

A comparative experimental study on counterfactual conditionals: counterfactual thoughts, perspectives, and emotions

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Global mental health has deteriorated since the COVID-19 pandemic [1], suggesting the importance of coping mechanisms. Certain personality traits and counterfactual thoughts (CFT) were found to associate with different emotive states and coping mechanisms: E.g., neuroticism was found as a vulnerability factor for depression and anxiety [5]. CFTs involve the activation of the real outcome of an event and the simulation of alternative outcomes (Dual Meaning [6]); two CFT directions are thus possible: Downward counterfactuals (dCFT), i.e., imagining a worse outcome as reality, relate to positive emotions and the affective-focused coping mechanism [2]. Upward counterfactuals (uCFT), i.e., imagining a better outcome as reality, relate to negative emotions and the problem-focused coping mechanism [2]. uCFTs with an egocentric perspective (EgoP), i.e., self referent, serve a self-improvement function and occur more frequently than non-egocentric (NEgoP) uCFTs [2]. We report on two experiments we conducted for Germany and the UK in Jan./Feb.2021, with the aim to relate the direction of CFT to personality traits, emotional states, and life changes due to the pandemic. We had two predictions. **A. CFT and Perspective:** More uCFTs than dCFTs would be used in the EgoP condition. **B. CFT and COVID-19:** More uCFTs would be used, the higher the scores are in personality traits (e.g., neuroticism which we focus on here), emotional states, and the COVID-19 situations.

Exp.1. (Country=Germany, Subject N=99, CFT-task: Item=12, Filler=24, Online at Prolific) contained the following questionnaires in the indicated order: 1) general information, 2) Big Five Inventory with 10 items (BFI-10, [7]) for personality traits, 3) CFT-task, 4) Depression Anxiety and Stress scale with 21 items (DASS-21, [4]) for the emotional states, and 5) Epidemic-Pandemic Impacts Inventory (EPII, [1;3]) for the COVID-19 situations. For 3), we used a COVID-19 themed completion task in order to assess the direction of CFT: Participants were shown a context sentence (S1) and the antecedent of a counterfactual conditional (S2) and they were asked to complete the consequent of the conditional, see (1). The consequents were manually coded into dCFT and uCFT, see (2). **Results: A. CFT and Perspective.** We computed a binary linear mixed model on the data in Table 1: uCFTs were significantly more frequently produced than dCFTs in EgoP (73%, $p < 0.0001$). **B. CFT and COVID-19:** For the CFT-score, we summed over uCFT coded as 1 and dCFT coded as -1. For obtaining the other measurements' scores, the scale specific procedures were followed (Table 3). We computed a linear mixed model. There were no significant effects of the personality traits/emotional states/the COVID-19 situations. For example, the effect of neuroticism was not significant.

Exp.2. (Country=UK, Subject N=97, CFT-task: Item=12, Filler=24, Online at Prolific) used the same (experimental and data analysis) procedure as in Exp. 1. **Results** (Table 2): In general, participants reported higher EPII scores (i.e., more severe impact of the COVID-19) than those in Exp.1. All DASS-21 scales also show higher scores (indicating more negative emotions) than in Exp.1. (Table 3). **A. CFT and Perspective:** uCFTs were significantly more frequently produced than dCFTs in the EgoP condition (67%, $p < 0.0001$). **B. CFT and COVID-19:** There were no significant effects of the emotional states or the COVID-19 situations. But the effect of neuroticism was found significant ($p < 0.009$) in that the higher the neuroticism-score, the more dCFTs (related to the affective-focused coping mechanism) were used. Furthermore, we also found a significant gender effect ($p < 0.05$) in that women produced more uCFTs than men.

Conclusion: Results show that across the two samples, the direction of CFTs is perspective-dependent. As expected, more uCFTs were found in the EgoP condition. There are differences between the two data sets in the EPII, DASS-21, and BFI-10 measures. Furthermore, we found an effect of neuroticism and of gender on the CFT only in the UK sample.

- (1) (S1) Wegen Corona befindet sich Deutschland in einem zweiten Lockdown.
Because of the coronavirus, Germany has declared a second lockdown.
 (S2) Wenn die Pandemie nicht gewesen wäre, hätte ich **EgoP**... / hätten die Leute **NEgoP**...
*If the pandemic had not happened, I would **EgoP**... / the people would **NEgoP**...*
- (2) a. **dCFT**: ... hätte ich nicht so viel Zeit mit meiner Familie verbracht.
 ... *I would not have spent so much time with my family.*
 b. **uCFT**: ... hätte ich meine Familie besuchen können.
 ... *I would have been able to visit my family.*

	uCFT	dCFT	
EgoP	317	162	479
NEgoP	262	277	539
	579	439	Σ 1018

Table 1: Amount of counterfactual types per condition in Exp.1. Removal of neutral (n=160) and ungrammatical (n=10) sentences.

	uCFT	dCFT	
EgoP	282	158	440
NEgoP	220	282	502
	502	440	Σ 942

Table 2: Amount of counterfactual types per condition in Exp.2. Removal of neutral (n=211) and ungrammatical (n=11) sentences.

Score	Scale	Exp.1.			Exp.2.		
		N	Mean	SD	N	Mean	SD
Personality (BFI-10)	e.g., Neuroticism	198	3.10	1.14	194	3.25	1.11
Emotional State (DASS-21)	Anxiety	99	8.02	5.92	97	9.10	6.05
	Depression	99	8.01	5.20	97	9.87	5.75
	Stress	99	5.00	4.81	97	6.12	4.72
CFT		99	0.13	0.35	97	0.07	0.45

Table 3: Descriptive statistics of Exp.1/2. Higher scores relate to higher degrees of neuroticism, anxiety, depression, and stress. CFT-score ranges from -/+12. The mean close to 0 indicates an overall equally frequent use of dCFTs/uCFTs.

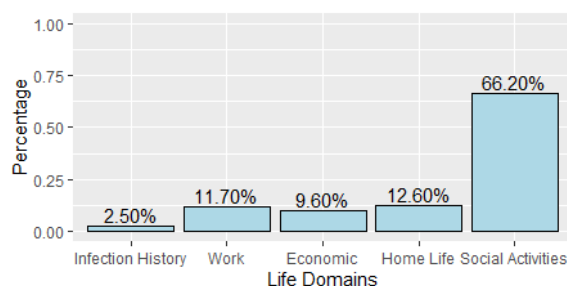


Figure 1: EPII-score in Exp.1. Percentage showing questions answered with 'yes' which indicates an impact of the pandemic on the specific sector.

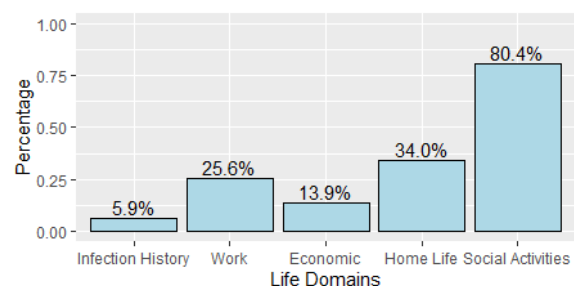


Figure 2: EPII-score in Exp.2. Percentage showing questions answered with 'yes' which indicates an impact of the pandemic on the specific sector.

References: [1] Alzueta et al. (2020). How the COVID-19 pandemic has changed our lives: ... [2] Epstude et al. (2008). The Functional Theory of Counterfactual Thinking. [3] Grasso et al. (2020). The epidemic – pandemic impacts inventory (EPII). [4] Lovibond et al. (1995). Depression anxiety stress scales. [5] Nikčević et al. (2021). Modelling the contribution of the Big Five personality traits, health anxiety, and COVID-19 psychological distress ... [6] Orenes et al. (2019). The comprehension of Counterfactual Conditionals: [7] Rammstedt et al. (2012). Measuring personality in one minute or less: ...