The Speed-Accuracy Paradigm as an Objective Measure for Regulatory Focus

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Abstract

This study is intended as a basic contribution to a better understanding of regulatory focus and its measurement. Therefore, an objective measure, taking into account the reference-point definition, of regulatory focus was used. The participants completed a speed-accuracy task in one of two conditions (promotion vs. prevention). Priming respective condition, a text assignment was used in which the participants either report their hopes (promotion) or obligations (prevention). In the following speed-accuracy task, participants should respond as quickly and correctly as possible to whether there are nine *ones* in the matrices presented. Participants in the promotion condition should try to gain points whereas participants in the prevention condition should try to avoid losing points. Since no significant results are available, possible limitations of the study are discussed.

Keywords: regulatory focus, reference-point, objective measure, speed, accuracy

Introduction

People act differently towards the same situation. For example, when buying a car people focus on different attributes. Some might focus on speed, while others want the car to be reliable and safe, this is because that car fulfils different goals (Florack, Keller &Palcu, 2013). Some scholars go even further, instead of just focusing on the goal, they focus on the strategies, that people adopt to achieve a goal. The *Regulatory Focus Theory (RFT)* (Higgins, 1997; Molden, Lee & Higgins, 2008) proposes two ways of approaching or avoiding a desired or undesired end-state.

Imagine two students who are going to have a test on mathematics. For both the goal is to get a good grade. Student A is very eager to improve his reputation by approaching a good result, while student B acts vigilant as he/she doesn't want to lose his/her reputation (Sassenrath, Sassenberg& Scheepers, 2016). RFT would depict student A as someone who acts rather eager and therefore adapts a promotion strategy, while student B is vigilant and adapts a prevention strategy (Higgins, 1997).

Those two strategies can be either chronic (Molden et al., 2008) or situationally induced (Florack et al., 2013). However, although there has been numerous of theoretical research on the RFT, measuring the individual regulatory focus has been difficult as according to Summerville & Rose (2008) most of those measurements rely on self-report measures and moreover lack theoretical consistency. We therefore want to fill that gap, by exploring a possible theoretically based objective measure for RFT.

Two steps are important while exploring possible measures of RFT: Naming the specific characteristics for both promotion and prevention strategies and analyzing the existing measurements of RFT. By combining those steps, we can gain insight, which characteristics could be useful for finding an objective method of measuring RFT. This paper is intended as a contribution of a better understanding of RFT and its measurement.

In terms of RFT a person that uses a promotion strategy (student A) is framed by a gain/non-gain situation and therefore has a sensitivity for the presence or absence of positive outcomes. Furthermore, for this person internal standards (hopes & aspirations) and growth needs, as advancement and development, are important (Higgins, 1997). Therefore, a person that adopts this strategy will act eager to approach a gain and avoid errors of omission (Crowe & Higgins, 2008). In practice this implies that a person will rather focus on speed than on accuracy, while solving a task (Molden et al, 2008).

In comparison, people that adapt a prevention strategy (student B) focus on non-loss/ loss situations. This characteristic makes people sensitive to the absence or presence of negative outcomes and creates an inclination to avoid mismatches to desired end-states. Moreover, regulation here happens according to external standards (duties & obligations) and security needs as safety and protection (Higgins, 1997). Thus, there is the tendency to act more vigilant and "narrowing in on what seems most certain" (Molden et al, 2008, p.177). According to Crowe & Higgins (2008) those people also try to avoid errors or commission and therefore tend to focus more on accuracy than on speed, while solving different tasks (Molden et al., 2008).

Moreover, both strategies seem to differ in other characteristics such as emotions during failure or success (Higgins, 1997) and their influence on quality of life. Results are mixed here, on one hand some consider the promotion strategy superior in terms of improving positive outcomes as healthiness and well-being (Manczak, Tapata-Gietl,& McAdams, 2014). On the other hand, Higgins (1997) describes those strategies as orthogonal instead of opposed to each other, while other results also indicated independent effects of both strategies on coping (Grant & Higgins, 2003). These mixed results might derive from the way that regulatory focus has been operationalized and measured before.

Thus, in our second step we want to look at existing measurements of RFT. In their study, Grant and Higgins (2003) use the Regulatory Focus Questionnaire (RFQ) by Higgins,

Friedman, Harlow, Idson, Ayduk,and Taylor (2001) to measure prevention and promotion. Here they ask for achievement orientations from subjective histories of success in either a promotion or a prevention condition. In addition to that, Summerville and Roese (2008) compare the RFQ to another self-report measure the General Regulatory Focus Measure (GRFM) by Jordan, Kunda,and Lockwood (2002). While the RFQ is based on the self-guide definition of RFT, which states that people either regulate themselves to internal (promotion strategy) or external standards (prevention strategy), the GRFM on the other hand is based on the reference-point definition of RFT. In this definition, the desired end state (gain or non-loss) is crucial for people, who therefore regulate themselves according to their desired goal. Summerville and Roesefound the two measures to be largely unrelated and suggested, that this might be due to them covering different constructs. This seems reasonable as different definitions of RFT are used here and thus both measures are problematic, when they try to measure an individual's regulatory focus (Summerville and Roese, 2008).

Therefore, in our exploration we need to investigate for a measure that on the one hand uses the characteristics of RFT and on the other hand avoids the typical problems of a self-report and self-report measures such as recall or social desirability bias (Lance and Vandenberg, 2009), while choosing a common and useful definition of RFT for our measure.

The paradigm

A more practical approach in measuring the regulatory focus derives from the research of Förster, Higgins, and Bianco (2003). By investigating performances in a speed-accuracy task (connecting consequently numbered dots with their mouse cursor). Here, by comparing individuals in a prevention and a promotion condition, results revealed a faster, but less accurate performance by individuals in the promotion condition, whereas individuals in the prevention condition performed more accurately, but slower as people in the promotion condition. This is in line with the characteristics of both strategies that were mentioned before (Molden et al., 2008) and is useful for our further investigation.

To apply this paradigm in a practical way and develop our own measure we use the reference-point definition that was also mentioned before. We do this, to know which reference point participants adopt while they are solving the respective task. So, in contrast to Förster et al. (2003), we add a reference point as a status quo and credits as a feedback mechanism that function as the status quo. Participants will be informed about the number of credits during the process and will be able to set themselves goals based on their number of credit points. Therefore, they can actively choose between distinct strategies to achieve their desired end-state and either use a promotion or prevention strategy (see Methods).

Both strategies of RFT are possible in this paradigm, on one hand a person who uses a gain/non-gain reference point can act eager to gain more points, while he/she takes the risk for losing a point for not acting accurate enough. On the other hand, a person with a non-loss/loss reference point can adopt an accurate strategy without focusing on the speed component at all to maintain his/her status quo.

To gain insight, whether this paradigm is a useful tool to measure the individual regulatory focus, we will induce a framing by using an essay task (Freitas & Higgins, 2002). By doing this, we will be able to analyze whether a participant uses a strategy in a matrix task according to that manipulation.

Research Question

To explore an objective measure for the RFT (Higgins, 1997), we apply the speed-accuracy paradigm that was used by Förster et al. (2003) before. Here, we use the reference-point definition of RFT (Summerville &Roese, 2008) and concentrate on the speed and accuracy characteristic of the distinct strategies of regulatory focus. We moreover use a different task than Förster et al. (2003) did. If this measure is valid, a person that was framed by the promotion condition should rather adopt a strategy that focuses on speed, while a person in the prevention condition should rather adopt an accurate strategy. Our research

question is, whether we can find and measure the typical answer pattern of the distinct regulatory focus strategies within our procedure.

Method

Participants

136 psychology students (108 women, 28 men, M_{Age}: 20.55 years, age range: 18-37 years) from Vienna participated in the study. All participants were recruited via LABS-System from Vienna University. For participating in this study, they earned credits for contemporary courses. An a priori analysis of power (Means: Difference between two independent means) using a power of 0.80, moderate effect size of 0.5 and alpha of 0.05 resulted in a required sample size of 128, or 64 participants for each condition (prevention vs. promotion) (Faul, Erdfelder, Lang, & Buchner, 2007).

Overall six participants were excluded from the analysis. Four participants did not answer the manipulation task in the first part of the study. Two participants were excluded, because of excessive response times. Exclusion criterion was selected, as response time was ±3 *SD* from each participant's mean for the respective run. The final sample size consisted of 130 participants with 58 participants in the promotion condition and 72 participants in the prevention condition.

Procedure and Material

The study was taking place in the Social Science Research Lab at the University of Vienna. Participants were placed in front of a computer that was connected to a keyboard and a mouse. Instructions were given in written form. In the beginning, participants had to consent to participating in the study before entering their demographic data. The study consisted of two parts. In the first part, participants' regulatory focus was manipulated, following the procedure by Freitas and Higgins (2002). Participants were assigned randomly to either a prevention or a promotion condition. They were instructed to write a short essay on how their hopes and aspirations (promotion condition), or duties and obligations (prevention condition)

have changed since they had been growing up. The second part consisted of the speed-accuracy paradigm.

In the speed-accuracy paradigm, participants were presented matrices that were composed of 64 digits (*zeros*, *ones*, and *twos*). Participants were instructed to determine the quantity of *ones* within a single matrix. Matrices were sized with eight rows by eight columns (Appendix A). Each matrix contained the digit *one* either eight, nine, or ten times. Participants had to press "M" on the keyboard, if the matrix contained the digit *one* exactly nine times. They had to press "C" on the keyboard, if the matrix contained the digit *one* more or less than nine times. All digits were arranged randomly within each matrix. Matrices were presented in a fixed order for every participant (Appendix B). The speed-accuracy paradigm consisted of two blocks; an adaptation block (20 trials) and a main block (16 trials).

The adaptation block started with the introduction of the task. Participants were instructed to process each matrix as fast and as accurate as possible. They were informed that, first, they would be presented with two runs of five matrices each with a feedback on their performance after each run. Second, they would be presented with a run of 10 matrices where they should show their best performance. Subsequently, they were informed that they would receive 20 credits for completing the 20 matrices. According to Ponds, Brouwer, and Van Wolffelaar (1988), the feedback was designed such that participants would adapt their performance to a level where they would act both, as fast and as accurate as possible. If five out of five matrices were answered correctly, participants were asked to act faster regardless of their actual response time. If less than five out of five matrices were answered correctly, participants were asked to act more accurately. Therefore, in the subsequent run with 10 matrices, participants were assumed to show their best performance in terms of speed and accuracy. This run (10 matrices) served the purpose of calculating an individual value for participants' average response time under best performance.

The main block started with the release of the 20 credits. Then, participants were introduced to the task. The procedure stayed the same as in the adaptation block, but, this time, participants could decide on their own, if they would like to act particularly fast or accurate. Depending on their performance in terms of speed and accuracy they could now earn or lose credits. The value for participants' average response time under best performance from the previous run served as an individual threshold. Participants were informed that they would receive one credit for acting faster than the threshold. If they acted slower than the threshold, they would receive no credit. Participants' individual threshold was displayed in the instruction as numeric value with two decimal places. Moreover, participants were informed that they would lose one credit for giving an incorrect answer. If they gave a correct answer, they would not lose any credits. Finally, participants were informed that the task would comprise 16 matrices and that they were going to receive feedback about their performance and their latest credit score after each matrix. In detail, the feedback comprised information whether participants acted faster or slower than the threshold, whether they answered correctly or incorrectly, and how much credits they had earned or lost overall for the respective matrix. If they acted faster than the threshold and answered correctly, the message "Fast and correct! +1" was displayed. If they acted faster than the threshold and answered incorrectly, the message "Fast and wrong! 0" was displayed. If they acted slower than the threshold and answered correctly, the message "Slow and correct! 0" was displayed. If they acted slower than the threshold and answered incorrectly, the message "Slow and wrong! -1" was displayed. Participants' credit score was displayed throughout the entire main block and was updated after each matrix. If the score was greater or equal to 20 credits, it was displayed in green. If the score was less than 20 credits, it was displayed in red. After the 16 matrices, the study ended, and participants received a debriefing.

Statistical Analysis

Based on participants' response behavior during the main block (16 trials), six measures were created for each participant in total: (a) the mean response time, (b) the number of responses that were faster than the respective individual threshold (fast responses), (c) the number of incorrect responses, (d) the final credit score, (e) a ratio between response time and number of incorrect responses (ratio 1) (see Appendix C), (f) a ratio between the number of responses faster than the threshold and the number of incorrect responses (ratio 2) (see Appendix D). Ratio 1 attains lower values with an increasing number of incorrect responses and a decreasing response time reflecting a faster and more inaccurate response behavior. The ratio attains higher values with a decreasing number of incorrect responses and an increasing response time reflecting a slower and more accurate response behavior. Ratio 2 attains lower values with an increasing number of incorrect responses and a decreasing number of fast responses reflecting a slower and more inaccurate response behavior. The ratio attains higher values with a decreasing number of incorrect responses and an increasing number of fast responses reflecting a faster and more accurate response behavior. As the requirement of normal distribution was only met for the mean response time, the remaining five variables were ln-transformed for further analyses.

In order to test whether condition (prevention vs. promotion) had an influence on any of the six measures, an independent-samples t-test was calculated for each measure with condition as grouping variable and the respective measure as dependent variable.

Förster et al. (2003) who also applied a speed-accuracy task found performances in terms of speed and accuracy to be not correlated. In this study, correlations were calculated between the accuracy measure (number of incorrect responses) and the two speed measures (mean response time and number of fast responses).

Results

Preliminary Analysis

Age and gender were ruled out as covariates. In a first step, the influence of gender on each measure was tested with six independent-samples t-tests. A significant influence of gender on three measures (final score, fast responses, and ratio 2) was found. Men (M = 31.92, SD = 2.97) had a higher final score than women (M = 30.28, SD = 3.62), $t(128) = 2.53$, $p = .013$. Men (M = 14.35, SD = 1.85) had more fast responses than women (M = 13.21, SD = 2.92), $t(128) = 2.12$, $p = .036$. Men (M = 6.84, SD = 5.04) had also higher values for ratio 2 than women (M = 4.81, SD = 3.35), $t(128) = -2.264$, $p = .025$, reflecting a faster and more accurate response behavior. In a second step, a chi²-test of independence was calculated with number of men and women in both conditions (prevention vs. promotion). No significant difference for the distribution of men and women was found, $\chi^2(1) = 0.070$, $p = .791$. Therefore, gender should have no significant influence on the main analysis. Next, correlations between age and the six measures were calculated. Age was significantly correlated with number of fast responses ($r = -.246$, $p = .005$). With increasing age number of fast responses decreases. Subsequently, an independent-samples t-test with condition (prevention vs. promotion) as grouping variable and age as dependent variable revealed no significant difference between the prevention (M = 20.36, SD = 2.29) and promotion (M = 20.67, SD = 2.96) condition in terms of age,$t(128) = -0.675$, $p = .501$. Therefore, age should have no significant influence on the main analysis.

Regulatory Focus Measures

For the mean response time, no significant difference between the prevention and promotion condition was found (see Table 1). Influence of condition on the number of fast responses, the number of incorrect responses, final credit score, and both ratios also revealed no significant results (also see Table 1). Overall analysis revealed no significant influence of condition (prevention vs. promotion) on any of the six measures.

A correlation between the mean response time and the number of incorrect responses was significant in the prevention condition (r = -.355, p = .002), but not in the promotion condition (r = -.102, p = .444). To test for an interaction effect, a stepwise multiple linear regression with number of incorrect responses as dependent variable was calculated. In the first block mean response time and condition were selected as predictors, revealing a significant regression equation (F(2,127) = 4.58, p = .009), with an R^2 of .071. Only mean response time was a significant predictor of number of incorrect responses, β = -.258, p = .003. In the second block an interaction term of mean response time and condition was included as predictor, revealing no significant interaction effect, β = .120, p = .168, with an ΔR^2 of .014.

The number of responses faster than the individual threshold and the number of incorrect responses were not correlated significantly in the prevention condition (r = -.137, p = .252) or the promotion condition (r = -.032, p = .814).

Additional Analysis

To rule out the possibility that the feedback in the adaptation block has interfered with the regulatory focus manipulation, the influence of condition (prevention vs. promotion) on participants' mean response time during the first run (5 matrices) was tested. Here, participants were asked to act as fast and as accurately as possible without any preceding emphasis on speed or accuracy. As Förster et al. (2003) had found a difference in response times, while also asking participants to act as fast and as accurately as possible, there should be a difference in the first run of the current study, too. However, no significant difference between the prevention (M = 7.22 s) and promotion (M = 6.66 s) condition was found, t(127) = 0.129, p = .196.

General Discussion

The study aimed to provide an accurate measure of successful manipulation of promotion or prevention condition.

According to Higgins (1997) it is important to understand underlying motivation and self-regulation to reach a desired end-state. On the one hand promotion focus relates to needs, strong ideals and gain/non-gain situations. On the other hand prevention focus relates to security needs, strong oughts and non-loss/loss situations. Furthermore, strategic tendencies insure certain outcomes or insure against certain other as *„promotion focus should be to insure hits and insure against errors of omission, whereas in a prevention focus, they should be to insure correct rejections and insure against errors of commission"*(Higgins, 1997, p. 1285).

These foci can be chronical or induced by specific situations, depending of its activation of promotion concerns or prevention concerns (Molden et al., 2008). This study in accordance with Higgins'RFT (Higgins, 1997) aims to demonstrate that a person's motivation to show approach or avoidance behavior depends on different concerns within promotion focus settings as well as prevention focus settings.

In this particular study, based on Förster et al. (2003), a speed-accuracy task was used to measure the regulatory foci. In contrast to Förster et. al (2003), matrices were used for testing (as opposed to joining points). Therefore, the participants had to specify whether exactly nine times *one* occured in the matrix or not. As a reference point, all subjects received 20 points before starting the main trial. In order to manipulate promotion or prevention focus, the subjects had to write a few words about their hopes and aspirations (promotion) or duties and obligations (prevention) at the beginning of the study. On the one hand, as shown in the study of Förster et al. (2003), it was expected that the participants in the promotion condition work faster than in the prevention condition. On the other hand it was expected that the participants work more accurately in the prevention condition than in the promotion condition.

The core result of the study shows no significant relationships in both conditions. This applies to the average response time between the two conditions promotion and prevention

focus, as well as the influence of the respective condition on fast responses, incorrect responses, final score and both ratios.

Based on the present result, two explanatory approaches are suggested. On the one hand, it is possible that the priming in the promotion or prevention condition was too weak.

This can be caused by two possible reasons. Maybe 4-5 sentences to manipulate the promotion or prevention focus are too weak to achieve the desired effect. Furthermore, it may be possible that the priming was scheduled too soon (at the beginning of the study). Since there were twenty test matrices between priming and main trial, it is possible that the priming effect has disappeared through completing the test trials. The second explanation might lie in the matrices themselves. In this study, participants were presented with matrices with a total of 64 digits. Maybe this number of digits is too few/ too easy, so that the respective primed focus could not be influenced.

The above assumptions to explain the result also indicate an important limitation of this study. Namely the missing pretests, which could possibly have shed light on the points mentioned. Unfortunately, these pretests were not possible due to lack of time. This criticism should also be the impetus for future studies in order to take a closer look at this topic.

However, the study of regulatory focus and its manipulation is not only important and interesting in different fields of psychology. In various areas of psychology topics are examined taking into account Higgins' RFT (1997), which have immediate practical benefits for everyday and professional life.

For example, Crowe & Higgins (1997) investigated how promotion and prevention conditions affect decision-making. Furthermore, a study by Jordan, Kunda,and Lockwood (2002), which has studied the influence of positive and negative role models.

Based on these studies and the knowledge that situation-specific priming can be used independently of the chronic regulatory focus (Molden et al., 2008), there are practical applications for health and economics, as well as many more.

In business, the use of promotion and prevention settings can have a positive effect on success in achieving goals. Thus, it is also an essential topic for management development and how executives interact with their employees.

In the health sector, knowing about the RFT's mechanisms (Higgins, 1997) can help to increase the desired effect in awareness campaigns (HIV / fitness) using appropriate role models and slogans.

For example, a prevention model to encourage adolescents to practice protected sexual intercourse or a promotion model that encourages more exercise. By increasing the importance of the appropriate regulatory goal, one should be able to maximize the respective motivating effects.

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Appendix

2	1	0	2	1	0	2	2
2	2	0	0	0	0	0	1
0	2	1	2	2	0	1	0
0	0	2	0	1	1	0	0
2	0	2	0	2	0	2	0
0	0	0	2	0	2	0	2
1	0	0	0	2	0	2	0
2	2	0	1	0	0	2	2

Appendix A. Matrix with nine *ones*. All digits are arranged randomly.

Adaptation block		
	First run	9, 8, 10, 9, 10
	Second run	9, 10, 9, 8, 9
	Third run	8, 9, 10, 9, 10, 9, 8, 9, 9, 8
Main block		
	Fourth run	10, 9, 8, 8, 9, 10, 9, 9, 8, 9, 10, 10, 9, 9, 8, 9

Appendix B. Order of matrices for each run. Number of *ones* within a matrix is displayed as numerical value. Order of matrices was selected randomly within each run.

$$Ratio\ 1 = \frac{Mean\ response\ time}{1 + \ Number\ of\ incorrect\ responses}$$

Appendix C. The value one was added to the number of incorrect responses, so the denominator does not yield zero.

$$Ratio\ 2 = \frac{1 + Number\ of\ responses\ faster\ than\ the\ individual\ threshold}{1 + \ Number\ of\ incorrect\ responses}$$

Appendix D. The value one was added to the number of responses faster than the individual threshold and the number of incorrect responses, so numerator and denominator do not yield zero.

Figures and Tables

Table 1

Group comparison (prevention vs. promotion) for six regulatory focus measures

	Condition			
	Promotion	Prevention		
Measures	*M* (*SD*)	*M* (*SD*)	*t* (128)[a]	*p*
Mean response time	4.96 (1.23)	4.99 (1.43)	0.120	.905
Number of incorrect responses	2.64 (1.83)	3.00 (2.05)	0.735	.464
Number of fast responses	13.57 (2.44)	13.33 (3.02)	0.147	.884
Final score	30.95 (3.11)	30.33 (3.87)	0.624	.534
Ratio 1	1.78 (1.06)	1.83 (1.51)	-0.334	.739
Ratio 2	5.30 (3.49)	5.15 (4.09)	-0.768	.444

Note. N = 130. Measures were calculated based on participants' response behavior during the main block (16 trials).

[a] Test statistics and p-values are displayed for calculations with ln-transformed variables for five measures (Number of incorrect responses, Number of fast responses, Final score, Ratio 1, Ratio 2).