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Learning the affective value of target categories: The role of category valence and the Behavioural Inhibition System (BIS)[☆]

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ABSTRACT

Previous studies carried out within the rule-discovery paradigm demonstrated that people use different strategies depending on the affective value of the rule exemplars (i.e., whether they are sources of personal gains or losses). When learning positive categories, people tend to attach more weight to false positives than false negatives, resulting in overly narrow final categories (prevalence of sufficient over necessary categorization criteria), whereas when learning negative categories, the relative weights attached to the categorization errors are reversed, resulting in larger final categories and a prevalence of necessary over sufficient categorization criteria. This asymmetry is underlain by the affective negativity effect, responsible for risk aversion in decision making.

In the present study, we tested the role of anxiety in categorization behaviour, operationalized within Gray's theory of the behaviour inhibition system (BIS), and predicted intensification of the usual asymmetry in high BIS participants. Using the rule-discovery paradigm we manipulated the affective meaning of categories (gains vs. losses) and type of feedback for categorization decisions (full vs. incomplete feedback). Results confirmed positive–negative asymmetry in categorization. However, contrary to expectations, the high BIS persons placed in the incomplete feedback gain conditions were not more but less risk averse than were low BIS persons.

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1. Introduction

One of the major challenges that people face in life is how to distinguish stimuli that are beneficial, and thus worth approaching, from those that incur costs and should be avoided. Processes through which stimuli acquire their affective meaning include in-born mechanisms, classical conditioning, vicarious learning, and learning through social and cultural traditions. Affective meaning is also acquired through people's direct experience with novel objects, often in a highly uncertain environment, in the process of empirically testing evaluative hypotheses. This latter process has been subject to an empirical investigation in the present paper.

2. Positive–negative asymmetry and processes of categorization

Categorization processes are usually studied within the so called rule-discovery paradigm (Bruner, Goodnow, & Austin, 1956; Klayman & Ha, 1987; Wason, 1960) in which participants

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are asked to test hypotheses about the content of a rule by encountering its confirming and disconfirming instances. The task has the form of a decision matrix with four types of categorization decisions, two correct (positive and negative hits) and two incorrect (false positives and false negatives). On the basis of feedback (yes – it is a confirming instance, no – it is not) participants learn a rule whose final content may either correspond to the “true” category or deviate from it (be overly general or overly restricted). The most spectacular finding, reported by Bruner et al. (1956) and elevated to one of the main effects in human cognitive functioning by Wason (1960; see Lewicka, 1998; Nickerson, 1998 for a review of relevant research) is the tendency to test a hypothesis with cases predicted by this hypothesis (confirmation bias) and to ignore cases which this hypothesis does not predict. This is due to the disproportionately greater weight attached to elimination of one of the categorization errors, namely false positives, at the expense of false negatives. The result is overly narrow final categories based on sufficient criteria of category belonging (optimizing the ratio of false positives to sum of false positives and positive hits) rather than necessary criteria (optimizing the ratio of false negatives to sum of false negatives and positive hits) (Klayman & Ha, 1987; Lewicka, 1988; Thompson, 1995). This risk-averse bias is considered an adaptive strategy (Friedrich, 1993; Klayman & Ha, 1987; Lewicka

1988), underlain by what in literature on social evaluation is known as the 'negativity effect' (Peeters, 1971; Peeters & Czapiński, 1990), i.e., more weight attached to harmful than to beneficial stimuli.

The studies reported in this paper are based on the assumption that categorizations are first and foremost pragmatically useful, i.e., they facilitate efficient approach and avoidance. In line with this rationale, Lewicka (1988) hypothesized that confirmation bias is also pragmatically useful. She predicted that it would occur primarily when the learned category signifies gains but that it would disappear when the content of the learned category entails losses. The rationale behind this reasoning is that in an otherwise stable environment the mastering of a single sufficient condition of a positive outcome is enough to ensure gain, while in order to efficiently avoid negative stimuli one would have to identify at least one of its necessary conditions (Lewicka, 1988). False positives should thus be weighted more heavily than false negatives in situations of approach and the reverse should be true in situations requiring avoidance. This should result in broader negative than positive categories, and the greater use of sufficiency criteria for categorizing positive than negative stimuli, and greater use of necessity criteria for categorizing negative than positive stimuli.

These hypotheses were confirmed in a series of experiments, all of them a modification of Wason, 1960) classical 2-4-6 task, in which participants could either gain or lose real money for entering into or avoiding contact with positive or negative instances of categories (Lewicka, 1998, 2000). The studies demonstrated that people use risk-averse strategies, i.e., try to eliminate false positives rather than false negatives, more often when rule exemplars bring gains than when they bring losses, and that the reverse happens when instances of the rule bring losses rather than gains.

Strategies employed to identify the defining features of gains vs. losses depend on situational premises (e.g., utilities of correct and erroneous decisions) but also on individually differentiated patterns of motivation (Spiegel, Grant-Pillow, & Higgins, 2004). In the study presented in this paper we focused on the role of the individually differentiated levels of trait anxiety, operationalized as the Behavioural Inhibition System (BIS) described by Gray (Gray & McNaughton, 2000), and associated with risk aversion.

3. Anxiety – Behavioural Inhibition System

Trait anxiety is thought to arise from long-term modulation of BIS (such that anxious individuals have a more reactive BIS; Gray & McNaughton, 2000). In the old version of the Reinforcement Sensitivity Theory (RST) aversive stimuli activate BIS. However, according to the reformulated BIS theory (Gray & McNaughton, 2000; McNaughton & Corr, 2008), all aversive stimuli activate the FFFS (Fight-Flight-Freeze System) while BIS is activated by conflict, i.e., the choice between two incompatible decisions whose consequences are unknown and potentially dangerous. The classical type of conflict occurs between approach (operated via the Behavioural Activation System, BAS) and avoidance (operated via FFFS) tendencies (McNaughton & Corr, 2008). Although the activation of BIS in conflict situations results from a simultaneous activation of BAS and FFFS, the generally stronger association of BIS with FFFS than with BAS leads to risk aversion (Corr, 2004; McNaughton & Corr, 2008). Signals of potential punishment attract attention of high BIS persons and trigger elaborate information processing which, in turn, helps to correctly assess the magnitude of risk and avoid negative consequences of the decision.

Since both sufficiency and necessity seeking strategies help to prevent contact with harmful stimuli (the former through identification of a secure source of positive stimuli, the latter through identification of more abstract sources of negative stimuli), we ex-

pected that BIS would enhance the use of both kinds of strategies. Therefore we predicted that in the conditions of gains (approach behavior) high BIS subjects would behave in a more risk-averse way than would low-BIS subjects, commit fewer false positive errors, and end up with more narrow final categories. On the other hand, in conditions of losses (avoidance behavior), we expected that high BIS persons would behave in a cognitively less risk-averse way, commit fewer false negative errors, and end up with larger final categories. Both strategies: sufficiency in the gains conditions and necessity in the loss conditions should thus be enhanced in high compared to low BIS individuals.

Decision situations differ in the extent to which they provide people with unambiguous feedback on consequences of decisions, i.e., feedback certainty. The feedback provided in the rule-discovery task may be framed in an unambiguous way, with positive and negative reinforcement fully contingent on the participant's reactions, or it may create uncertainty as to the type of outcome, i.e., be "incomplete". We predicted that the hypothesized effects of BIS would be more pronounced when the feedback is uncertain, that is "incomplete", than in the fully structured complete feedback situations. The rationale behind this prediction is the assumption that incomplete feedback triggers anxiety-provoking uncertainty (Miceli & Castelfranchi, 2005).

4. Study objectives

The aim of our studies was to investigate how the BIS affects testing hypotheses about sources of gains and losses when the provided feedback differs in level of certainty. Along with two full feedback conditions (all accurate decisions and all incorrect decisions followed by feedback) we included two conditions in which erroneous response might but did not have to be followed by a feedback. In the "gains – complete feedback" condition, correct responses (hits) were consistently rewarded and incorrect decisions – consistently punished. In the "losses – complete feedback" condition, the correct responses were consistently punished and incorrect responses – consistently rewarded. In the incomplete feedback conditions the correct decisions were, respectively, rewarded (gains) or punished (losses) but incorrect decisions were not reinforced. We assumed that the incomplete feedback, i.e., lack of consistent reinforcement, would create decisional conflict and this in turn would lead to engagement of the BIS. As a result, we expected more risk aversion, manifested in higher sufficiency seeking among high than among low BIS participants in the gains conditions when feedback was incomplete, but not when feedback was complete (Hypothesis 1). By the same token, we expected more BIS activation and thus stronger effects of the BIS on categorization in incomplete than in full feedback losses conditions, revealed in higher necessity seeking in the former than in the latter conditions (Hypothesis 2).

5. Method

5.1. Participants

Three hundred and fourteen secondary school students participated voluntarily in this study conducted in the computer room of their school (172 women and 141 men; mean age = 17.09, $SD = .81$).

5.2. Personality measures

Participants completed the BIS/BAS scales (Carver & White, 1994, in the Polish adaptation of Müller and Wytykowska, 2005). The scale comprises 7 items diagnostic of BIS reactivity (CWBIS; $\alpha = 0.769$) and 13 items diagnostic of BAS reactivity, the latter

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