Why Do We Enjoy Creative Tasks? Results from a Multigroup Randomized Controlled Study

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Abstract

Previous studies have linked positive emotions with creativity, but it remains unknown why creative activities may enhance positive emotions. We tested how creative tasks influence autonomous self-expression and task absorption, and whether this in turn increases positive emotions. Data from 478 participants were divided into four language samples (English, German, Italian, and Polish) and analyzed in a series of multigroup structural equation models. The indirect effects were replicated in all samples. Creative tasks enhanced positive emotions through an increase in autonomy. However, participants who solved creative tasks also reported lower task absorption, and this has hindered their experience of positive emotions. In total, a small increase of positive emotions was recorded for creative tasks in comparison to non-creative ones. We suggest that creative activities may support autonomous functioning and enhance positive emotions, given that participants will stay sufficiently focused on the task.

Keywords: creativity, autonomy, positive emotions, divergent thinking, task absorption

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1 Introduction

The power of positive emotions to unleash creativity has been repeatedly verified. Two meta-analyses confirmed that positive mood enhances creativity (Baas, De Dreu, & Nijstad, 2008; Davis, 2009). Interestingly, creative activities may further improve emotional well-being, forming a gain spiral (Amabile, Barsade, Mueller, & Staw, 2005; Bar, 2009; Richards, 2010). Even though an increase in positive emotions during creative activities has been previously hypothesized, circumstances when it occurs remain unknown. Thus, an investigation into whether and why creative tasks might enhance positive emotions forms the main theoretical contribution of this study. We argue that tasks requiring creativity may support autonomous self-expression, and this in turn enhances positive emotions. Our empirical strategy is based on randomized control trial methodology applied in multiple group setting. We investigate how creative tasks - in comparison to non-creative ones and across four diverse samples - influence feelings of autonomy, task absorption, and positive emotions. Such complex and robust empirical test gives our findings a chance to significantly contribute to the body of evidence connecting creativity with positive emotions.

1.1 Creativity and Positive Emotions

Creative activities have been widely used as a tool to improve mood. Clinicians have employed creative tasks during occupational therapies (Leckey, 2011), and mental health rehabilitation (Van Lith, Schofield, & Fenner, 2013). Creative activities were shown to alleviate depressive symptoms amongst cancer patients (Bar-Sela, Atid, Danos, Gabay, & Epelbaum, 2007), mental health patients (Caddy, Crawford, & Page, 2012), and prison inmates (Gussak, 2006). In an experimental setting, unstructured writing or drawing improved the mood of participants who previously viewed a disturbing video (De Petrillo & Winner, 2005; Drake, Coleman, & Winner, 2011). Similar effects occurred in non-clinical samples (Bell & Robbins 2007; Drake, Searight, & Olson-Pupek, 2014). These findings suggest that creativity can reduce negative mood, but further changes from neutral to positive emotional state still await verification (Forgeard & Eichner, 2014).

Creativity is often considered a desirable feature due to its relationship with positive personality traits such as openness, curiosity, humor and flexibility (e.g., Cropley, 1990). Hence, creativity is listed as one of the character strengths (Peterson & Seligman, 2004). Previous findings suggest that strength-based interventions effectively increase positive emotions and life satisfaction (Proyer, Ruch, & Buschor, 2013). Using strengths in a novel and original way led to an increase in happiness in six months following the intervention (Seligman, Steen, Park, & Peterson, 2005). However, these studies investigated the role of several different character strengths, thus an isolated impact of creativity on emotional well-being remains unknown.

Only recently have researchers started to examine specific effects of creative activity on positive emotions. Silvia and colleagues (2014) have found that doing something creative at a given moment correlates with feeling happy and energetic at that moment. Moneta (2012) has shown that having an opportunity to be creative at work triggers positive emotions. However, experimental studies on this topic brought unclear results: solving a divergent thinking task led to enhanced positive mood in one experiment (Akbari Chermahini & Hommel, 2012), but in the other study a creative task hindered positive emotions (Cseh, Phillips, & Pearson, 2014). Further research is needed to clarify these contradictory results. We aim at experimentally test whether an involvement in creative activities improves the level of experienced positive emotions.

Hypothesis 1: Creative tasks would enhance positive emotions.

1.2 Creativity and Autonomy

Autonomy refers to an experience of ownership and volition of one's behavior (Ryan & Deci, 2006). Such sense of volition can be achieved for example by having an opportunity to make independent choices and express personal opinions (Van den Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010). Offering choices supports autonomous expression of behavior, and is defined as one of the conditions for autonomy (Su & Reeve, 2011). Thus, a task instruction that encourages self-expression may enhance participants' autonomous motivation (e.g., Shalley & Perry-Smith, 2001). Creative activities may also promote autonomous self-expression due to their focus on originality and novelty. Creative tasks usually read as follows: compose a drawing of your own choice (Fink, Benedek, Grabner, Staudt, & Neubauer, 2007), write down your most interesting thoughts (Conti, Amabile, & Pollak, 1995), note your own original ideas (Bechtoldt, Choi, & Nijstad, 2012), and express your own opinions (Griskevicius, Cialdini, & Kenrick,

2006). Thus, autonomy may increase during creative activities as they encourage autonomous self-expression.

Furthermore, both theory and empirical evidence justify the existence of a link between autonomy and positive emotions. Proponents of the self-determination theory classify autonomy as one of the basic psychological needs (together with relatedness and competence; Deci & Ryan, 2000). They argue that the fulfillment of basic needs supports well-being, and mediates the effects of situational factors on well-being (Deci & Ryan, 2011; Sheldon & Gunz, 2009). Experiencing high levels of autonomy has been linked to positive emotions, including classroom engagement (Cheon, Reeve, & Moon, 2012), interest and enjoyment (Benita, Roth, & Deci, 2014), and psychological well-being across different cultures (Chen et al., 2014). We aim at testing whether creative tasks promote autonomy, and thus indirectly enhance positive emotions.

Hypothesis 2: Creative tasks would indirectly enhance positive emotions through an increase in autonomy.

1.3 Creativity and Task Absorption

Creative tasks are loosely formulated and can be solved in many different ways. No ultimate test exists for an assessment of validity or quality of their solutions (Coyne, 2005). Open formulation of the problem may present an exciting opportunity, but it also makes the results of a creative activity hard to predict. Such lack of a clear objective may decrease task absorption (e.g., Locke & Latham, 2002). Besides, performance in divergent thinking tasks requires effortful control, an executive cognitive function that helps staying focused on the task (Lin, Hsu, Chen, & Chang, 2013). Thus, it might be more difficult to resist distraction during a creative task in comparison to a non-creative, well-defined task.

Moreover, the creative process is characterized by a broad attention span (Kasof, 1997). Narrowing the field of attention has null or even negative effect on creativity (Baas, Nevicka, & Ten Velden, 2014; Colzato, Szapora, Lippelt, & Hommel, 2014), while allowing the mind to wander facilitates creative problem solving (Baird et al., 2012). Creative thinkers easily notice peripheral cues and connect previously unrelated ideas (Ansburg & Hill, 2003), possibly due to their impaired ability to suppress irrelevant cognitive activity (Takeuchi et al., 2011). Thus, a lower level of task absorption can be expected when solving a creative task due to both task

characteristics (open formulation without a clear objective) and creative process characteristics (broad attention span).

At the same time, task absorption - staying fully focused on a task - facilitates the experience of positive emotions (e.g., feelings of flow, Csikszentmihalyi, 1990; work engagement, Bakker, Schaufeli, Leiter, & Taris, 2008). Activating positive emotions, such as engagement, relate strongly to being fully concentrated on one's work (e.g., Schaufeli, Salanova Bakker, & Gonzalez-Roma, 2002). Moreover, practicing meditation that requires focused attention can increase positive affect (Colzato, Ozturk, & Hommel, 2012; Jain et al., 2007). Thus, we aim at testing whether creative tasks, in comparison to uncreative ones, may indirectly decrease positive emotions due to reduced task absorption.

Hypothesis 3: Creative tasks would indirectly decrease positive emotions through a decrease in task absorption.

2 Method

2.1 Participants

The study was conducted in Austria, Italy, Ireland, Poland, and in the UK. Ethical approvals were granted from local ethical committees in each of the countries. Adult participants were recruited via personal, social and university networks. All provided informed consent to complete the study in their free time.

A sample of 731 individuals participated in the online study across all countries. However, data from 253 participants (35%) were excluded from the analyses due to the following: 232 participants (32%) withdrew before the end of the study (30% registered for the study but withdrew prior to the task assignment, 2% withdrew without answering the post-task questions), and 21 participants spent less than twenty seconds or more than twenty minutes on a task (0.03%). The last exclusion criterion was based on the assumption that those who spent too little time on a task may have put insufficient effort in solving it, while those who spent too much time on a task may have been distracted by other activities. In total, data from 478 participants were analyzed (70% women; age range 18-65; for detailed demographic information see Table 1).

Participants in the experimental group withdrew from the study more often, resulting in the control group being slightly larger ($\Delta N=14$). Mean age and gender distributions were similar in both conditions. Missing data occurred in 1.05% of cases and 0.10% of values.

Table 1

Characteristics of the Sample

	English (*N* = 159)		Italian (*N* = 106)		Polish (*N* = 123)		German (*N* = 90)		Total (*N* = 478)	
Age *(SD)*	28.3	*(9.8)*	24.0	*(2.9)*	26.1	*(6.3)*	34.3	*(13.7)*	27.90	*(9.5)*
Education *(SD)* [a]	16.3	*(3.2)*	15.9	*(1.9)*	16.2	*(2.9)*	14.3	*(3.6)*	15.8	*(3.1)*
Women (%)	132	(83.0)	55	(51.9)	88	(71.5)	61	(67.8)	336	(70.3)
Nationality (%)										
Irish	37	(23.3)	-	-	-	-	-	-	37	(7.7)
English	52	(32.7)	-	-	-	-	-	-	52	(10.9)
Italian	-	-	105	(99.1)	-	-	-	-	105	(22.0)
Polish	-	-	-	-	123	(100)	-	-	123	(25.7)
Austrian	-	-	-	-	-	-	62	(68.9)	62	(13.0)
German	-	-	-	-	-	-	26	(28.9)	26	(5.4)
Other	70	(44.0)	1	(0.9)	-	-	2	(2.2)	73	(15.1)
Study area (%)										
Art & Humanities	26	(16.4)	26	(24.5)	16	(13.0)	5	(5.6)	73	(15.3)
Social Sciences	69	(43.4)	27	(25.5)	45	(36.6)	35	(38.9)	176	(36.8)
Business, Law	11	(6.9)	23	(21.7)	6	(4.9)	8	(8.9)	48	(10.0)
Engineering	34	(21.4)	17	(16.0)	50	(40.7)	2	(2.2)	103	(21.5)
Health	12	(7.5)	9	(8.5)	4	(3.3)	3	(3.3)	28	(5.9)
Not specified	7	(4.4)	4	(3.8)	2	(1.6)	37	(41.1)	50	(10.5)
Main activity (%)										
Paid work	42	(26.4)	18	(17.0)	32	(26.0)	43	(47.8)	135	(28.2)
Education	106	(66.7)	76	(71.7)	78	(63.4)	29	(32.2)	289	(60.5)
Other	11	(6.9)	12	(11.3)	13	(10.6)	18	(20.0)	54	(11.3)
Condition (%)										
Experimental	75	(47.2)	53	(50.0)	62	(50.4)	42	(46.7)	232	(48.5)
Control	84	(52.8)	53	(50.0)	61	(49.6)	48	(53.3)	246	(51.5)

Note. [a] Years of education starting from the first year of primary school. SD = standard deviation.

2.2 Procedure

The study was conducted online and accessed via an anonymous link. Participants were informed that the topic under investigation was problem solving, and no links to creativity were given. The

159 survey platform automatically and randomly assigned participants to solve a creative task
160 (experimental) or a non-creative task (control). Within these groups participants were asked to
161 choose a specific task based on short descriptions. Thus, participants could choose the task which
162 best matched their preferred level of difficulty. Participants had unlimited time to solve the task
163 (on average it took less than 5 minutes, see Table 2). Immediately after completion, participants'
164 positive emotions, autonomy, and absorption were measured in reference to the task that they
165 solved (i.e. "How did you feel while solving this task?"). Finally, participants reported the extent
166 to which they experienced the task as creative, difficult, or dull (on a 7-point response scale
167 where 1 = "not at all", 4 = "moderately", and 7 = "very much").

168 2.3 Experimental Tasks

169 Participants in the experimental group solved one of the three creative tasks: 1) invent titles for a
170 cartoon (Sternberg, 2006), 2) list different uses for a rubber band (Guilford, 1967), or 3) improve
171 the design of a table for individuals with impaired vision (inspired by Torrance's product
172 improvement task; Kim, 2006). The tasks were based on creativity tests, and therefore calibrated
173 to trigger divergent thinking. Such tasks have many different solutions (triggering fluency),
174 encourage switching between semantic categories (triggering flexibility), and enable individuals
175 to approach a problem in a novel way (triggering originality).
176 In the control condition participants were given a choice between three non-creative tasks: 1)
177 find the differences between two cartoons, 2) answer questions about a presented book excerpt
178 (Sacks, 2008), or 3) write instructions on how to assemble a table based on given illustrations.
179 The non-creative tasks were tailored so that the effort they required was similar to those of the
180 creative tasks.

181 2.4 Manipulation Check

182 Prior to the experiment, we conducted a validation study (Bujacz et al., 2014). Competent judges
183 (psychology and social sciences students or graduates; five in each language group) were trained
184 to rate tasks on the creativity criteria: fluency, flexibility and originality. The results revealed that
185 the creative tasks had significantly higher potential to trigger divergent thinking than the non-
186 creative tasks.

These results were confirmed in the current study. Participants across all language groups considered the tasks to be more creative in the experimental condition (F[1,475] = 100.06, $p < .001$, $\eta^2 = .18$), and not particularly dull in either of the conditions (F[1,475] = 0.03, $p = .86$).

2.5 Analytical Strategy

Multiple samples were analyzed separately, and were systematically compared to empirically test for the robustness of the results, following the assumptions of multivariate meta-analysis (Jackson, Riley, & White, 2011). Data were analyzed in a series of multi-group structural equation models (SEM). To test the plausibility of an indirect effect of creative tasks on positive emotions through autonomy and absorption, models with both direct and indirect paths were compared. Indirect effects were further tested using bootstrapping with 5,000 samples (e.g. Preacher & Hayes, 2008). Significant indirect effects are indicated by confidence intervals that do not include zero. Due to small numbers of indicators, an alternative definition and measurement of psychometric properties, appropriate for structural equation modelling, were applied (Bollen, 1989). Reliability could be defined as the magnitude of direct relations that a latent variable have with an item, and thus reliability coefficient would reflect the squared correlation between the item and the factor. Validity could be defined as the magnitude of direct structural relations between the factor and the item, and thus validity coefficient would reflect the standardized factor loadings.

All analyses were performed with Mplus 7.2 (Muthén & Muthén, 1998-2012), using the robust full information maximum likelihood estimation (MLR). For the evaluation of a model the following fit indices were used with the respective cut-off values: CFI, above .90 acceptable fit, above .95 good fit; RMSEA, below .08 acceptable fit, below .05 good fit; and SRMR, below .10 good fit (Kline, 2005; Williams, Vandenberg, & Edwards, 2009). Chi-square differences test was employed to compare models using the adjusted Satorra-Bentler scaled chi-square statistic (Muthén & Muthén, 1998-2012).

2.5.1 Multigroup Analyses

The invariance of the measurement model across language groups had to be tested first to secure a meaningful comparison of factor covariances. When a measurement tool is used across groups, its internal structure should follow at least two requirements: 1) the same number of factors

should be found in all groups, i.e. configural invariance, and 2) the similar pattern of factor loadings should be observed across groups, i.e. metric invariance (e.g., Brown, 2006). Those requirements are met when a model that imposes them fits the data well, allowing the structural parameters across groups to be legitimately examined and compared (e.g., Meredith & Teresi, 2006; Raykov, Marcoulides, & Li, 2012).

2.6 Measures

All items used in the study were translated from the English versions. We employed unified 7-point response format where 1 = "not at all", 4 = "moderately", and 7 = "very much". See Table 2 for the correlations between all the variables used in the analyses.

Table 2

Descriptive Statistics and Correlations among the Study Variables

English above German below	1	2	3	4	5	6	7	8	9	10	*M English*	*SD English*
1. Interested		**.73**	**.49**	**.23**	**.16**	**.35**	**.32**	-.11	.07	**.24**	*4.55*	*1.48*
2. Engaged	**.67**		**.39**	**.28**	.15	**.36**	**.43**	**-.26**	-.04	**.32**	*4.89*	*1.45*
3. Happy	**.61**	**.56**		**.24**	**.16**	**.35**	**.31**	-.03	.01	**.23**	*3.98*	*1.86*
4. Decide	**.37**	**.40**	**.40**		**.52**	**.23**	**.27**	.14	.05	.05	*5.44*	*1.55*
5. Express	.13	.19	**.35**	**.60**		**.16**	**.17**	**.41**	.12	-.06	*4.90*	*1.95*
6. Focused	.05	.18	.16	-.03	.00		**.73**	**-.16**	.07	**.19**	*2.80*	*1.77*
7. Absorbed	**.21**	**.25**	**.24**	.14	.18	**.54**		**-.23**	.00	**.24**	*3.28*	*1.85*
8. Task	-.15	-.20	.01	.12	**.24**	-.15	**-.30**		**.29**	**-.36**	-	-
9. Difficulty	-.07	-.10	-.07	-.11	-.03	.21	.10	-.03		.05	*2.42*	*1.64*
10. Time in minutes	.32	**.25**	.13	.03	-.10	.04	.18	**-.40**	.04		*3.99*	*3.30*
M German	*4.82*	*4.89*	*3.86*	*5.42*	*4.82*	*2.46*	*2.98*	-	*2.33*	*4.51*		
SD German	*1.69*	*1.65*	*1.67*	*1.66*	*1.87*	*1.68*	*1.88*	-	*1.47*	*3.85*		
Italian above Polish below	1	2	3	4	5	6	7	8	9	10	*M Italian*	*SD Italian*
1. Interested		**.61**	**.51**	**.26**	**.31**	**.26**	**.37**	.04	.02	.10	*4.53*	*1.58*
2. Engaged	**.88**		**.41**	.08	.16	**.29**	**.34**	**-.24**	.18	**.33**	*4.63*	*1.37*
3. Happy	**.59**	**.55**		**.23**	**.28**	.11	.16	-.05	-.06	-.02	*3.31*	*1.42*

4. Decide	**.61**	**.54**	**.53**		**.69**	.06	.19	**.35**	-.02	-.13	*4.84*	*1.71*
5. Express	**.44**	**.37**	**.46**	**.61**		.06	.10	**.40**	-.01	**-.24**	*4.81*	*1.91*
6. Focused	**.47**	**.49**	**.28**	**.28**	**.22**		**.57**	-.13	.05	.06	*2.56*	*1.55*
7. Absorbed	**.57**	**.58**	**.34**	**.29**	.15	**.76**		-.11	-.05	.16	*3.06*	*1.68*
8. Task	.15	.06	**.27**	**.31**	**.59**	-.07	-.10		-.01	**-.51**	-	-
9. Difficulty	.04	.02	.04	-.05	-.01	.01	.03	.06		**.26**	*2.41*	*1.35*
10. Time in minutes	.08	.07	.08	-.05	-.15	.14	**.19**	**-.24**	**.25**		*4.51*	*3.76*
M Polish	*4.99*	*5.18*	*3.72*	*4.76*	*4.93*	*2.49*	*3.40*	-	*2.46*	*4.77*		
SD Polish	*1.50*	*1.52*	*1.57*	*1.93*	*2.09*	*1.91*	*2.06*	-	*1.49*	*3.81*		

Note. Task is coded 0 (non-creative) and 1 (creative). Significant coefficients marked in bold, $p < .05$.

2.6.1 Positive Emotions

Three items measured positive emotions ("To what extent during the task have you felt: interested", "happy", and "engaged"). The items were based on the Basic Emotions State Test (BEST, Vittersø, Oelmann, & Wang, 2009), and the scale yielded high internal consistency (average across language groups $\alpha = .81$). Average estimated item reliability coefficient amounted .61 and average standardized validity coefficient reached .77 across items and language groups.

2.6.2 Autonomy

Two items measured autonomy ("I felt free to decide for myself.", "I was free to express my ideas and opinions."). The items were based on scales measuring the satisfaction of basic need for autonomy within the self-determination theory framework (Longo, Gunz, Curtis, & Farsides, 2014; Van den Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010), and were moderately correlated (average across language groups $r = .60$). Average estimated item reliability coefficient amounted .62 and average standardized validity coefficient reached .78 across items and language groups.

2.6.3 Task Absorption

Two items measured task absorption ("I was so focused that I forgot where I was.", "I was so absorbed that I forgot about everything else."). The items were based on scales measuring the experience of flow (Martin & Jackson, 2008), and were moderately correlated (average across language groups r = .65). Average estimated item reliability coefficient amounted .65 and average standardized validity coefficient reached .80 across items and language groups.

2.6.4 Control Variables

Two task-related control variables were accounted for in the final analysis: difficulty of the task, and time spent on solving the task. Difficulty of the task was subjectively reported; participants assessed to what extent they considered the task to be difficult. Time spent on the task was measured automatically, and without participants' knowledge, by calculating for how long task instructions were displayed in the browser. In general across groups, creative tasks were experienced as slightly more difficult (F[1,475] = 4.24, p = .04, η^2 =.01), yet participants spent less time solving them (F[1,475] = 81.98, p < .001, η^2 =.15).

2.6.5 Baseline Pretest

Due to the randomization procedure, the comparison groups should be characterized by the same baseline distribution of the dependent variables. To test this assumption, an average daily level of these variables was estimated using the Day Reconstruction Method (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). In reference to the episodes from the preceding day, participants reported their perceived autonomy, task absorption and positive emotions during each of the activities. The multivariate ANOVA analysis found no differences in baseline measurement between experimental and control groups (for positive emotions F[1,475] = .30, p = .59; for autonomy F[1,475] = .31, p = .58; for task absorption F[1,475] = .08, p = .78). Therefore, pre-existing individual differences were omitted in the analyses.

3 Results

3.1 Measurement Model

The confirmatory factor analysis model was specified with three correlated factors (autonomy, task absorption, and positive emotions). The three-factor structure fitted the data well across all language groups (RMSEA=.06, CFI=.98, SRMR=.04), securing the configural invariance (see Model 1 in Table 3). The metric model fitted the data as good as the configural model ($\Delta\chi^2$ [12] = 14.55, p = .27), suggesting the invariance of factor loadings (see Model 1a in Table 3). Further analyses were based on the established metric invariance of the measurement model (i.e. factor loadings were always fixed to be equal across language groups).

Table 3

Multigroup Model Fit and Model Fit Comparison

	χ^2	df	RMSEA	CFI	SRMR	$\Delta\chi^2$ adj	Δdf	Δ*p*
Measurement model [a]								
1. Configural	60.75	44	0.056	0.984	0.041	-	-	-
1a. Metric invariant across groups	75.48	56	0.054	0.981	0.055	14.55	12	0.267
Structural model								
2. Partial mediation	170.83	104	0.073	0.949	0.060	-	-	-
2a. Partial mediation invariant	191.69	119	0.071	0.944	0.078	21.15	15	0.132
3. Full mediation	180.41	108	0.075	0.945	0.060	9.21	4	0.056
3a. Full mediation invariant	198.57	120	0.074	0.940	0.080	18.26	12	0.108

Note. [a] Solution with three correlated factors: positive affect, absorption and autonomy.

3.2 Structural Model

The indirect model was specified as follows: the task (creative or non-creative) predicted the extent to which participants felt autonomous and absorbed by the task. Both autonomy and task absorption predicted the variability of positive emotions (see Figure 1). The task effects on autonomy, absorption and positive emotions were adjusted for control variables (time spent of the task and self-reported difficulty of the task).

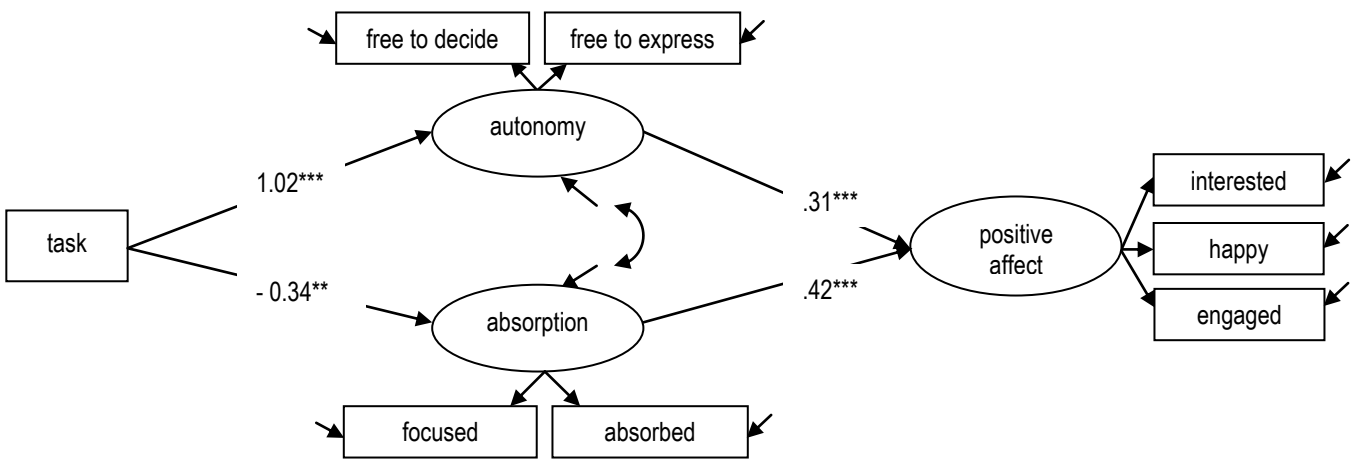
The analyses started with a partial mediational model where both direct and indirect paths were free to vary across groups (see Model 2 in Table 3). Revealing that direct paths were insignificant in all groups, we proceeded to test a full mediational model (see Model 3 in Table

3). The fit indices did not detect a significant worsening of this more parsimonious model ($\Delta\chi^2$ [4] = 9.21, p = .06), suggesting that the indirect paths can fully account for the effects of the task on positive emotions.

Finally, the structural paths were shown to be invariant across all language groups for both partial mediation model (see Model 2a in Table 3) and full mediation model (see Model 3a in Table 3). In the creative condition, autonomy was significantly higher, and task absorption was significantly lower across all language groups (see Figure 1). Creativity of the task was a more important predictor of autonomy (across groups average R^2 = .20) than it was of task absorption (across groups average R^2 = .08). Positive emotions increased for participants who felt autonomous and absorbed during the task. Higher perceived difficulty of the task reduced positive emotions, and longer time spent on the task enhanced them. Invariance of the effects of control variables was not tested; they were allowed to vary across language groups. In general, the model explained from one third to half of the variability of positive emotions (see Table 4).

Figure 1

The Final Model of Indirect Effects of Creative Tasks on Positive Emotions



Note. Task is coded 0 (non-creative) and 1 (creative). Structural paths constrained to equality across groups. Figure presents standardized estimates of the English language group. * p< .05; ** p< .01; *** p < .001

3.2.1 Indirect Effects

Following the constraints placed on the adjacent paths, indirect effects were also invariant across all language groups (see Table 4). Solving the creative task led to a higher level of positive emotions through an increase in autonomy. However, during creative tasks absorption was lowered, which further decreased positive emotions. The opposite indirect effects of autonomy and task absorption summed up into a total small increase of positive emotions after solving the creative task.

Table 4

Indirect Effects of Creative Tasks on Positive Affect in Standardized Coefficients

	Indirect via Autonomy		Indirect via Absorption		**Total**		
	β	95% CI	*β*	95% CI	*β*	95% CI	R^2
English	.32	.20; .44	-.14	-.25; -.04	.18	.00; .35	.43
Italian	.36	.21; .50	-.16	-.28; -.04	.20	.01; .39	.40
Polish	.32	.20; .44	-.14	-.25; -.04	.18	.01; .35	.50
German	.29	.17; .41	-.13	-.23; -.03	.16	.00; .32	.36

Note. Task is coded 0 (non-creative) and 1 (creative). CI = confidence interval. Structural paths constrained to equality across groups.

4 Discussion

This study tested whether and why creative tasks may bring more positive emotions than non-creative ones. As expected, open-ended and imaginative tasks promoted autonomous self-expression and enhanced positive emotions. This effect was limited by the fact that participants spent less time solving the creative task, and thus decreased task absorption have limited their emotional experience. In total, creative tasks brought more positive emotions than non-creative ones, yet the effect was weak.

In general, participants reacted positively to a freedom of self-expression that creative task provided, and their emotional well-being improved. Creative activities may support autonomous expression of behavior as they offer choices, have non-controlling language of instructions, and are often pursued as means of personal growth (Su & Reeve, 2011). Acting creatively enables perspective taking (Grant & Berry, 2011), provides a growth-based rationale for an activity

(Ohly & Fritz, 2009), and serves as a socially accepted form of expressing frustration (Kim, Zeppenfeld, & Cohen, 2013). In a previous study, participants who solved a creative task reported an increased spontaneous interest in the subsequent activity (Conti, Amabile, & Pollak, 1995). Hence, we suggest that creative activity may support autonomous functioning and increase emotional well-being, given that participants stay sufficiently focused on a task.

4.1 Generalizability of the Results

The findings of this study are based on complex and robust methodology, combining the randomized control trials with multigroup analyses. Such strategy allows for simultaneous comparisons of effects across four samples, which is the main empirical contribution of this study. We replicated the results across four language samples, showing their relative robustness. A multigroup analysis offers three important advantages over traditional methods (e.g., ANOVA). First, it accounts for possible biases in measurement across groups, a crucial benefit for cross-cultural studies (Davidov, Schmidt, & Billiet, 2011). Second, it estimates several effects in one analysis, thus controlling for the within-study correlations that occur when multiple effects are calculated for the same participants (Jackson, Riley, & White, 2011). Third, obtaining similar results from several samples strengthens the conclusions and secures their international generalizability. Meta-analytic and cross-cultural studies – like the present one – complement and extend single-sample study designs (Anderson, De Dreu, & Nijstad, 2004).

Furthermore, a quality of our randomized controlled study results depended greatly on the appropriateness of the control condition. We aimed at designing control tasks that differed from the experimental tasks only by the lack of support for the creative process. Previous studies failed to compare the effects of creativity to such clear control, mainly because a placebo task was also somewhat creative (e.g., write down your early memories, Seligman, Steen, Park, & Peterson, 2005; find a word association, Akbari Chermahini & Hommel, 2012). Therefore, the non-creative tasks employed in this study were designed to have all the features of creative tasks apart from the ability to trigger divergent thinking.

Our findings are in line with the results obtained by Akbari Chermahini and Hommel (2012) who recorded an increase in positive mood after solving a divergent thinking task. Tasks typical for creativity tests were previously used in studies on positive mood and creativity (Baas, De Dreu, & Nijstad, 2008, Davis, 2009). They are also good predictors of creative achievement

(Kim, 2008), even though divergent thinking is just one of the cognitive skills underlying the creative process (Runco & Acar, 2012).

In order to avoid confounding influences identified in previous studies, our design did not involve negative mood induction (excluding the role of emotional regulation strategies e.g., De Petrillo & Winner, 2005) and clinical samples (excluding the role of therapeutic relationship e.g., Van Lith, Schofield, & Fenner, 2013). The study design also accounted for the confounding effects of decreased task absorption. Our conclusions are similar to the results of Cseh and colleagues (2014) who found that flow (i.e. profound task absorption) moderated affect improvement during the creative task.

4.2 Limitations and Future Directions

This study found only a small effect of creative tasks on positive emotions. A long-term exposure may influence well-being more powerfully (Seligman, Steen, Park, & Peterson, 2005), possibly due to a gain spiral of resources (e.g., Hobfoll, 1989). Future studies may investigate positive emotions experienced by participants who complete creative tasks regularly for a longer period of time.

A more absorbed participation in the creative condition would strengthen the effect of creative activity on well-being. Lower task absorption was expected in a creative condition, yet it could have been facilitated by the study design. For instance, the design could include procedures known to increase participants' epistemic motivation (i.e., their willingness to expend effort needed to reach an accurate understanding of a task; De Dreu, Nijstad, Bechtold, & Baas, 2011). Examples of such procedures include setting a minimum time limit that participants must spent solving a task (Kruglanski, Shah, Pierro, & Mannetti, 2002), and informing participants that after the task they will be asked to describe their thought process (Scholten, van Knippenberg, Nijstad, & De Dreu, 2007).

The assessment of this study was limited by a small number of indicators. We have prioritized the validity of item content over their range, a strategy previously used for building short personality measures (e.g., Gosling, Rentfrow, & Swann, 2003). Even though two items are certainly not enough to build a stand-alone scale with good psychometric qualities, choosing one or two best indicators is plausible in structural equation modeling (Hayduk & Littvay, 2012). Alternative measures of reliability and validity (Bollen, 1989) and the replication of the model

across several samples provides some evidence regarding reliability and validity of our assessment, yet for further research we recommend the use of well-established measures whenever possible.

The fit of our final model was acceptable, yet with room for improvement. Apart from the impact of imperfect measurement (i.e., small number of indicators), the loss in a model fit could have resulted from the omission of important variables influencing the connection between creative activity and positive emotions. For example, individuals high in need for closure prefer order and predictability (Webster & Kruglanski, 1994), which creative tasks lack. This could make some individuals feel incompetent, and consequently decrease their positive emotions. Forthcoming studies should pay more attention to feelings of competence and self-efficacy, which are important predictors of involvement in creative behavior (Tierney & Farmer, 2011).

In conclusion, we hope that future research will unveil the potential of creative activities to form a gain spiral with positive emotions, as supported by the reciprocal relationship between creative behaviors and the basic need for autonomy (Devloo, Anseel, De Beuckelaer, & Salanova, 2014). Creativity may be exercised not only for the sake of developing a product or improving one's performance, but simply for the sake of gaining autonomy in expressing oneself.

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