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Individual differences and counterfactual thinking

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Abstract

The present study explored the impact of deductive reasoning capabilities and the five personality dimensions, measured by the 16PF-5 (i.e., extraversion, anxiety, self-control, tough-mindedness and independence), on counterfactuals and responsibility attribution in judicial cases. The authors hypothesized that individual differences in these personality traits predicted the direction, magnitude, and content of counterfactual thoughts and responsibility judgments. The results showed that as regards counterfactual direction (downward vs. upward), Anxiety (positively) and Self-Control (negatively) predicted downward counterfactual judgments in a medical malpractice case; whereas people with high deductive capabilities generated upward counterfactual assessments in an assault case. Perfectionism positively predicted an upward direction independently of the scenarios. As regards the magnitude of counterfactuals, no significant results were found. As regards the content, participants with high levels of accommodation and trust focused on the behaviour of the victim in the malpractice case. Moreover, Anxiety (positively) for the medical malpractice case and Self-Control (negatively) for the assault case predicted counterfactuals focused on external factors. Finally, Extraversion and deductive reasoning capabilities predicted the attribution of responsibility to the victim, whereas Anxiety and Tough-Mindedness predicted responsibility judgments to external causes in the medical malpractice case. For the assault case, Self-Control predicted both the attribution of responsibility to the agent and to external causes. The results were discussed considering the functional meaning of counterfactuals and their implications in the judicial field.

Keywords: counterfactual thinking, legal responsibility, personality traits, logical reasoning

1. Introduction

On December 5th 2017, the Court of Appeal of Rome declared two doctors responsible for the crime of manslaughter of a patient. The two defendants were accused of not having promptly diagnosed the fatal peritonitis following surgery performed by one of the two doctors for the removal of two uterine myomas. Despite the worsening of the woman's clinical conditions, they failed to arrange instrumental tests that would have allowed a correct diagnosis to be made. The verdict stated that a correct diagnosis would have allowed the patient's life to be saved in terms of high probability through the use of counterfactual reasoning. In this regard, the Supreme Court of Cassation stated that to determine the responsibility of a doctor for homicide or negligent injury, it is necessary for the judge to offer an exhaustive overview of the situation, considering the degree of fault of the doctor, the causal relationship between their conduct and the event and the counterfactual judgment about how things could have been different. Through counterfactual reasoning it would be ascertained that, if the doctors had acted correctly, the event would not have occurred, or would have occurred but at a significantly later time or with less harmful intensity. This example of a news story clearly shows the importance of counterfactual reasoning in legally relevant situations, and how the individual predisposition to produce more or fewer counterfactuals and their direction (how the situation could have gone better or worse) has a critical influence on the verdict of guilt or innocence of the defendants.

Many court cases concern events with complex casual chains, which lead to a negative outcome, and jurors and judges are repeatedly asked to decide who is responsible for such an outcome by creating mental alternatives to past events, thus engaging in counterfactual thinking (e.g., Spellman & Kincannon, 2001; Catellani et al. 2020).

Counterfactual thinking is a form of mental simulation in which one or more occurrences that precede the main event are hypothetically mutated, resulting in a different imagined outcome of that event (Byrne, 2017; Roese, 1997; Girotto, Legrenzi, & Rizzo, 1991; Kahneman & Tversky, 1982). A considerable body of research has focused on the consequences of counterfactual thinking, including

causal attributions (e.g., Mandel & Lehman, 1996; Roese & Olson, 1996; Wells & Gavanski, 1989), perception of control (Markman & Weary, 1996; Nasco & Marsh, 1999) and responsibility attribution (e.g., Chockler & Halpern, 2004; Markman & Tetlock, 2000). However, little attention has been paid to whether some people are more likely to engage in counterfactual thinking than others and, thus, to the question of how individual differences influence counterfactual thinking (Kasimatis & Wells, 2014). The previous limited research suggests that specific personality traits, such as optimism (e.g., Kasimatis & Wells, 1995), self-esteem (e.g., Sanna, Carter, & Small, 2006), impulsivity (Schmidt & Van der Linden, 2009), fantasy proneness (Allen, Greenlees, & Jones, 2014) and perfectionism (Sirois, Monforton, & Simpson, 2010), have a role in the direction, magnitude and/or content of counterfactual thoughts. For example, individuals with high self-esteem or greater levels of optimism tend to generate more downward counterfactuals (i.e., thoughts about events with a worse alternative to reality), whereas people with low self-esteem or greater levels of pessimism tend to generate more upward counterfactuals (i.e., thoughts about events with a better alternative to reality) (Sanna, 1996). Moreover, fantasy proneness, a personality trait typified by excessive fantasies that are hard to distinguish from reality, predicts the generation of counterfactual thoughts independently of negative mood state (Allen et al., 2014).

As far as we know, broad personality dimensions or logic deductive reasoning capabilities have not been given much consideration in this regard, even if counterfactual reasoning is considered to require procedures that are an extension of those used for conditional reasoning (Byrne & Tasso, 1999). Previous studies have shown that the requirements to maintain, manipulate and compare representations during counterfactual reasoning, executive functions, in particular cognitive flexibility, are implicated (Beck & Riggs, 2014), whereas intellectual abilities, in a single study, were found not to be associated with counterfactuals (Kasimatis & Wells, 1995), leaving open the question about the role of these capabilities in counterfactual reasoning.

Regarding personality traits, perfectionism (adaptive, that is following a personal standard that leads one to reach objectives, vs. maladaptive, that is following a personal standard with high costs for the

individual) was investigated by Sirois et al. (2010). The authors showed that people with maladaptive perfectionism are prone to generate more upward counterfactuals when they think about negative life events, showing low motivation to change their conditions. Recently, Allen et al. (2014), using a non-experimental design in which athletes describe how their competitions could have been worse or better, showed that openness, which assesses the tendency to seek out new and exciting experiences, related negatively to upward counterfactuals, whereas neuroticism, which assesses susceptibility to emotional instability, related positively. These correlations can be explained by research about emotion and counterfactual thoughts (Dray & Uphill, 2009; Mandel & Dhimi, 2005) showing that upward counterfactual thinking amplifies negative affect and specific negative emotions (i.e., guilt, shame, regret, disappointment and sadness), whereas downward counterfactual thinking was unrelated to emotional responses. However, other research showed that people tend to generate more downward counterfactuals when they are in a good mood (Sanna & Meier, 2000), given that their affective function is helping people to feel better (Byrne, 2002). A crucial role is played by individuals' roles (e.g., reader, observer, actor), which shape their counterfactual thoughts. For example, Girotto et al. (2007) showed that readers mentally undo the negative outcome of a story by undoing the protagonist's choice to tackle a given problem rather than their unsuccessful attempt to solve it; whereas actors, who make the same choice and experience the same negative outcome, depicted in the story mentally alter the features of the problem-solving.

In the judicial context, identifying the necessary and sufficient antecedents of an event through counterfactual reasoning is one of the main procedures chosen when assessing causal relations and determining responsibility in court (Alvarez & Miller, 2016; Daftary-Kapur & Berry, 2010). Psychological research has shown that individuals are more likely to attribute responsibility for the outcome to the actor on whom the counterfactual thought is focused (Catellani & Bertolotti, 2014). In this regard, Catellani et al. (2020) showed that counterfactual focus has a strong effect on both lay jurors' and judges' causal and responsibility attributions. Moreover, research has shown that the direction of counterfactuals (upward or downward) affects retrospective outcome evaluation and, in

turn, increases responsibility attributions (Gambetti et al., 2017; Savani & King, 2015). For example, Gambetti et al. (2017) showed that when downward counterfactuals were linked to a greater focus on the context, people tend to judge an event as less intentional, the defendant as less responsible, and, therefore, to give them a less severe punishment. Conversely, upward counterfactuals lead people to perceive the defendants as more responsible, to evaluate their behaviour as more intentional and, consequently, to give them a more severe punishment. The authors also showed that the relationship between counterfactuals and intentionality judgments was partially mediated by the perceived defendant's predictability of the negative outcomes, in line with research on cognitive biases, such as the outcome bias (Baron & Hershey, 1988; Mazzocco et al., 2004) or the hindsight bias (e.g., Roese & Vohs, 2012). With regard to the latter issue, some researchers (Roese & Olson, 1996; Roese, 1997) have argued that any counterfactual that suggests causal inference accounting for an outcome should increase the hindsight bias.

1.1 The present study

Limited attention has been dedicated to the effect of individual differences on counterfactual thinking and responsibility attribution (Parikh, LaBar & De Brigard, 2020; Allen et al., 2014; Sirois et al., 2010), and there are few studies which have checked or manipulated counterfactuals before making judgments of responsibility (Gambetti et al., 2017). To address these gaps in the literature, in the present article we investigated the impact of specific individual differences, such as personality factors and deductive reasoning abilities, on counterfactuals about responsibility attribution.

According to the big five taxonomy, a widely used inventory measuring both logical reasoning and personality is the 16PF-5 (Rossier, de Stadelhofen, & Berthoud, 2004). This tool identifies five broad dimensions, which have their independent focus and function within the personality. It also permits detailed information about the uniqueness of the individual through the convergence of the sixteen primary traits (see Table 1). The 16PF-5 also evaluates reasoning capabilities, measuring a person's ability to solve problems using verbal, numerical and logical reasoning, separately from the other

factors because it is not a part of the hierarchical structure of personality in the same way as the others. Logical or deductive reasoning is the mental process of drawing deductive inferences that are valid if their conclusions necessarily follow from their premises.

---Table 1 about here

We hypothesized that logical reasoning capabilities and the five personality dimensions (i.e., extraversion, anxiety, self-control, tough-mindedness and independence), measured by the 16PF-5, influence counterfactual thoughts in terms of direction, magnitude and/or content. The present research sought to test this hypothesis empirically using real and complex scenarios about criminal events, in line with recent studies (Catellani et al., 2020; Gambetti et al., 2017; Catellani & Bertolotti, 2014). We presented participants with two scenarios: one about a medical negligence case and one about an assault case, both with a negative outcome, in a within-subject design, to control for individual differences considered. The reason why two scenarios were used was to emphasize those effects that occur independently of the specific scenario, in order to have the possibility to generalize the results to legally relevant situations. Finally, given that previous research (e.g., Gambetti et al., 2017) showed some effects of demographics on counterfactual thinking and responsibility attribution in the judicial field, the associations between demographic variables (i.e., age, gender, education and experience in the judicial field) and dependent variables (i.e., the direction and magnitude of downward and upward counterfactuals, the content of counterfactuals and responsibility judgments) were assessed.

Hypothesis 1. Direction of counterfactuals

Hy1a Consistent with previous research, we expected that people with greater levels of trait anxiety (as found for neuroticism by Allen et al., 2014; Murphy, 2005) and tough-mindedness (as found for perfectionism by Sirois et al., 2010) would report upward counterfactual assessments in evaluating legally relevant situations.

Hy1b We presumed a significant positive effect of accommodation (low independence) and extraversion, which are both related to optimism (Sharpe et al., 2011), on downward mutability judgments.

Hy1c We hypothesized that self-control trait would positively predict upward and negatively predict downward counterfactual assessments, given that individuals with high self-control, who are organized, determined and conscientious (see Table 1), may wish to learn from their own and others' past mistakes, giving upward counterfactual judgments and inhibiting downward ones (see Bacon et al., 2020).

Hy1d Regarding reasoning capability, there are no studies in literature that evaluate the correlations between verbal, numerical, and logical deductive abilities and upward or downward direction of counterfactuals; thus, no specific hypotheses were made.

Hypothesis 2. Magnitude of counterfactuals

Hy2a In line with previous research (e.g., Bacon et al., 2020) showing that counterfactual thinking was related to high neuroticism and low agreeableness, we expected that anxiety and independence traits would increase the number of counterfactuals.

Hy2b We expected that extraversion and receptivity (low tough-mindedness), traits generally typified by positive emotions and interest in new experiences and ideas (Costa & McCrae, 2006), would negatively predict the magnitude of counterfactuals given that people of this type tend to not think about the past (Fortunato & Furey, 2009; Bacon et al., 2020).

Hy2c As far as we know this is the only research that evaluates the correlations between self-control trait and the production of counterfactuals about responsibility attribution. We hypothesized that, as previously mentioned, individuals with high self-control (high conscientiousness for Big Five model), may make upward counterfactuals and, in general, a larger number of counterfactuals in order to learn from past experience (Bacon et al., 2020).

Hy2d Although one single study suggested that the ability to generate counterfactuals is not related to intellectual abilities (Kasimatis & Wells, 1995), we expected that reasoning was positively related to the magnitude of counterfactual thinking, given that thinking of counterfactual alternatives contributes to “debias” thinking from bias such as “hindsight” (i.e. the judgment, after an outcome is known, that it was inevitable) increasing the objectivity of life-experiences analysis (Byrne, 2002).

Hypothesis 3. Content of counterfactuals and responsibility judgments

Hy3a We hypothesized that mutability and responsibility attributions about internal factors (defendant and/or victim of the following judicial cases) would prevail among participants with high anxiety and tough-mindedness, in line with previous studies about personality traits and counterfactual thinking (Bacon et al., 2020; Allen et al., 2014; Sirois et al., 2010; Murphy, 2005).

Hy3b Given that previous research (Gambetti et al., 2017) found a positive correlation between upward counterfactuals and focusing on internal factors, we expected that self-control trait, which is associated with upward ones (Bacon et al., 2020), would predict counterfactual thinking focused on victim and/or defendant behavior.

Hy3c On the other hand, given the positive association between downward counterfactuals and focusing on external factors found in literature (Gambetti et al., 2017), we hypothesized that extraversion and low independence, which are associated with downward counterfactuals (Bacon et al., 2020), would predict counterfactual thinking focused on external factors (i.e., situational factors or the behaviour of other characters).

Hy3d No specific hypotheses were made about reasoning capabilities and the content of counterfactuals, such as responsibility judgments.

2. Material and methods

2.1 Participants

We performed a power analysis using G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) which, with an alpha level of .05 (two-tailed), 90% of power and with a maximum of 22 predictors (age, five global factors, sixteen primary factors), suggests a minimum sample size of 96 participants to obtain a medium Cohen's f^2 effect size (.035) (Cohen, 1992).

One hundred and two participants ($M_{age}=32.4$, $SD=11.6$) took part in the study as volunteers and were recruited via adverts on social networks and university notice boards. We excluded 11 participants, before running and analysing the data, who obtained scores over 95^o percentile on one or more of the three validity scales of the 16PF-5 (see below in the Instrument section), because their responses were insufficiently reliable and descriptive of their personality characteristics (Cattell et al., 2002). This approach is common in literature on personality research, given that invalid data can add noise to the results, amplifying error and providing less valid results (e.g., Curran, 2016).

The final sample ($N=91$) had a mean age of 31.32 years ($SD=11.60$) ranging from 20 to 60 years and were 23% males. The educational level of the sample was the following: 9.9% of participants had a primary school certificate, 26.4% had graduated from high school, and 63.7% had a bachelor's or graduate degree. Demographic variables also concerned experience in judicial topics: 51.1% of the sample was inexperienced, and 48.9% had studied judicial topics or worked in the field of law.

2.2 Instruments and procedure

After obtaining informed consent and asking a few questions in order to collect demographic information (age, gender, educational level and professional position), the 16PF-5 (Cattell et al., 2002) and two judicial cases (Catellani et al., 2020; Catellani & Milesi, 2001) were administered in a counterbalanced manner in order to avoid the possible order effect that could affect the responses (Hogarth & Einhorn, 1992).

The 16PF-5 is a 170-item questionnaire, made up of the sixteen primary traits, some of which contributed to more than one of the five global factors, which are constructs similar to the Big Five traits (see Table 1). The global factor Extraversion/Introversion (i.e., the tendency to move toward versus away from interaction with others) is composed of the following primary traits. Warmth

(Factor A) refers to the tendency to move toward others seeking closeness and connection because of genuine feelings of care, sympathy, and concern (versus the tendency to be reserved and detached, and thus be independent and unemotional). Liveliness (Factor F) refers to the tendency to be high-energy, fun-loving, and carefree, and to spontaneously move towards others in an animated, stimulating manner. Social Boldness (Factor H) refers to the tendency to seek social interaction in a confident, fearless manner, enjoying challenges, risks, and being the centre of attention. Low-scorers tend to be shy and timid and to be more modest and risk-avoidant. Forthrightness (Factor N) is the tendency to want to be known by others - to be open, forthright, and genuine in social situations, and thus to be self-revealing and unguarded. Affiliative (Factor Q2), is the tendency to seek companionship and enjoy belonging to and functioning in a group (inclusive, cooperative, good follower, willing to compromise).

The global factor Anxiety (vs Low Anxiety) refers to the ability to manage tension and worry and is made up of the following primary traits: emotional stability vs reactivity (Factor C); vigilance vs trusting (Factor L); apprehension vs self-assured (Factor O); tension vs relaxed (Factor Q4).

The global factor Receptivity versus Tough-Mindedness is made up of four primary traits that describe different kinds of openness to the world: Openness to sensitive feelings, emotions, intuition, and aesthetic dimensions (Sensitivity – Factor I); Openness to abstract, theoretical ideas, conceptual thinking, and imagination (Abstractedness – Factor M); Openness to free thinking, inquiry, exploration of new approaches, and innovative solutions (Openness to Change – Factor Q1) and Openness to people and their feelings (Warmth – Factor A).

The global factor Independence vs Accommodation is organized around traits of dominance and assertiveness and is defined by the following primary factors: Dominant/Deferential (Factor E); Bold/Shy (factor H), Vigilant/Trusting (Factor L) and Open to Change/Traditional (Factor Q1).

The global factor of Self-Control versus Unrestraint results from the natural coming together of four primary factors that define the different ways that human beings manage to control their behaviour. Rule-Consciousness (Factor G) involves adopting and conscientiously following society's accepted

standards of behaviour. Perfectionism (Factor Q3) describes a tendency to be self-disciplined, organized, thorough, attentive to detail, and goal-oriented. Seriousness (Factor F) involves a tendency to be cautious, reflective, self-restrained, and deliberate in making decisions. Groundedness (Factor M) involves a tendency to stay focused on concrete, pragmatic, realistic solutions.

Among the 16 primary scales, the 16PF-5 model included factor B, which measures logical capabilities by the responses to 15 reasoning problems at the end of the questionnaire. The problems consist of simple basic math, patterns and analogy questions (for example “Ice” is to “water” like “rock” is to a) lava, b) sand, c) oil ?; which number goes on with 1,4,9,16?).

The 16PF-5 also includes three bipolar validity scales, which measure the person's response style namely to what extent the person presented him/herself in a genuine and non-defensive way: Impression Management scale, with high scores reflecting a preponderance of socially desirable responses and low scores reflecting a preponderance of socially undesirable responses, Acquiescence scale, which measures the degree to which the examinee agreed with items regardless of what was being asked, and Infrequency scale, which comprises the most statistically infrequent responses on the test.

The responders have to choose for all the items between two alternatives (for example “I prefer people who are: a) reserved; b) immediately friendly) or to answer “I don’t know” when they cannot decide between one of the two alternatives. Scores on the 16PF are presented on a 10-point scale (i.e., Sten scale). The Sten scales are bipolar, meaning that each end of the scale has a distinct definition and meaning, scores below 4 are considered low and scores above 7 are considered high. In the present sample, the Cronbach’ α ranged from .80 to .94 across the sixteen primary scales. In the current study, both the five global factors and the 16 primary factors were used as independent variables.

The two judicial cases consisted of two-page reports of a medical malpractice case (Catellani et al., 2020) and an assault case (Catellani & Milesi, 2001) and are summarized below.

In the first case, Giorgio went to Doctor Landini,, suffering from abdominal pain. At the end of his examination, the doctor suggested a light diet and a few days of rest for Giorgio. A few days later,

Giorgio went away on holiday and, during his stay in the mountains; he suffered from abdominal pain again and was forced to go to the nearest emergency room to the remote locality where he was staying. He then underwent emergency surgery for peritonitis. The consequences for Giorgio were 20 days of hospitalization and a long convalescence. Giorgio decided to press charges against Dr. Landini. The coroner assessed Giorgio's health damage at 20% and recognized a period of disability. In the second case, two motorists, Stefano and Mauro, were driving along different roads when they both decided to change their usual route for a less busy one. They simultaneously came to a crossroads where they both had to take the same road. Mauro entered the road without stopping at the give-way signal, cutting in front of Stefano, who had to brake suddenly. Both of them got angry: Stefano tried to overtake Mauro, who braked sharply, and then Stefano collided into Mauro's car. The two men got out of their cars and started arguing more and more angrily. Suddenly, Mauro, who was a plumber, flew into a rage and took a monkey wrench out of his pocket while grabbing Stefano's arm. Stefano raised his arm to protect himself and after having been hit by the wrench collapsed. Mauro ran to his car and drove away. Passersby helped Stefano, who was hospitalized for 15 days. Afterwards, Stefano was charged with assaulting Mauro, who admitted to having hit Stefano in self-defence.

After reading each case, participants were asked the following questions in a counterbalanced manner "To what extent could the event have been better?" and "To what extent could the event have been worse?" on a scale from 0 to 10. In order to integrate the two judgments, the scores obtained were subtracted to get a measure of the participant's preference for upward vs. downward (counterfactual direction). Successively, in order to measure counterfactual magnitude, participants were invited to produce counterfactual thoughts starting from the following questions: "What could have been better?" and "What could have been worse?"; for the data analyses, the number of antecedents of the event that participants hypothetically mutated were considered (counterfactual magnitude). Then, participants' accounts were analyzed in order to distinguish the counterfactuals depending on the content. A distinction was made between counterfactuals focused on the behavior of the defendant (e.g., for the assault case Participant # 70: "*Mauro might not have hit Stefano*") or the victim (e.g.,

Participant # 20: “*Stefano might not have tried to overtake Mauro*”) or external causes, such as situational factors (e.g., Participant # 5: “*There might not have been traffic*”) or the behaviour of other characters (e.g., Participant # 45: “*Someone should have intervened to stop the quarrel*”). Two independent judges, unaware of hypothesis, carried out the coding distinguishing between counterfactuals inherent to external factors or factors relating to the victim or the defendant, with an agreement of 98%. Any discrepancies in coding were resolved through discussion.

Finally, in order to measure judgments of responsibility for the event, participants were asked to state to what extent the defendant, the victim and/or external factors were to be considered responsible for the damage experienced by the victim on a scale from 0 to 10 (responsibility judgment).

Participants were engaged for about one hour in an online survey, with the questions written in Italian, using Qualtrics software, version 2020. Once the task was completed, participants who requested it were given a brief report of their personality characteristics to encourage the most accurate answers possible to the questions. The study was approved by the Ethics Committee of the local University.

3. Results

3.1 Descriptives

Descriptives and inter-correlation of the 16PF global factors and the dependent variables are reported in Table 2 for the first judicial case and in Table 3 for the second judicial case.

-----Table 2 about here

-----Table 3 about here

We performed a MANOVA for each scenario because the dependent variables are conceptually related and there are some significant intercorrelations between them (see Tables 2 and 3). As regards demographics, gender (*ps* from .16 to .85), education (*ps* from .93 to .11) and experience in the judicial field (*ps* from .95 to .22) were not associated with dependent variables. The regression analyses showed that age did not predict any of the dependent variables (*ps* from .84 to .07), except for the number of both upward [$\beta=-.31$; $F(1,90)=9.64$, $p<.01$, $R^2_{Adj}=.08$] and downward

counterfactuals [$\beta=-.39$; $F(1,90)=11.02$, $p<.01$, $R^2_{Adj}=.14$] in both the judicial cases and for the content of counterfactuals and responsibility judgments in the assault case. In particular, increasing age decreases counterfactuals focused on the victim [$\beta=-.22$; $F(1,90)=4.58$, $p<.05$, $R^2_{Adj}=.04$] and to the defendant of the assault [$\beta=-.26$; $F(1,90)=6.14$, $p<.05$, $R^2_{Adj}=.05$] and, consequently, responsibility attributed to the defendant [$\beta=-.21$; $F(1,90)=4.22$, $p<.03$]. Thus, age was considered at the first step in the following hierarchical regression analyses on the magnitude and content of counterfactuals and responsibility judgments.

3.2 Direction of counterfactuals

For the medical malpractice case, contrary to our hypotheses, the linear regression analyses did not reveal any significant relationship between the 16PF global factors and upward counterfactual judgments [$F(5,85)=.13$, $p=.98$], whereas results showed that Anxiety ($\beta=.19$) and Self-Control ($\beta=-.26$) predicted downward counterfactual assessments [$F(5,85)=2.66$, $p<.05$, $R^2_{Adj}=.08$]. Thus, two linear regression analyses considering Anxiety and Self-Control primary factors as independent variables and downward counterfactual judgments as dependent variable were performed. Results showed that Apprehension, a primary factor of Anxiety [$\beta=.35$; $F(4,86)=1.67$, $p<.05$; $R^2_{Adj}=.06$], and Perfectionism, a primary factor of Self-Control [$\beta=-.32$; $F(4,86)=2.93$, $p<.05$; $R^2_{Adj}=.08$], significantly predicted downward counterfactual assessments. Then, two linear regression analyses were performed considering, respectively, the five global factors and sixteen primary factors as independent variables and counterfactual direction score (obtained by subtracting downward from upward counterfactual score) as the dependent variable. Both Self-Control [$\beta=.23$; $F(5,85)=2.45$, $p<.05$; $R^2_{Adj}=.07$] and Perfectionism [$\beta=.37$; $F(16,74)=2.92$, $p<.01$; $R^2_{Adj}=.07$] predicted counterfactual direction, showing a positive association between these two personality characteristics and the tendency to evaluate that this specific judicial case could have gone better (upward direction), as predicted by Hy1c.

For the assault case, contrary to our hypotheses (see Hy1a and Hy1b), the linear regression analyses did not reveal any significant relationship between the 16PF global factors and upwards

[$F(5,87)=1.46, p=.20$], downwards [$F(5,87)=.47, p=.79$], or counterfactual direction (obtained from subtraction of the two judgments) [$F(5,87)=.45, p=.80$]. However, the linear regression analysis, considering as independent variables the sixteen primary factors and as dependent variable counterfactual direction score, revealed that Perfectionism [$\beta=.37; F(16,74)=4.53, p<.01; R^2_{Adj}=.04$] was the only primary factor that predicted this measure, as hypothesized (see Hy1c). Finally, the regression analyses considering as independent variables reasoning scale and as dependent variable upwards, downwards or counterfactual direction score (see Hy1d), showed that reasoning scale positively predicted upward counterfactual judgments [$\beta=.23; F(1,89)=4.98, p<.01, R^2_{Adj}=.011$].

3.3 Magnitude of counterfactuals

Overall, participants generated a mean number of 4.14 downward counterfactuals ($SD=2.32$) and of 6.26 upward counterfactuals ($SD=3.71$). For the medical malpractice case, the hierarchical regression analysis, controlling for age, did not reveal any significant relationship between the five global factors and the number of upward counterfactuals [$F(5,85)=.24, p=.94$]. Similarly, the hierarchical regression model did not show significant effects of the five global factors on the magnitude of downward counterfactuals [$F(6,84)=3.55, p<.01$]; only age predicted the number of downward counterfactuals ($\beta=-.36$), accounting for 15% of the variance.

For the assault case, the hierarchical regression models, controlling for age, did not show significant effects of 16PF global factors on the magnitude of upward counterfactuals [$F(6,84)=.40, p=.84$], or that of downward counterfactuals [$F(6,84)=3.46, p<.01$]. Also in this case, increasing age decreases the number of downward counterfactuals ($\beta=-.41$), accounting for 14% of the variance. Thus, Hypotheses 2 were not confirmed for both judicial cases.

3.4 Content of counterfactuals

71.4% of counterfactuals in the medical malpractice case and 96.7% in the assault case referred to the behaviour of the victim; 80.2% and 91.2% respectively focused on the behaviour of the defendant, and 84.6% and 56% focused on external factors (i.e., situational factors or the behaviour of other characters).

We performed three hierarchical regression analyses, considering in the first step the content scores for the other two categories (i.e., if the dependent variable is the number of counterfactuals focused on the victim, the number of counterfactuals about the agent and the external events were entered into the regression as estimators) and in the second step the five global factors or the factor B (i.e., reasoning scale). The results showed that Independence ($\beta=-.24$, $p<.05$) negatively predicted counterfactuals focused on the behaviour of the victim for the medical malpractice case [$F(7,83)=1.03$, $p=.24$], accounting for 7% of the variance. Successively, a hierarchical regression analysis considering in the first step the content scores about defendant behavior and external factors and in the second step the Independence primary factors was performed. Results showed a significant effect of Vigilance/Trusting [$\beta=-.33$; $F(6,84)=3.21$, $p<.01$; $R^2_{Adj}=.09$] on counterfactuals focused on victim behaviour. No global factor predicted counterfactuals focused on the victim for the assault case [$F(8,82)=.67$, $p=.66$],

Counterfactual focused on the behaviour of the defendant was not predicted either by the logical abilities of the participants or by any of the 16PF global factors in the malpractice case [$F(7,83)=.51$, $p=.84$] or in the assault case [$F(8,77)=.42$, $p=.86$].

For the malpractice case, Anxiety ($\beta=.22$) significantly predicted counterfactuals focused on external factors [$F(8,82)=1.32$, $p<.05$, $R^2_{Adj}=.08$], whereas for the assault case it was Self-Control that significantly predicted this measure [$\beta=-.30$; $F(8,77)=2.39$, $p<.05$, $R^2_{Adj}=.09$]. Successively, a hierarchical regression analysis considering in the first step the content scores about the victim and in the second step the Anxiety and Self-Control primary factors was performed. In both cases none of the primary factors that composed the two global scales (Anxiety: $F(6,84)=1.16$, $p=.33$; Self-Control: $F(6,79)=1.38$, $p=.24$) were significant predictors of the dependent variables considered.

3.5 Responsibility judgments

We performed three hierarchical regressions in which the responsibility judgments were added before the personality dimensions or factor B (i.e. reasoning capabilities), thus keeping them under control.

For the medical malpractice case, hypotheses 3a and 3c were not confirmed: Extraversion ($\beta=.29$) and Reasoning Scale ($\beta=.23$) significantly predicted the responsibility attribution to the victim [$F(8,82)=2.32, p<.05, R^2_{Adj}=.08$], whereas Anxiety ($\beta=.27$) and Tough-Mindedness ($\beta=-.26$) significantly predicted the responsibility attribution to external causes [$F(7,83)=2.80, p<.05, R^2_{Adj}=.05$]. The responsibility attribution to the defendant was not predicted either by the logical abilities of the participants [$F(3,87)=1.80, p=.10$] or by any of the 16PF global factors [$F(7,83)=1.91, p=.10$].

For the assault case, hypothesis 3b was confirmed for Self-Control that positively predicted responsibility attribution to the defendant [$\beta=.27; F(8,82)=2.32, p<.05, R^2_{Adj}=.09$] and negatively to external causes [$\beta=-.31; F(7,83)=2.02, p<.05, R^2_{Adj}=.06$]. The attribution of responsibility to the victim was not predicted either by the logical abilities of the participants [$F(3,87)=1.90, p=.15$] or by any of the 16PF global factors [$F(8,82)=1.52, p=.18$], controlling for age.

4. Discussion

As regards the *direction* of counterfactuals, anxiety and tough-mindedness traits did not predict upward counterfactual judgments as hypothesized (see Hy1a). These results contrast previous studies that found associations between neuroticism, rumination (repetitive and unwanted thought), anxiety (Allen et al., 2014; Murphy, 2005) and upward counterfactuals. However, we must distinguish between the feelings and the thinking of anxious people, who tend to amplify negative emotions and focus on better scenarios, and how such people can assess a judicial event that does not involve them personally (e.g., Giroto et al., 2007). In line with previous studies (Gambetti et al., 2017), participants who observe a criminal event, when they have to think about worse rather than better scenarios, are prone to judge the outcome of the event as less intentional because they perceive that the defendant could hardly predict the negative outcome. In this sense, previous research (Gambetti et al., 2017), showed that the production of downward counterfactuals, rather than upward counterfactuals, leads people to judge the defendant as less responsible and, therefore, to give them a less severe

punishment. In this study, the relationship between counterfactual direction and responsibility judgments was not considered, but only the correlations between specific personality traits and the direction of counterfactuals were observed. The results showed that anxious and apprehensive people tend to give higher scores on the downward mutability judgments and to attribute, such as people with low tough-mindedness, the outcome of the malpractice case to external causes (e.g., ambulance delay, bad weather conditions, distance of the hospital from the holiday location) rather than internal causes (e.g., the superficiality of the doctor or the recklessness of the patient).

Another significant result concerning the counterfactual direction was that Self-Control and Perfectionism, a primary factor of Self-Control in the 16PF model, negatively predicted downward counterfactual judgments in the medical malpractice case; Perfectionism was the only personality characteristic that predicted upward counterfactual direction independently of the scenarios. These results confirm Hy1c and are in line with previous studies (e.g., Sirois et al., 2010; Stoeber & Diederhofen, 2017); they can be explained considering the functional meaning of counterfactual thinking, according to which upward counterfactuals aim at self-improvement and motivation for future better outcomes at the cost of increase negative emotions, whereas downward counterfactuals have the function of improving mood, relieving regret and anxiety generated by negative events (Epstude & Roese, 2008). The present study showed that people with high Self-Control and Perfectionism, who are prone to have high internal self-discipline to inhibit urges and control emotions and behaviour (Cattell et al., 2002), tend to inhibit negative emotions and thus downward counterfactual assessments, giving instead higher scores on the upward mutability judgments.

The last considerable result with regard to counterfactual direction was that participants with high reasoning capabilities (i.e., Factor B, see Hy1d) tended to give upward counterfactual assessments only in the assault case. This potentially interesting result should be further investigated in future studies.

As regards the *magnitude* of counterfactuals, contrary to hypothesis 2, personality or reasoning did not predict the number of counterfactuals generated about judicial cases. These results align with past

research, which showed that the production of counterfactuals is not related to intellectual abilities, nor any of the Big Five personality traits (Kasimatis & Wells, 1995). Other factors, such as the controllability (e.g., Roese & Olson, 1995) and the repeatability (e.g., Markman et al., 1993) of events, moderate the number of counterfactuals; another relevant factor in predicting the magnitude of counterfactuals that also emerged in the present study was age, which is negatively correlated with the production of counterfactual thoughts. Such results could be explained by considering motivation, given that in this study, the participants were just asked to state the antecedents that could be hypothetically mutated (i.e., they were not asked to produce as many counterfactuals as possible). An alternative explanation is based on the relationship between counterfactuals and fluid intelligence, which concerns the ability to solve problems and adapt to new situations (Cattell et al., 2002). Counterfactual thoughts are produced instantaneously and do not relate to previously learned knowledge or crystallized intelligence that concerns, the ability to put previously acquired knowledge into practice (Roese, Sanna & Galinsky, 2005). Thus, the mental creation of alternative scenarios is a constructive process that, as much as fluid intelligence, can decline with age. Future studies could explore this suggestion by comparing samples of different ages (e.g., people between 20 and 30 years vs. people over 65 years old).

As regards hypothesis 3, the present study showed that participants with high levels of accommodation and trust, who tend to call into question blaming themselves rather than others, focused on the behaviour of the victim in the malpractice case, putting probably themselves in his shoes. It is interesting to note that, even if the participants with these personality traits focus on the victim's behavior, they do not attribute responsibility for what happened to the injured. Moreover, Anxiety (positively) for the medical malpractice case and Self-Control (negatively) for the assault case predicted counterfactuals focused on external factors. While anxious people, as already mentioned, tend to give downward mutability judgments and to attribute the outcome of the malpractice case to external causes, people with high self-control, who have high moral standards and respect for order, tend to inhibit downward counterfactual assessments and focus little on

environmental circumstances for the assault case. They are prone to focus their thoughts on the defendant (e.g., he could have behaved less impulsively), attributing to him the responsibility for what happened.

Finally, a positive correlation emerged between Extraversion and reasoning capabilities and the attribution of responsibility to the victim in the medical malpractice case. Contrary to highly anxious and tough-minded people, who are more prone to attribute the negative outcome of the malpractice case to environmental causes, extroverted individuals, who are more optimistic, outgoing, open to social interaction and have higher positive affect than those who are introverted (Fleeson, Malanos & Achille, 2002), tend to focus on the victim's behaviour, attributing the health damage to his recklessness.

5. Conclusion

The results showed some relationships between reasoning capabilities or personality traits and both the direction and content of counterfactuals, confirming that they play a role in responsibility attributions and offering some elements of interest for the study of counterfactual thought in the legal field. However, this topic remains controversial and will be explored in future studies considering that, besides age, only perfectionism was found to be a significant predictor of counterfactual judgments in both the judicial cases considered in this study. Thus, although there are some limitations to this research, such as the impossibility of generalizing the results to different criminal cases and the necessity to replicate results using a greater sample, the present study stresses the importance of considering personality traits and reasoning capabilities separately and offers a fresh insight into the way in which individual characteristics are related to counterfactual thinking and attribution responsibility in the legal field.

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Table 1. Big Five and 16PF factors

<i>Big Five factors (Costa and McCrae)</i>	<i>16PF global factors (Cattell)</i>	<i>16PF primary factors (Cattell)</i>
Extroversion/Introversion	Extroversion/Introversion	Warmth (+), Liveliness (+), Social Boldness (+), Privatness (-), Self-Reliance (-)
Neuroticism/Emotional Stability	High Anxiety/Low Anxiety	Emotional Stability (-), Vigilance (+), Apprehension (+), Tension (+)
Conscientiousness/Lack of Direction	Self-Control/Lack of Restraint	Liveliness (-), Rule-Consciousness (+), Abstractedness (-), Perfectionism (+)
Closeness to experience/Openness	Tough-Mindedness/Receptivity	Warmth (-), Sensitivity (-), Abstractedness (-), Openness to Change (-)
Antagonism/Agreeableness	Independence/Accommodation	Dominance (+), Social Boldness (+), Openness to Change (+), Vigilance (+)

Notes. In the brackets the positive (+) or negative (-) contribute of each 16PF primary scale to its 16PF global scale (adapted by Cattell & Mead, 2008)

Table 2. Means, standard deviations and inter-correlations of 16PF global factors and dependent variables for the medical malpractice case

	Mean (SD)	Inter-correlations													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Extraversion	4.76 (2.01)	-													
2. Anxiety	6.49 (2.35)	-.47**	-												
3. Tough-Mindedness	5.85 (2.12)	-.30**	.11	-											
4. Independence	5.35 (1.77)	.35**	-.04	-.14	-										
5. Self-Control	6.10 (1.85)	-.29**	.04	.52**	-.16	-									
6. Direction_upward	7.14 (1.87)	-.01	-.03	.00	-.08	.01	-								
7. Direction_downward	7.04 (2.58)	.12	.10	-.23*	.11	-.32**	.17	-							
8. Responsibility_victim	4.79 (2.53)	.05	.01	.11	-.08	.11	.14	.09	-						
9. Responsibility_agent	5.99 (2.38)	.01	-.03	.10	.09	.10	-.33**	.02	-.10	-					
10. Responsibility_external	6.91 (2.01)	-.08	.23*	-.11	-.05	.06	.06	.34**	.15	-.02	-				

11. Magnitude_upward	2.26 (1.17)	.11	-.06	-.03	-.15	.06	.02	-.13	.13	-.01	.21*	-			
12. Magnitude_downward	1.93 (1.27)	-.02	.18	-.17	.05	-.15	.05	.13	.09	.04	-.21*	.58**	-		
13. Content_victim	1.14 (1.04)	.13	-.08	-.04	-.15	-.36	.44*	.47*	.37*	-.13	.08	.13	.06	-	
14. Content_agent	.96 (.64)	.11	-.05	-.03	.01	-.04	.42*	.19	-	.36*	.17	-.02	-.10	-.02	-
15. Content_external	2.06 (1.83)	-.04	.20*	-.16	.05	-.12	.71*	.75*	-.04	.01	.22*	.07	.01	.12	.13

Note: The global factors of 16PF-5 (i.e., first five scores in the table) are expressed in Sten Scores, with a mean of 5.5 and a standard deviation of 2;

whereas counterfactual direction scores and responsibility judgments are on a 10 point scale. * $p < .05$; ** $p < .001$

Table 3. Means, standard deviations and inter-correlations of 16PF global factors and dependent variables for the assault case

	Mean (SD)	Inter-correlations													
		EX	AX	TM	IN	SC	6	7	8	9	10	11	12	13	14
6. Direction_upward	8.86 (1.37)	.04	-.01	-.21*	.13	.26*	-								
7. Direction_downward	7.25 (2.66)	-.01	-.01	-.00	-.01	-.06	.09	-							
8. Responsibility_victim	4.81 (2.48)	.02	-.11	.16	.01	.22*	-.22*	.26*	-						
9. Responsibility_agent	8.68 (1.62)	-.02	-.05	-.06	-.06	-.22*	.36**	.23*	-.15	-					
10. Responsibility_external	4.81 (3.04)	.14	-.15	.02	.03	.22*	-.31**	.02	.25*	-.18	-				
11. Magnitude_upward	4.00 (3.07)	-.02	-.01	-.12	-.15	-.11	.12	-.17	-.15	.16	-.14	-			
12. Magnitude_downward	2.21 (1.37)	.02	-.05	.01	.13	-.11	.01	.03	-.02	.15	-.01	.65**	-		
13. Content_victim	3.22 (2.06)	.07	-.17	-.07	.01	-.10	.77*	.68*	-.08	-.01	-.04	.06	-.06	-	
14. Content_agent	4.47 (2.50)	.07	-.12	-.08	.02	-.12	.85*	.66*	-.19	.12	-.08	.04	-.12	.84*	-
15. Content_external	.93 (1.34)	-.12	.19	.01	.14	-.18	.63*	.66*	-.06	.09	.02	.06	-.13	.38*	.36*

Notes. Descriptives and inter-correlation of 16PF global factors are reported in Table 2. Counterfactual direction scores and responsibility

judgments are on a 10-point scale. * $p < .05$; ** $p < .001$