p < .05$, ** $p < .01$

When analyzing negative functional forecasting accuracy, as there were two significant correlates for absolute accuracy, we inserted them in a stepwise multiple regression equation. The initial model containing only task difficulty as a predictor was a good fit ($F(1, 83) = 7.12$, $p = .009$, $R^2 = .08$), however the second model containing both task difficulty and rational beliefs was still a good fit ($F(2, 82) = 5.83$, $p = .004$), providing an additional 5% in explaining variance in the data. Gradients, standard errors, and standardized regression coefficients for both iterations are presented in Table 14.

Table 14. *Gradients (B), standard errors (SE), and standardized coefficients (β) for the multiple regression equation*

Predictor / Criterion	Absolute accuracy for negative functional forecasts		
	B	*SE B*	*β*
Step 1			
Constant	10.90	2.16	
Task difficulty	-1.50	0.56	-.28**
Step 2			
Constant	16.50	3.44	
Task difficulty	-1.55	0.55	-.29**
Rational beliefs	-0.33	0.16	-.21*

Note: $R^2 = .08$ for Step 1, $\Delta R^2 = .05$ for Step 2 ($p = .042$). * $p < .05$, ** $p < .01$.

Influence of forecasting accuracy on task persistence, engagement and performance

We ran separate ANOVAs with the categorical variable defined above and each of the variables: persistence, engagement, and performance as dependent variables, for each classification discussed above. We also explored time spent in the task on the solvable items, and time spent in the task overall (on both solvable and unsolvable items) as dependent variables a posteriori. There were no significant differences among categories in which regards persistence or engagement. However, there was one significant effect of annoyance forecasting accuracy on task performance, $F(2,101) = 4.05$, $p = .02$, with a medium effect size of $\eta^2 = .07$. Gabriel's *post hoc* showed that underestimaters of annoyance had fewer correct answers ($M = 2.45$, $SD = 1.44$) than accurate forecasters of annoyance ($M = 3.47$, $SD = 1.28$), $p = .025$. There were no differences in performance between underestimaters and overestimaters, $p = .702$, nor between accurate forecasters and overestimaters, $p = .103$.

Discussion

We had several aims in the present research, the first of which was to investigate relative and absolute accuracy of affective forecasting, in a computerized cognitive task with default negative feedback. We focused solely on negative forecasts and emotions. However, we added a classification of affect used in the REBT literature, namely functional versus dysfunctional. Concerning relative accuracy, individuals predicted with high accuracy their future negative feelings. As regards absolute accuracy, individuals systematically overestimated negative emotions. These results confirmed our hypotheses.

Furthermore, we investigated rational beliefs, irrational beliefs, and task difficulty as predictors of absolute inaccuracy. For negative dysfunctional forecasting accuracy, no predictor constantly associated with more accurate predictions. However, our participant sample had a low irrationality level when compared to the national normative (David, 2007). Findings were different for the accuracy of functional forecasts, in the sense that we found negative functional forecasting accuracy to be negatively associated with task difficulty and rationality, while annoyance and disappointment only associated negatively with task difficulty. Rationality and task difficulty both contributed in predicting negative functional forecasting accuracy, in the sense that individuals who were more rational and perceived the task to be more difficult made more accurate forecasts of their negative functional emotions.

Finally, we examined whether affective forecasting accuracy had a distinct role in influencing individuals in their task persistence, engagement and performance. It has been suggested that individuals who overpredict future emotions may be biased in decision making and future behavior. In our study, there were no differences among underestimaters, accurate forecasters, and overestimaters in task persistence or subjective engagement. Additionally, accuracy in predicting annoyance in case of failure was the only type of accuracy influencing performance of participants in this task. More explicitly, individuals who thought they would be less annoyed than they actually were solved less correct items than accurate estimaters of annoyance. This is surprising as current consensus in affective forecasting claims that the overestimation of emotion is generally deleterious to performance, not its underestimation.

The most important limitation to the present research consists in low participant count, which led to insufficient achieved power in some of the analyses. More investigations are needed in order to prove absolute inaccuracy in affective forecasting has its purported deleterious effects. Secondly, the type of task we constructed may have influenced our findings, as the task might not have been motivationally relevant. Future research could take into consideration the interplay between underestimation of negative emotion, motivation and performance

CHAPTER IV. GENERAL DISCUSSION AND CONCLUSIONS

4.1 General discussion and concluding considerations

The general goal of this research project was to investigate the relative and absolute accuracy of emotional predictions, to clarify the predictors of accuracy in emotional prediction, as well as to explore possible implications of inaccuracy in predicting future emotions. We have approached this goal through three specific objectives, addressed in four distinct studies.

Our first major objective was to establish the degree of accuracy in emotional predictions, and this was undertaken both by means of quantitative meta-analysis (Studies 1a and 1b), and by means of replication (Studies 2, 3, and 4). From our quantitative reviews (Studies 1a and 1b) we concluded that predictions regarding future emotions are accurate in the relative sense, and inaccurate in the absolute sense, a finding in line with previous research (Mathieu & Gosling, 2012). To rephrase, individuals estimate correctly the direction and relative magnitude of their future emotions, but systematically overestimate the intensity of these emotions, more so for negative ones, for the ones related to negative events, and for the ones related to familiar events.

These findings were generally replicated in our following studies, where we investigated accuracy of emotional predictions in several contexts. Study 2 reported results in line with our meta-analytical findings, while Study 3 revealed that in some contexts (i.e. attachment-related), only negative dysfunctional emotions are overestimated and not negative functional ones. It also showed that positive emotions can be underestimated under the same circumstances. Summarizing, individuals indeed seem to overestimate the *negativity* of their feelings and underestimate their *positivity*. Thus, Study 4 focused only on negative functional and dysfunctional predictions and emotions, and results regarding accuracy of prediction were once again confirmed.

Our following objective was to establish predictors of emotional forecasting accuracy. In Studies 1a and 1b we investigated moderators of the relationship between predictions and emotions. We found no significant moderators for the relative accuracy of emotional predictions, however we did find several moderators for the absolute accuracy of emotional predictions (here represented as effect size of the difference between predictions and emotions), namely emotional valence, event valence, and familiarity with the event. We retained event valence and familiarity for confirmation in our following studies, as we further measured positive and negative (functional and dysfunctional) predictions and emotions independently.

Study 2 confirmed that individuals who perceived the event they were making the emotional predictions for to be more negative had less accurate predictions regarding their future negative emotions. In Study 3, beside negatively perceived event valence and high attachment related anxiety, a high level of irrational beliefs was also found to predict lesser accuracy in emotional predictions. Study 4 revealed that individuals who had higher levels of rational beliefs and perceived a cognitive performance task to be more difficult, predicted more accurately their negative functional emotions in case of negative feedback. The last three studies investigated predictors of absolute (in)accuracy using a predictive correlational design, irrespective of the direction of the accuracy error.

Our third and last objective was to evaluate implications of absolute inaccuracy in emotional prediction, and was addressed in Study 4. We compared individuals who underpredicted, accurately predicted and overpredicted negative emotion in a cognitive

performance task with invariable negative feedback, and results showed no influence of absolute accuracy on task persistence and engagement. However, task performance seemed to be influenced by inaccurate prediction of emotion, in the sense that participants who underpredicted annoyance at their possible failure had a weaker performance than those who accurately forecasted their level of annoyance.

4.2 Theoretical and conceptual advances

4.2.1 Literature integration

Our first research question led to the investigation of whether predictions regarding future emotions were indeed accurate or inaccurate, and this opened up several new research problems. First of all, emotional predictions had been previously studied in the literature in two different research domains, one of which pertaining to clinical psychology and the other to social psychology. This discrepancy between the two lines of literature needed to be resolved and studies from both paradigms needed to be taken into consideration. We decided to adopt Mathieu and Gosling's (2012) differential definition of accuracy, in which relative accuracy refers to the association between prediction and emotion, and absolute accuracy refers to equality between the two.

In order to answer our first question and to solve the discrepancies found in the literature, we conducted a meta-analytical review of the relationship between emotional predictions and actual emotions, comprising two distinct meta-analyses, one set about investigating relative accuracy of emotional prediction (i.e. their association), and the other absolute accuracy of emotional prediction (i.e. the magnitude of their difference) **Study 1a** revealed a medium effect size for the association between predictions and emotions, in accordance with previous research (Mathieu & Gosling, 2012; Sohl et al., 2009), confirming emotional predictions to be accurate in the relative sense. Further, in **Study 1b** we obtained a small to medium effect size for the difference between predictions and emotions, again in line with previous literature (Levine et al., 2012; Mathieu & Gosling, 2012). Thus, our results confirm that emotional predictions are inaccurate in the absolute sense, by overestimating future emotions.

Our following studies generally confirmed our meta-analytical ones and brought about several specifications. Accordingly, **Study 2** showed functional and dysfunctional negative predictions, as well as positive predictions, to be all highly accurate in the relative sense. Consequently, negative functional and dysfunctional predictions were both inaccurate in the absolute sense, although in this case positive predictions resulted accurate. **Study 3** replicated findings concerning relative accuracy of prediction, with positive predictions being highly accurate and negative functional and dysfunctional predictions being less accurate (although still moderately to high). However, it also revealed a difference between positive, negative functional and negative dysfunctional predictions in which regards absolute accuracy. Thus, in the day focal to the event, both positive and negative functional emotions were inaccurately predicted, while negative functional ones were not. The absolute inaccuracy in prediction was also observed for positive emotions in the day following the focal event, while for the third day all emotions were predicted accurately in the absolute sense.

Furthermore, results in **Study 3** showed that while positive emotions were underestimated, negative dysfunctional emotions were overestimated, irrespective of valence of the event. These results emphasize the difference between negative functional predictions for the day of the event, which accurately estimate emotions, and negative dysfunctional predictions, which overestimate the intensity of emotions for the focal event. In **Study 4**, we only addressed negative predictions and emotions pertaining to a negative event. Results

regarding accuracy were again confirmed, with both negative functional and dysfunctional predictions being highly accurate in the relative sense, and inaccurate in the absolute sense.

In conclusion, our results support the integration of the two lines of research mentioned above, as they address the same underlying phenomenon. **Study 1a** showed no differences in terms of magnitude of effect regardless of paradigm studies originated from, and emotional predictions we subsequently investigated in different contexts proved both accurate in the sense maintained by response expectancy literature, and inaccurate in the sense conveyed by the affective forecasting line of research. We propose that the unifying term for predictions regarding future emotions be "emotional predictions", as it clearly defines the phenomenon without being biased towards one line of research or another, and has been previously used in research (Gilbert & Wilson, 2009).

4.2.2 Clarification of existing and investigation of novel predictors of accuracy

Our following research question regarded possible predictors of accuracy in emotional prediction. First of all, our meta-analysis (**Study 1b**) gave us some indication as to what moderates the weight of the relationship between predictions and emotions in which regards absolute accuracy, namely *emotion valence*, *event valence*, and *event familiarity*. As such, positive emotions seem to be more accurately predicted than negative emotions, emotions regarding negative events seem to be overpredicted while those regarding positive events not so, and emotions regarding unfamiliar events seem to be more accurately predicted than those familiar. Therefore, we addressed event valence by quantifying positive and negative (functional and dysfunctional) predictions and emotions separately, as previously discussed, and we retained event valence and familiarity for further investigation.

Thus, from the predictors of absolute accuracy previously examined, *event valence* significantly predicted absolute accuracy of negative functional and dysfunctional emotional predictions (**Studies 2 and 3**), and even of positive predictions for the day of the event (**Study 3**). More specifically, individuals who perceived the event for which they made the prediction to be more negative were less accurate in predicting their emotions. Likewise, *attachment anxiety* proved to be a significant predictor of absolute accuracy in our attachment relevant study (**Study 3**). In this case, higher attachment anxiety predicted less accuracy of negative functional and dysfunctional forecasts made for the day of the event and the two subsequent days. Conversely, self-report emotional intelligence did not predict absolute prediction accuracy beyond any of the other predictors, and neither did active coping.

In which concerns *familiarity with the event*, a predictor stemming from the response expectancy paradigm and found to moderate the weight of the difference between predictions and emotions in our meta-analysis (**Study 1b**), neither of our studies confirmed its significance. Both these results and the ones in our quantitative review go in opposition to response expectancy assumptions, which claim that familiarity with the event should adjust emotional prediction accuracy. However, they are in line with the retrospective impact bias hypothesis (Wilson et al., 2003), which states that individuals misremember emotions they felt in the past, unwittingly enhancing their intensity. Should past emotions be misremembered, this does not allow for the individual to calibrate future predictions based on what they remember to have felt in similar situations, but rather it maintains the inaccuracy.

Regarding previously uninvestigated predictors of absolute accuracy, *rational beliefs* significantly predicted accuracy of positive emotions (**Study 3**) and negative functional emotions (**Study 4**), in the sense that individuals who were more rational predicted these emotions more accurately. *Irrational beliefs* resulted as sound predictors in **Study 3**, with individuals who were more irrational being less accurate in foreseeing their future negative

dysfunctional emotions for the day of the event, and their negative functional emotions for the two days following the event. To our knowledge, this is the first time mechanisms of change in psychopathology closely related to emotion generation such as rational and irrational beliefs have been studied as predictors of absolute accuracy.

4.2.3 Implications of emotional prediction accuracy

Our final research question regarded implications of inaccuracy in emotional prediction. Many of the affective forecasting studies emphasized the importance of the field by arguing that constant overestimation of future negative emotions was detrimental in which regards decision making in salient life domains such as medical or economic decisions (Camerer, 2000; Rhodes & Strain, 2008; Sieff et al.,1999; Ubel et al., 2005). However, little research focused specifically on examining the effects and implications of inaccuracy in emotional prediction on decision making, or otherwise on objective outcomes measuring specific detrimental behaviors. Having in mind this large gap in the literature, we set forth to investigate whether absolute prediction inaccuracy has any implications in task persistence, engagement and performance.

We have addressed this gap in **Study 4,** where we investigated possible differences between individuals who underestimated, predicted correctly, or overestimated future functional and dysfunctional negative emotions in a negative event involving failure feedback in a cognitive task. Results showed no influence of emotional prediction accuracy on persistence or engagement in the task, although task performance was affected in one singular way: underestimaters of future annoyance in the face of failure resulted in a lesser performance than accurate estimation of annoyance for said failure. This is surprising, as affective forecasting literature stipulates that overprediction, and not underprediction of negative emotion has detrimental effects. However, our studies show that this type of inaccuracy needs also be taken into consideration, shedding a new light on previous claims.

Summarizing our theoretical and conceptual advances, in this research project we have argued for the need of integrating affective forecasting and response expectancy literature under the emotional prediction umbrella. Our research points out no differences between results obtained in the two, and it also supports claims held by both of these lines of research. We investigated some of the already proposed predictors of absolute accuracy in emotional prediction and clarified their role. Moreover, we examined and confirmed novel predictors of absolute accuracy, namely rational and irrational beliefs. By introducing a categorization of negative emotions in terms of functionality and studying irrationality as a predictor, we tried to integrate studies from the social psychology paradigm in the clinical domain. We further uncovered the role of underestimating future emotions in emotional prediction research and disconfirmed the assumed implications of overestimating them.

4.3 Practical implications

Our research project was not meant to specifically target practical implications as it bears a more fundamental approach to investigating accuracy in emotional prediction. However, some suggestions emerge from our results, which may be used in clinical settings. First of all, the fact that future emotions, especially negative ones are regularly overpredicted can be used in psychotherapy settings. Furthermore, our studies show that sometimes only negative dysfunctional emotions related to a negative event are overpredicted. Thus, irrational beliefs, which are known to determine dysfunctional emotions, and we found to be salient predictors of accuracy in emotional forecasting, could be specifically targeted in these interventions. Although in general positive predictions follow the general pattern of overestimation of future positive emotions, our studies show that there are instances in which

individuals underpredict positive emotions. Underestimating the intensity of positive emotions in some future events could deprive individuals of certain benefits, should they chose not to pursue said events. Lastly, our results show that when underestimating future annoyance in case of failure, individuals have impaired task performance. Not realizing the impact of future failure can lead to underestimating the personal importance of the task at hand, promoting less healthy behaviors such as avoidance and procrastination. Calibration of annoyance predictions beforehand could, however, help in addressing this issue earlier and could thus be incorporated in procrastination regulations techniques.

4.4 Limitations and future directions

There are several limitations related to this research project, from which stem future directions in the emotional prediction field of research. First of all, the limited number of participants in Study 4 resulted in lack of sufficient power for some of the statistical procedures. This may have led to non-significant results in our sample when in fact there is an effect in the overall population. Secondly, the modality we chose for data collection in Studies 2 and 3 (online), combined to our rigorous constraints on time of measurement completion meant to overcome previous limitation in the literature, led to a high drop-out number. Unfortunately, this type of limitation is not easy to overcome, as on-line measurements usually have a higher drop-out rate than pen and paper ones. Moreover, the samples used in our studies were generally young, with a high proportion of females and a high proportion of psychology students. As such, its findings can only be generalized to a non-clinical population, with these limitations in mind. Further studies are needed on subclinical and clinical populations taking into account clinical conceptualizations of emotions, as well as established predictors of distress and disability such as irrationality.

Furthermore, the failure task we used in Study 4 might not have been motivationally relevant enough for the participants, in order to prompt irrational beliefs which largely determine dysfunctional emotions. Future studies should control for personal relevance of the events for which emotional predictions are made, especially in which regards motivation to succeed in cognitive performance tasks such as the one we constructed. Self-report measures were used in assessing most of the predictors we examined regarding absolute accuracy in emotional predictions. The nature of some does not allow for a more objective quantification (e.g. irrational beliefs), however others could further be investigated using methods which are less penetrable to social desirability issues (i.e. emotional intelligence, active coping). Concerning our meta-analysis of relative accuracy in emotional prediction, we established high heterogeneity in our data. However, we found no significant moderators of this association. Additionally, in our following research studies, our design did not allow for examining predictors of relative accuracy. Upcoming studies need to focus their attention on what makes individuals more accurate in predicting emotion in the relative sense.

Future directions of research stem not only from our limitation, but also from our conclusions. As such, the differential impact of emotion valence on forecasting accuracy needs to be further investigated. Next, more studies are required in order to determine the influence functionality of negative emotions has on the accuracy of individuals' predictions. Lastly, future studies should continue to investigate possible implications of emotional prediction accuracy.

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