Acta Psychologica 131 (2009) 171–177

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

Playing TETRIS for science counter-regulatory affective processing in a motivationally "hot" context

Dirk Wentura [a,*], Andreas Voss [b], Klaus Rothermund [c]

[a] Universität des Saarlandes, Fachrichtung Psychologie, PF 15 11 50, D-66041 Saarbrücken, Germany
[b] Albert-Ludwigs-Universität Freiburg, Institut für Psychologie, Engelbergerstr. 41, D-79085 Freiburg im Breisgau, Germany
[c] Friedrich-Schiller-Universität Jena, Institut für Psychologie, Am Steiger 3, Haus 1, D-07743 Jena, Germany

ARTICLE INFO

Article history:
Received 17 October 2008
Received in revised form 26 May 2009
Accepted 26 May 2009

PsycINFO classification:
2346
2360

Keywords:
Negativity bias
Attentional biases
Flexibility
Action regulation
Emotion regulation

ABSTRACT

We adapted the computer game TETRIS to investigate the process of affective-motivational counter-regulation, that is, attentional biases for emotional stimuli that are in opposition to the momentary motivational focus. Counter-regulation is seen as a mechanism which should prevent escalation and impulsivity, and it should help to avoid becoming "locked up" in affective-motivational states. Accordingly, for a negative outcome focus condition (i.e., risk of losing a current high score), we hypothesized greater interference by positive distractors that were included in the game, whereas for a positive outcome focus (i.e., chance to improve one's current high score), we hypothesized greater interference by negative distractors. Supporting our hypotheses, we found the predicted interactions between distractor valence and type of outcome focus.

1. Introduction

An important topic at the intersection of cognition and emotion concerns mechanisms of selective attention that are active during the processing of valent stimuli. One recurrent result is the finding of a negativity bias, that is, the preferential allocation of attention to negative stimuli as compared to positive stimuli (Brosch & Sharma, 2005; Buchner, Rothermund, Wentura, & Mehl, 2004; Fox et al., 2000; Öhman, Flykt, & Esteves, 2001; Öhman, Lundqvist, & Esteves, 2001; Pratto & John, 1991). Although such a bias makes intuitive sense – overlooking a dangerous situation might have more severe consequences than overlooking a beneficial situation – one might question whether our cognitive apparatus is adequately characterized by the rigidity of an inflexible allocation of attention. The maladaptivity of a generalized negativity orientation (of attention) is also evident from the results of a recent meta-analysis, showing that a perceptual advantage for negative stimuli is limited to highly anxious individuals (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007).

Recently, Rothermund, Voss, and Wentura (2008) argued that attentional biases are moderated by motivational phases during goal pursuit. In detail, they hypothesized that affective processing is governed by a counter-regulatory mechanism that prevents an escalation or perseveration of affective-motivational states and helps to sustain motivational tension in striving for positive outcomes and in order to prevent failures.

In support of this counter-regulatory mechanism, Rothermund and colleagues (2008), see also Rothermund, Wentura, and Bak (2001), found evidence for an automatic allocation of attention to information whose intrinsic valence is incongruent with the current type of goal striving. In that study, they used a flanker task, that is, a target stimulus had to be processed in the presence of a distractor stimulus (see Eriksen & Eriksen (1974); Mordkoff (1996)). In the flanker task, longer response times and/or higher error rates in the presence of one type of distractor (e.g., a positive one) as opposed to another type (e.g., a negative one) are interpreted as a stronger automatic tendency of this kind of stimulus to interfere with target processing, that is, with a larger power to attract or hold attention. Given this backdrop, during a motivational phase that was characterized by a positive outcome focus (a prize money could be won without the risk of losing money), negatively valenced distractor stimuli caused more interference than positive ones. Under a negative outcome focus (a prize money

* Corresponding author. Address: Department of Psychology, Saarland University, Building A2 4, P.O. Box 15 11 50, 66041 Saarbrücken, Germany.
E-mail address: wentura@mx.uni-saarland.de (D. Wentura).

0001-6918/$ - see front matter
doi:10.1016/j.actpsy.2009.05.008

could be lost without the chance of winning money), the result was reversed.

With the present studies, we wanted to continue this line of research by assessing the counter-regulatory mechanism in the context of more naturally occurring motivational states. We developed a re-programmed version of the well-known computer game TETRIS and implemented features that allow for maximal experimental control without distorting the character of the game.

We chose TETRIS because it provides natural goal striving in a nutshell (see also Boot, Kramer, Simons, Fabiani, and Gratton (2008); Maglio, Wenger, and Copeland (2008), for the use of TETRIS in cognitive research). The game takes place on a game board on the computer display (see Fig. 1). When the game starts, the board is empty. Then "bricks" of various shapes appear at the top of the board and fall towards the bottom of the board. When a "brick" reaches the ground – or a point where it can fall no further because of the pile of "bricks" from the preceding trials – it remains in that spot and another "brick" appears at the top of the board. The player uses rotations and horizontal movements to orient the "bricks" as they fall, attempting to fill complete rows of the board. When a row is covered completely, the cells of that row disappear and the cells of the rows above drop to fill the gap. If the player does not fill the rows efficiently, eventually there will be no room to place further "bricks" and the game will end. Each trial is associated with the winning of points such that the goal overarching a session of games is to top the current high score. Thus, obstacles have to be overcome and elegant moves have to be made in order to reach the overarching goal of a final result that appears in a high score list. In sum, playing TETRIS is an intrinsically attractive activity triggering strong achievement motivations. Moreover, the basic structure of TETRIS mimics the structure of an experimental paradigm: The game is based on single trials with one of seven symbols ("bricks") being presented. Players have to respond very quickly such that response times and/or errors can be valid dependent variables. The trial-by-trial structure potentially allows for a high degree of experimental control. It is possible to add positive and negative symbols as distracting stimuli which accompany the current "brick". Finally, the game allows for the manipulation of outcome focus: In complete games (Experiment 1) or in phases of games (Experiment 2), we implemented a negative outcome focus – that is, the current individual high score could be lost upon bad performance – or a positive outcome focus – that is, the individual high score could be topped without danger of losing the current high score.

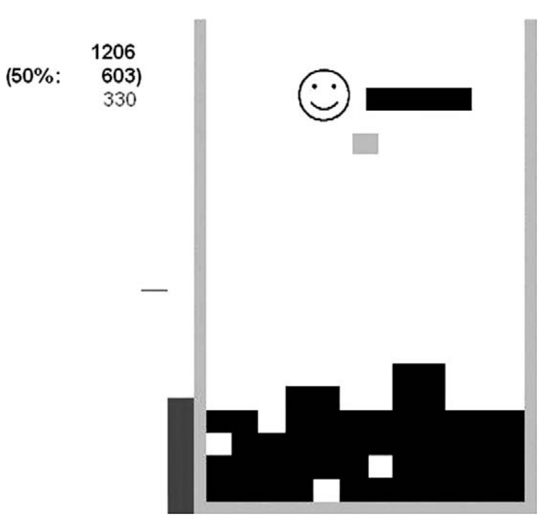

Fig. 1. The modified game of TETRIS (the top value indicates the current high score of the participant; the bottom value – in red if below the 50% high score value – indicates the current game score; see text for further explanations.)

According to the theory of counter-regulation in selective attention, and in line with previous results reported by Rothermund et al. (2001, 2008), we predicted an incongruency effect: In a negative outcome focus phase, distractor effects of positive symbols should exceed those of negative ones, whereas in a positive outcome focus phase, it should be the other way around.

2. Experiment 1

In Experiment 1, we randomly assigned complete games of TETRIS to be either games with a positive or a negative outcome focus. A positive outcome focus game was characterized by the opportunity to top the current individual high score (i.e., the score of the best game played during the competition, which finally determines the winner of a prize money) without jeopardizing it. In contrast, a negative outcome focus game was characterized by the risk of losing the current individual high score due to a bad performance.

2.1. Method

2.1.1. Participants

Fourteen students (nine females) participated in the experiment. The median age was 22 years (range 19–30 years). To create a highly natural motivational context, we decided to recruit small samples of players who did not know one another. They were informed that a maximum of 10 players would compete for a sizeable prize money (100 €) and that the player with the highest score (i.e., the one whose best scoring game is the best in the sample) would win the prize.[1] However, to secure that players played with maximal motivation to improve their *own* intra-individual achievement (with no knowledge about the current level of competitors), they were allowed to play at their home computer in a self-paced manner during a period of about four weeks and to send back their data by a fixed date.

2.1.2. Design

Two factors were varied within participants. First, there were four distractor conditions (happy face, sad face, neutral face, and none). Second, outcome focus was varied across games. A "negative outcome focus" game had the following features: First, if the final game score was below 50% of the current individual high score, the high score was reduced to 75% of its former level. Second, as soon as the 50% level of the current high score was achieved, the game stopped. Thus, in a "negative outcome focus" game, participants did not have the opportunity to increase their high score, but risked its reduction. To the contrary, in a "positive outcome focus" game, the final game score was taken as the new individual high score if it exceeded the previous high score; nothing changed if the current game score was below the previous high score. Note that the positive outcome focus resembles the standard modus of playing TETRIS.

2.1.3. Material

TETRIS was programmed in TurboPascal (text mode with two spaces defining a grid square). The distractor stimuli were schematic faces, construed by redefining the pixel matrix of some

[1] The full sample was recruited by announcing two competitions. Three participants either did not send back their data or sent back data that clearly indicated non-compliance (i.e., a very low overall playing time and a high score of <1000 points; to compare: the winners had final high scores of over 17,000 points). Furthermore, the data of three participants who did send them back were useless because they obviously did not conform to instructions: they developed a strategy of pressing keys already before the bricks appeared, which can be inferred from their large number of response latencies below 50 ms (>18%) and their large error rates (>33%).