Predictors of Emotional, Psychological, and Social Well-Being during COVID-19: The Effects of Extraversion, Adherence to Social Distancing Measures, and Gender on Well-Being in Times of Corona

M. Sc. Thesis

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July 2021

Abstract

Introduction: Prior to the COVID-19 pandemic, extraversion was labeled one of the strongest predictors of increased well-being. In times of the pandemic, it is unclear whether extraverts experience higher or lower levels of emotional, psychological, and social well-being than introverts. The overarching aim of the current study was to investigate the effect of extraversion on emotional, psychological, and social well-being in times of corona (1). Previous research findings implied that whether people adhere to social distancing might explain the relationship between extraversion and well-being, and that gender might modify this relationship. However, the extent to which the adherence to social distancing mediates the relationships between extraversion and the three dimensions of well-being (2) has not been studied thus far, and neither has the extent to which gender moderates these relationships (3), which was done in the current study. **Methods:** The data were taken from the LISS (Longitudinal Internet Studies for the Social Sciences) panel. The sample consisted of 440 Dutch participants. A revised MHC-SF, the extraversion scale from the IPIP, and a LISS panel scale about the adherence to social distancing were used to measure the variables. While well-being and adherence were measured in 2020, the participants' levels of extraversion were measured in 2019, thus making this a longitudinal study. **Results:** Extraversion significantly predicted increased emotional, psychological, and social well-being during the pandemic (1). There was no mediating effect of adherence to social distancing measures on the relationships between extraversion and the three dimensions of well-being (2). Gender did not moderate the relationships between extraversion and emotional, psychological, or social well-being (3). **Discussion:** It was found that higher levels of extraversion are a consistent predictor of well-being. Extraversion appears to predict emotional well-being to a somewhat smaller extent than psychological and social well-being. With extraversion-introversion in mind, future research could identify specific risk factors for decreased levels of well-being, based on which measures to protect and enhance the population's well-being could be taken.

Introduction

The COVID-19 pandemic is a serious threat to the world's population. The corona virus was first discovered in Wuhan, China, in the end of 2019 and closely resembled viral pneumonia (Huang et al., 2020). An infection with the corona virus leads to clusters of severe respiratory illness and is associated with ICU admission and high mortality (Huang et al., 2020). However, the threat also extends to those who are not physically affected by the virus (O'Connor et al., 2020). Lockdowns and limited mobility due to the corona restrictions have led to loneliness, uncertainty, and isolation among people (Kim & Laurence, 2020). Pandemics such as COVID-19 cause a tremendous amount of disruption, uncertainty, and fear among the population, which can lead to mental health problems and decreased levels of well-being (Hansel et al., 2020). While measures such as quarantines and social distancing are being used to protect people's physical health, little has been done to protect people's mental well-being (Kumar & Nayar, 2020). However, people's well-being appears to be at risk due to the pandemic and should be protected more explicitly (Cheng et al., 2020; Mana et al., 2021; Prati, 2020; van Zyl, 2021). Well-being is not only essential in order for people to be able to live a fruitful and productive life (Lamers et al., 2011), but it also decreases the likelihood of all-cause mortality (Keyes & Simoes, 2012), which is why it is an important aspect to take into account when exploring the impact of the corona virus.

The approach to well-being that will be used in the current study thoroughly represents it as a multidimensional construct (Luijten et al., 2019). There are three dimensions of well-being that compose an overall level of mental well-being. The first dimension is called emotional well-being, which incorporates satisfaction with life and the experience of positive emotions (Keyes et al., 2008). The second dimension is psychological well-being, which refers to people's positive functioning in life (Lamers et al., 2011). Psychological well-being encompasses six elements, namely autonomy, environmental mastery, personal growth,

positive relations with others, purpose in life, and self-acceptance (Ryff & Keyes, 1995). According to Keyes (1998), the five elements that compose social well-being are social integration, social contribution, social coherence, social actualization, and social acceptance (Keyes, 1998). Social well-being in general stands for the way people evaluate their circumstances and functioning in society (Keyes, 1998). Taken together, the three dimensions can provide an insightful overall picture of people's well-being.

A number of studies have been conducted that specifically explore overall levels of well-being in times of corona. For instance, Mana and colleagues (2021) found that scores of overall mental well-being were higher in countries in which the spread of the virus was less prominent, such as the Netherlands, while the well-being scores were significantly lower in countries with stronger spread, such as Italy. This indicates that the more a country is affected by the spread of the corona virus, the stronger the decline in the population's mental overall well-being. Prati (2020) found that, during the pandemic, the mean scores on well-being significantly dropped in Italy, while there were no notable differences in the prevalence of mental illness compared to pre-corona times. This finding resulted in the conclusion that corona negatively affected the well-being of a population that would otherwise to a great extent indicate the capacity to lead a productive and fruitful life. Van Agteren and colleagues (2020) explored mental well-being in Australia, and they found that levels of mental well-being decreased significantly during COVID-19. These findings suggest that people's levels of overall mental well-being have suffered due to the pandemic.

In accordance with the decreased levels of overall mental well-being in times of corona, the three dimensions that compose the overall levels of well-being seem to have dropped as well. Regarding emotional well-being, people's feelings of happiness were found to have decreased after the corona regulations were introduced (Greyling et al., 2020). Lades and colleagues (2020) found that the time that people spend outside in times of corona is

related to increased positive affect compared to staying at home. Moreover, people who experienced income loss due to the corona crisis reported a decline in life satisfaction that is twice as large as for people who did not experience any income loss (Cheng et al., 2020). Concerning psychological well-being, Fried and colleagues (2020) found that social distancing measures during the lockdown have led to a more negative outlook on the future in college students, meaning that they do not think they have anything to look forward to any longer. Furthermore, the lockdown seems to negatively affect psychological well-being through maladaptive changes in behavior, such as less time spent outside and increased screen time (Stieger et al., 2020). According to Stieger and colleagues (2020), physical distancing during the lockdown contributes to feelings of loneliness, which they define as a lack of meaningful relationships that leads to a decrease in psychological well-being. Additionally, the lockdown appears to negatively affect people's social well-being because it limits the extent to which social needs can be met (van Zyl, 2021). While a shared threat such as a pandemic could potentially strengthen social connections, levels of social well-being are likely to have dropped due to the reduction in needed face-to-face social contact (Sibley et al., 2020). Hence, the levels on all three dimensions of well-being appear to have decreased due to the pandemic.

One important factor to investigate in relation to the presence of well-being during the pandemic is extraversion. First of all, extraversion-introversion is one of the personality dimensions of the Big Five and can be viewed as a continuum, with extraversion on one end and introversion on the other (Sun et al., 2017). People who score high on extraversion tend to be sociable and actively engage in relationships with a larger number of people compared to introverts (Ypofanti et al., 2015). Extraversion incorporates sociability, vigor, sensation-seeking, the experience of positive emotions, and being active, gregarious, assertive, and warm (Costa & McCrae, 1980; McCrae & Costa, 1999). Generally, extraversion can be considered one of the strongest predictors of increased well-being, which Anglim and

colleagues (2020) suggested based on a meta-analysis on the effect of personality traits on well-being. While for instance the personality trait neuroticism is a strong correlate of negative affect, extraversion seems to consistently predict the presence of well-being (Anglim et al., 2020). However, in times of corona, it is not clear whether extraverts experience higher or lower levels of well-being than introverts (Folk et al., 2020; Gubler et al., 2020). The fact that it is not clear whether extraversion or introversion is a risk factor for decreased well-being in corona times makes this personality dimension a relevant factor to explore.

Related to a potential association between extraversion and well-being, there are two other factors that are relevant. Firstly, higher levels of extraversion have been associated with lower levels of adherence to social distancing measures (Brouard et al., 2020; Carvalho et al., 2020), while higher levels of adherence have been associated with lower levels of well-being (Greyling et al., 2020; Stieger et al., 2020; van Zyl, 2021). Hence, adherence to social distancing measures might explain the relation between extraversion and well-being. Secondly, women appear to rely on social relationships and value extraversion facets such as sociability more than men (Kwang et al., 2013; López-Madrigal et al., 2021; Taylor, 2006), while their declines in well-being during the pandemic seem to be steeper than men's due to a lack of social interaction in corona times (Etheridge & Spantig, 2020). This suggests that the relationship between extraversion and well-being might be modified by gender in times of the pandemic. In addition to the ambiguous effect of extraversion on well-being in corona times, the roles of adherence to social distancing measures and gender are important to investigate as well.

The Relationships between Extraversion and the three Dimensions of Well-Being

Generally, extraversion appears to be related to all three dimensions of well-being. Extraverts are predisposed to positive affect (Costa & McCrae, 1980), and the extraversion facet *positive emotions* is a strong predictor of life satisfaction (Røysamb et al., 2018), both of

which reflect emotional well-being (Keyes et al., 2008). Extraversion is a strong predictor of psychological well-being as well and is related in particular to the element *positive relations* (Anglim et al, 2020). Accordingly, extraversion has been found to predict higher friendship quality and relationship satisfaction among intimate partners (Festa et al., 2012; Malouff et al., 2010). Warmth and gregariousness especially help extraverts create and maintain well-functioning social relationships (Røysamb et al., 2018). Additionally, it was found that extraversion is strongly associated with social well-being (Lamers et al., 2012). Social well-being includes a broader context than the element of close relationships in psychological well-being, seeing as it incorporates people's functioning in society (Keyes, 1998). Through their social skills and positive affect, extraverts tend to more successfully initiate positive exchanges and receive more positive reactions from others than introverts (Tov et al., 2016). Social interactions allow people who score high on extraversion to reach the high, optimal levels of arousal that they prefer and that feel rewarding to them (Duffy et al., 2018). Overall, extraversion seems to predict increased levels on all three dimensions of well-being.

However, despite the previous studies, the relationship between extraversion and the three dimensions of well-being in corona times is somewhat unclear. Folk and colleagues (2020) theorized that extraversion serves as an overall buffer in crisis situations such as the pandemic because extraverts tend to have more perceived social support than introverts. Accordingly, introversion is associated with decreased support-seeking behavior as well as increased rumination and turning inward in times of corona (Wei, 2020). This "buffer" of perceived support could protect extraverts' levels of well-being in corona times. Nevertheless, there is also evidence that the opposite might be the case. In their study about personality and well-being during the pandemic, Gubler and colleagues (2020) found that, despite their sociability, extraverts are not protected from struggling, for instance with loneliness, and that their mental well-being suffers when their chances to engage in social interaction are taken away due to restrictive corona guidelines. This could be the case because extraverts are

reportedly more reliant on social contact than introverts (Carvalho et al., 2020). Overall, while researchers appear to agree that extraversion is linked with higher levels of mental well-being, its link with well-being in times of corona seems to be ambiguous, which is why it is deemed important to investigate.

Adherence to Social Distancing Measures as a possible Mediator of the Relationships between Extraversion and the three Dimensions of Well-Being in Times of Corona

The adherence to social distancing measures has been related both to extraversion and the three dimensions of well-being. There is evidence that being extraverted is associated with not adhering to the corona restrictions. Higher levels of extraversion have been found to predict decreased compliance with corona guidelines (Brouard et al., 2020; Carvalho et al., 2020). Carvalho and colleagues (2020) studied to which extent extraversion influences the adherence to corona restrictions because people who score high on this personality trait are more reliant on social interaction and closeness to others. They found that extraversion predicted lower levels of social distancing in particular (Carvalho et al, 2020). In their study on personality traits and public health recommendations, Brouard and colleagues (2020) expected that it would be difficult for extraverts to adhere to isolating guidelines that interfere with their sociability. Indeed, they found that extraversion predicted non-compliance with corona measures. According to Modersitzki and colleagues (2020), being extraverted is related to perceiving the implemented guidelines as too restrictive. Adhering to the lockdown and social distancing guidelines during corona times has been found to negatively affect people's emotional, psychological, and social well-being (Greyling et al., 2020; Stieger et al., 2020; van Zyl, 2021). Due to the possible negative effect of extraversion on adherence to social distancing measures, and the potential negative effect of adherence on well-being, it is expected that adherence mediates the relationship between extraversion and the dimensions of well-being.

***Gender as a Possible Moderator of the Relationships between Extraversion and the three
Dimensions of Well-Being in Times of Corona***

Gender might serve as a moderator of the relationship between extraversion and well-being in corona times. First of all, social interaction is an important aspect of extraversion, seeing as it is rewarding to extraverts and causes them to experience positive affect (Duffy et al., 2018). In times of corona, extraverts tend to experience larger declines in social connection with others (Folk et al., 2020). Women tend to have higher scores on extraversion than men, and the interactions that social connections bring tend to be more important for women than for men to be content with their lives (Joshanloo, 2018; Weisberg et al., 2011). Etheridge & Spantig (2020) found that the decrease in overall mental well-being was steeper for women than for men due to a lack of social interaction in corona times. In their study, women disclosed having larger social networks than men, and they showed significantly lower levels of well-being than men after the outbreak. One reason for the significant decrease in well-being could be that women tend to regulate their stress levels by using social support strategies such as talking about difficulties to others (López-Madrigal et al., 2021). Taylor (2006) suggested that social interaction is especially important for women because they tend to manage their stress with a so-called "tend and befriend" approach, meaning that reliance on a social network is crucial in women's stress management. Turning to members of one's social network to cope with stress or negative emotions appears to be a coping mechanism that is especially relevant for women because of role expectations that are imposed on them. According to these role expectations, women are more interpersonally oriented than men (Fedigan, 1986; Löffler & Greitemeyer, 2021). Moreover, women tend to view themselves as more embedded in social relationships than men (Kwang et al., 2013). If women score higher on extraversion, seek more social support and there is less social support available due to the COVID-19 restrictions, this could make it difficult to deal with stressful situations and subsequently lead to larger declines in well-being for women. Since social interaction and

social networks seem to be especially important to women and particularly related to decreases in women's well-being during the pandemic (Etheridge & Spantig, 2020), a moderating effect of gender on the relationship between extraversion and well-being is expected.

The Current Study

The overarching aim of the current study is to investigate to which extent extraversion influences emotional, psychological, and social well-being in times of corona (1). The two subsequent aims are to explore to which extent the adherence to social distancing measures mediates the relationship between extraversion and the three dimensions of well-being in times of corona (2), and to which extent gender moderates the relationship between the relationship between extraversion and the three dimensions of well-being in times of corona (3).

The aforementioned studies that dealt with these topics of interest were cross-sectional, which is why the current longitudinal study could give additional, valuable insights. A characteristic that distinguishes this study from previous studies is that it explores the extent to which extraversion measures from 2019 predict levels of emotional, psychological, and social well-being in 2020. Moreover, while most previous studies focused either on solely one dimension of well-being or overall levels of well-being, the current study examines all three dimensions of well-being in detail. Finally, mediation and moderation analyses as conducted in the current study have not been explored yet, which is why the current findings could serve as a basis for future research.

Methods

Design

The current study was based on a larger collection of research studies that is called the LISS (Longitudinal Internet Studies for the Social Sciences) panel. The LISS panel is an online platform that incorporates a variety of studies and encompasses approximately 5000 households in the Netherlands. The participants, whose households are recruited randomly based on municipal registers, fill in online questionnaires each month. The research studies that are part of the LISS panel are therefore of longitudinal nature. The data on the dependent variable *well-being*, the main variable, was collected in May 2020 in a LISS panel module about the revised Mental Health Continuum – Short Form (MHC-SF). In this module, the participants of the LISS panel were assigned to one of four different conditions, which is why not every participant filled in the version of the MHC-SF that was used for the current study. The data on the independent variable *extraversion* was collected in the eleventh wave of the LISS panel module "Personality." All participants from the LISS panel received this questionnaire and they answered it prior to the pandemic, from May 6th to May 28th 2019. The data on extraversion taken from the personality module (2019) was used to predict well-being in times of corona (2020). Finally, the data on the independent variable and potential mediator *adherence to social distancing measures* was collected in the first wave of the LISS panel module "Effects of the Outbreak of COVID-19," which all participants could answer from March 20th to March 31st 2020.

Procedure

The participants of the LISS panel were recruited randomly by contacting numerous households in the Netherlands based on municipal registers. The participants fill out the online questionnaires on a monthly basis. If the participants cannot access the LISS panel, they are supported and provided with computers or Internet access to make sure they can fill

out the questionnaires. In the overall panel, all members from each of the 5000 registered households were asked to fill out the questionnaires. In the MHC-SF module, only one person per household was asked to fill out the questionnaire.

Participants

A total number of 440 participants answered all questions regarding extraversion, well-being, and adherence to social distancing measures. Men and women were almost equally represented, with 48.9% reporting to be male (N=215) and 51.1% reporting to be female (N=225). The mean age of the participants was 51 (Age_{SD}= 19.45, Age_{min} = 16; Age_{max} = 91). With regards to the educational levels, 7.7% of the participants finished primary education (basisonderwijs), 21.4% had a pre-vocational education (VMBO), 13.4% either finished higher general continued education (HAVO) or preparatory scientific education (VWO), 23.4% had reached middle-level applied education (MBO), 23.9% had a higher professional education (HBO), and 10.2% of the participants had a scientific education (WO).

After the final sample was established, t-tests for equality of means as well as chi-square tests were used to determine whether there were significant differences between the participants who were and those who were not part of the final sample. It was found that there were no significant differences between the samples regarding their gender, age, educational level, domestic situation, or extraversion. Therefore, it was concluded that there was no selection bias involved in the participation and that those who were part of the final sample did not have a characteristic that those who were excluded from the final sample did not have.

Table 1

Characteristics of the participants who filled in the personality module (N=5025), the participants who were excluded (N=4585), and the final sample (N=440)

	Participants Personality Module	Excluded Participants	Final sample

Characteristics	N	%	N	%	N	%
Gender						
Male	2330	46.4	2115	46.1	215	48.9
Female	2695	53.6	2470	53.9	225	51.1
Age						
15-24	485	9.7	423	9.2	62	14.1
25-34	584	11.6	532	11.6	52	11.8
35-44	599	11.9	560	12.2	39	8.9
45-54	768	15.3	708	15.4	60	13.6
55-64	978	19.5	883	19.3	95	21.6
≥ 65	1611	32.1	1479	32.3	132	30.0
Educational level						
Primary education	401	8.0	367	8.0	34	7.7
VMBO	1034	20.6	940	20.5	94	21.4
HAVO / VWO	544	10.8	485	10.6	59	13.4
MBO	1169	23.3	1066	23.3	103	23.4
HBO	1277	25.4	1172	25.6	105	23.9
WO	600	11.9	555	12.1	45	10.2
Domestic situation						
Single	1148	22.8	1049	22.9	99	22.5
(Un)married co-habitation, without child(ren)	1864	37.1	1702	37.1	162	36.8

(Un)married co-habitation, with child(ren)	1581	31.5	1441	31.4	140	31.8
Single, with child(ren)	263	5.2	237	5.2	26	5.9
Other	169	3.4	156	3.4	13	3.0

Note. The t-tests and chi-square tests showed that there were no significant differences between the excluded participants and the final sample.

Measures

Well-Being

Mental well-being was assessed using the revised Mental Health Continuum – Short Form (MHC-SF). Despite being a short questionnaire, the MHC-SF sufficiently covers emotional, psychological, and social well-being (Lamers et al., 2011). The revised MHC-SF consists of 18 items, with three items measuring emotional well-being, six items measuring psychological well-being, and nine items measuring social well-being during the past week (Westerhof & ten Klooster, 2020). Examples of the emotional well-being subscale include, "I am happy," and "I am satisfied with my life." The items on psychological well-being each correspond to one of the elements of this dimension, meaning that there is one item about autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance, respectively (Ryff & Keyes, 1995). Example items of the psychological well-being subscale are, "I feel my life has meaning," and "I dare to express my ideas." The first five items on social well-being each correspond to one element of this dimension, which are social integration, social contribution, social coherence, social actualization, and social acceptance (Keyes, 1998). The four additional items on social well-being in the revised MHC-SF reflect contribution, satisfaction, relatedness, and support.

Example items of the social well-being subscale are, "I belong to a group of people," and "I can count on others to help me." The answer options ranged from *Never* (0) to *(Almost) Always* (5). The scores were computed by calculating the means for each dimension of well-being. A factor analysis was conducted, which revealed that the 18 items loaded onto three factors which were equated with emotional, psychological, and social well-being (see Appendix A). Even though a number of items did not load on the intended factors, the theoretical distribution of items was maintained in the analysis to ensure that the results remained comparable to other studies. The original MHC-SF was shown to have strong internal consistency with a Cronbach's alpha value of .80 (Lesser & Nienhuis, 2020). In the current sample, for which the revised version was used, the Cronbach's alpha value for the MHC-SF as a whole was .93, which indicates an excellent reliability. Concerning the different dimensions, emotional and social well-being both had a reliability value of .87, and psychological well-being had a value of .85, all of which indicate a good reliability.

Extraversion

Extraversion was measured in the ongoing LISS panel module "Personality." The Big Five personality traits, including extraversion, were measured in this module using the International Personality Item Pool (IPIP) by Goldberg (1999). The short version of this questionnaire, which was used in the current study, includes 50 items, with 10 items measuring each of the five personality traits (Ypofanti, 2015). The participants' level of extraversion was therefore measured with 10 items, examples of which include, "I am the life of the party," and "I feel comfortable around people." The response options ranged from *Very inaccurate* (1) to *Very accurate* (5). The scores were computed by adding together the items of the extraversion scale and dividing them by ten, thus calculating the means. The reliability of the extraversion subscale has been found to be high with a Cronbach's alpha value of .79

(Ypofanti, 2015). In the current sample, the Cronbach's alpha value was .89, which confirms a high reliability.

Adherence to Social Distancing Measures

To get a clearer picture of the relationship between extraversion and well-being, the participants' adherence to social distancing measures was taken into account as a possible mediator. The level of adherence was measured using an item about social distancing measures from the LISS panel module "Effects of the Outbreak of COVID-19." The item asked, "Which of the following recommendations did you act upon in the past week?" and suggested six social distancing measures such as *Avoid crowded places* and *Quarantine yourself even if you do not have symptoms*. The response options were *No* (0) and *Yes* (1). The scores on adherence were computed by calculating the means. In the current sample, the Cronbach's alpha value was .30, which indicates a low reliability. Three response options with a low item-rest correlation, namely *Change school or work arrangements* (item-rest correlation = .05), *Quarantine yourself because you have symptoms* (item-rest correlation = .14), and *Quarantine yourself even if you do not have symptoms* (item-rest correlation = .08), were excluded. The exclusion resulted in a Cronbach's alpha of .52. According to Ekolu and Quainoo (2019), a Cronbach's alpha smaller than .50 is considered low, while a value of above .50 is considered acceptable or moderate. The new reliability value of .52 is still quite low, but can be viewed as moderate, especially considering that short scales can lead to lower reliability values (Tavakol & Dennick, 2011).

Data Analysis

The statistical analysis software SPSS was used to analyze the datasets that were obtained through the LISS panel. First, the personality module from 2019, the MHC-SF module from 2020, and the module about the effects of corona from 2020 were combined in one SPSS file and matched based on participant number. The data were then screened to

determine the ultimate number of participants. Frequency distributions were drawn up for each variable and it was tested whether the collected data was normally distributed. Afterwards, Pearson correlations between the variables were calculated, which is useful to indicate the type and degree of association (Senthilnathan, 2019). The correlations were used as a means to determine to which extent extraversion predicted emotional, psychological, and social well-being in times of corona (1). The bootstrap technique that is available in the PROCESS macro tool for SPSS (Hayes, 2013) was used as a means to determine to which extent the adherence to social distancing measures mediated the relationships between extraversion and the three dimensions well-being in times of corona (2). Three simple mediation models were used to analyze whether extraversion influenced the three dimensions of well-being directly as well as indirectly through the mediator variable adherence. Finally, the bootstrap technique was used to determine to which extent gender moderated the relationships between extraversion and the three dimensions of well-being in times of corona (3). Three simple moderation models were used, through which it was analyzed whether the magnitude of the effect of extraversion on the three dimensions of well-being depended on a third variable, namely gender. The bootstrap technique offered an opportunity to randomly select a large number of samples from the original sample, which added statistical power (Cerina et al., 2006). For the mediation and moderation analyses, 5000 bootstrap samples were used.

Results

Descriptive Statistics

After excluding the participants with missing values, the descriptive statistics were calculated per variable (see Table 2). In the current study, the participants' level of overall mental well-being was quite high with a mean value of 3.3 and possible scores ranging from 0 to 5. Accordingly, the means on the subscales emotional, psychological, and social well-being

were relatively high as well. Regarding the other variables, the participants' level of

extraversion was quite high with a mean of 3.2 and possible scores ranging between 0 and 5.

Their level of adherence to social distancing measures was also relatively high with an overall

mean of .9 and possible scores ranging between 0 and 3.

Afterwards, the data were tested for normality using the Shapiro-Wilk test. Solely the

data of the variables extraversion and social well-being were normally distributed (see Table

2). The other variables showed distributions that had significant p-values, which indicated that

they were not normally distributed. To counteract the distortion of standard errors, confidence

intervals, and significance levels that can result from non-normally distributed variables in

regression analyses (Li et al., 2012), 5000 bootstrap samples were used.

Table 2

Mean, standard deviations (SD), minimum scores, maximum scores, W-statistics, degrees of

freedom (df), p-values and level of skewness per variable (N = 440)

Variables	Mean	SD	Min	Max	W	df	p-value	skewness
Extraversion	3.2	.68	1.4	5	1.00	440	.227	-.04
Adherence	.9	.22	0	3	.56	440	<.001	-2.15
Overall Mental Well-Being	3.3	.76	.44	5	.99	440	.001	-.41
Emotional Well-Being	3.6	.94	0	5	.95	440	<.001	-.55
Psychological Well-Being	3.3	.85	0	5	.97	440	<.001	-.64
Social Well-Being	3.2	.78	.22	5	.99	440	.016	-.21

Correlations

Before testing the hypotheses, correlations were calculated to indicate the strengths

and directions of the relationships between the variables (see Table 3). According to Cohen

(1998), in a statistical analysis, a correlation coefficient smaller than .30 represents a weak

correlation, a coefficient between .30 and .50 is considered a moderate correlation, and a coefficient of above .50 represents a strong correlation. When looking at the correlations, it can preliminarily be concluded that extraversion predicted emotional, psychological, and social well-being (1). With regards to the mediation analyses, it appears that extraversion did not predict the adherence to social distancing measures, while adherence predicted emotional but not psychological or social well-being, which suggests a lack of mediation effect (2).

Table 3

Correlations between the variables.

Variables	1	2	3	4	5	6
1. Extraversion	-					
2. Gender	.01	-				
3. Adherence	.04	.07	-			
4. Emotional Well-Being	.22**	.08	.10*	-		
5. Psychological Well-Being	.35**	.03	.04	.68**	-	
6. Social Well-Being	.37**	.13**	.07	.65**	.81**	-

*Note. *$p < .05$, **$p < .01$.*

The Mediating Effect of Adherence to Social Distancing Measures on the Relationships between Extraversion and the three Dimensions of Well-Being in Times of Corona

Emotional Well-Being

For all mediations, unstandardized scores were reported. It was found that that the direct effect of extraversion (X) on emotional well-being (Y) was significant (see Figure 1). The effect of adherence to social distancing measures (M) on emotional well-being (Y) was non-significant. It was also found that extraversion (X) did not significantly predict adherence to social distancing measures (M), which was the same in all three mediation models. With adherence (M) involved, extraversion (X) significantly predicted emotional well-being (Y).

The indirect effect was also not significant, seeing as the confidence interval contained zero. Involving adherence did not notably change the effect of extraversion on emotional well-being. Therefore, unlike hypothesized, it was concluded that adherence to social distancing measures did not mediate the relationship between extraversion and emotional well-being. Nevertheless, as hypothesized, it was shown that extraversion positively influenced people's emotional well-being in times of corona.

Figure 1.

The mediating effect of adherence to social distancing measures on the relationship between extraversion and emotional well-being
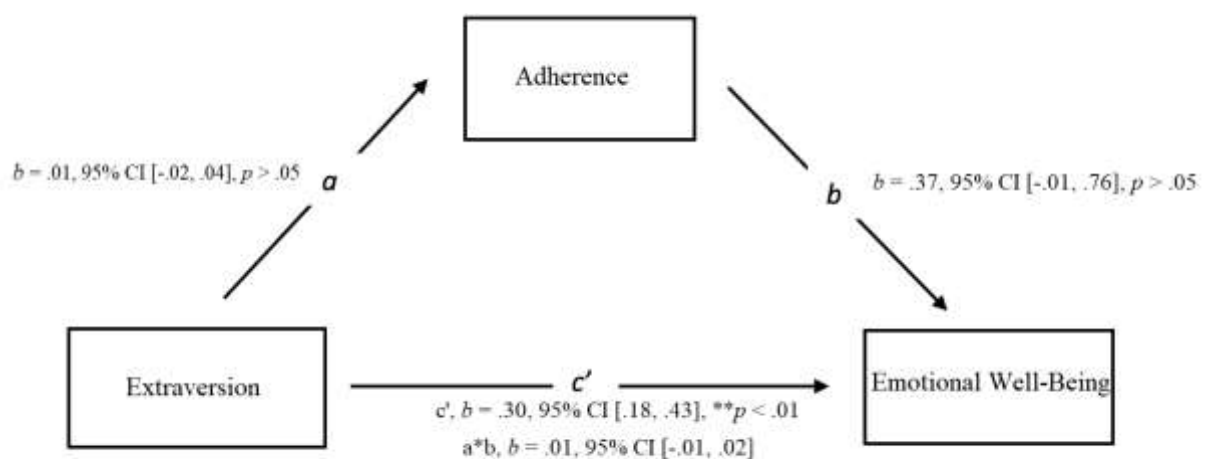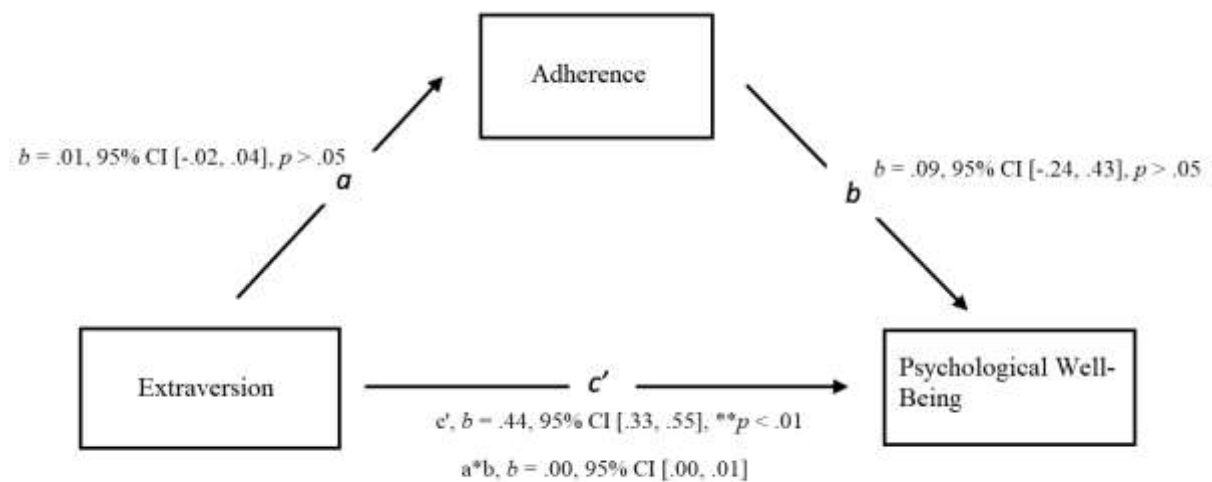

Psychological Well-Being

It was found that the direct effect of extraversion (X) on psychological well-being (Y) was significant (see Figure 2). However, adherence to social distancing measures (M) did not significantly predict psychological well-being (Y). As previously mentioned, extraversion (X) did not significantly affect adherence to social distancing measures (M). With adherence (M) involved, extraversion (X) significantly predicted psychological well-being (Y). The indirect effect was not significant, seeing as the confidence interval contained zero. With adherence integrated, the effect of extraversion on psychological well-being did not differ from the

direct effect. It was concluded that, unlike hypothesized, the adherence to social distancing measures did not mediate this relationship. However, as expected, it was shown that extraversion positively influenced people's psychological well-being in times of corona.

Figure 2

The mediating effect of adherence to social distancing measures on the relationship between extraversion and psychological well-being
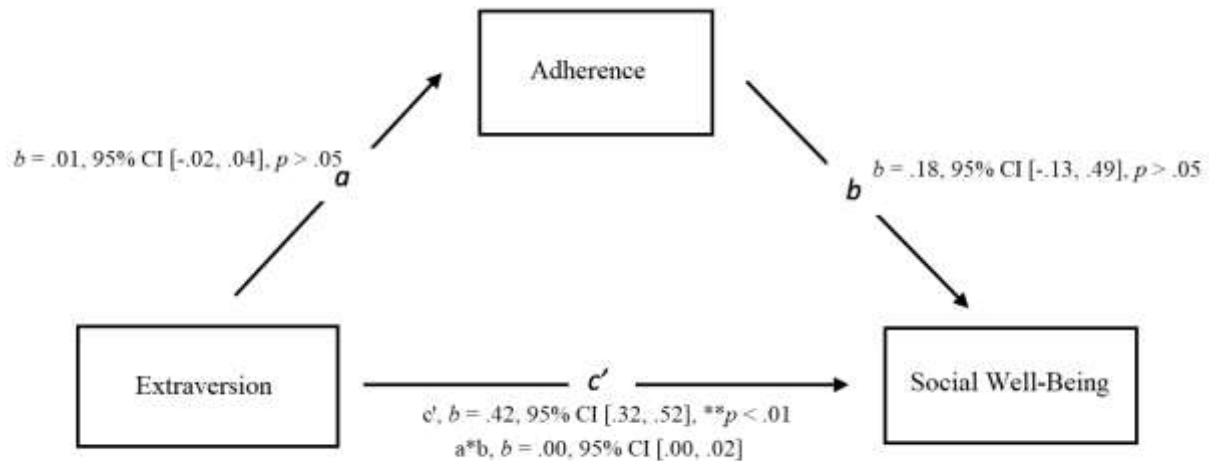

Social Well-Being

The direct effect of extraversion (X) on social well-being (Y) was significant (see Figure 3). The effect of adherence to social distancing measures (M) on social well-being (Y) was non-significant. As mentioned above, extraversion (X) did not significantly predict adherence to social distancing measures (M). With adherence involved, extraversion (X) significantly influenced social well-being (Y). The indirect effect was not significant, seeing as the confidence interval contained zero. Adding adherence did not make a notable difference to the effect of extraversion on social well-being. It was concluded that, unlike hypothesized, adherence to social distancing measures did not mediate the relationship between extraversion and social well-being. However, as expected, it was found that extraversion positively influenced people's social well-being in times of corona.

Figure 3

The mediating effect of adherence to social distancing measures on the relationship between
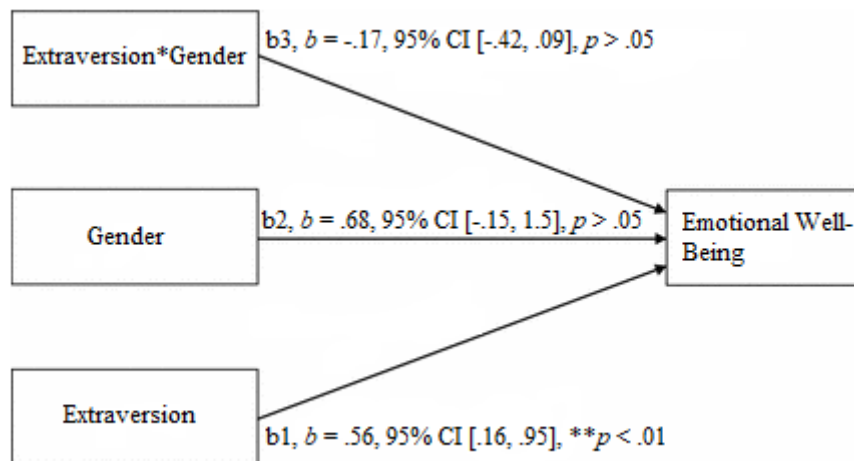
extraversion and social well-being

The Moderating Effect of Gender on the Relationship between Extraversion and Well-Being

Emotional Well-Being

For all moderations, unstandardized scores were reported. It was found that the effect

of extraversion (X) on emotional well-being (Y) was significant (see Figure 4). Gender (W)

did not significantly predict emotional well-being (Y). Moreover, the interaction effect

between extraversion (X) and gender (W) was non-significant. Therefore, unlike expected, it

was found that gender did not moderate the relationship between extraversion and emotional

well-being. This means that gender did not change the effect of extraversion on emotional

well-being.

Figure 4

The moderating effect of gender on the relationship between extraversion and emotional well-

being

Figure diagram: Extraversion*Gender → Emotional Well-Being, b3, *b* = -.17, 95% CI [-.42, .09], *p* > .05. Gender → Emotional Well-Being, b2, *b* = .68, 95% CI [-.15, 1.5], *p* > .05. Extraversion → Emotional Well-Being, b1, *b* = .56, 95% CI [.16, .95], **p < .01.
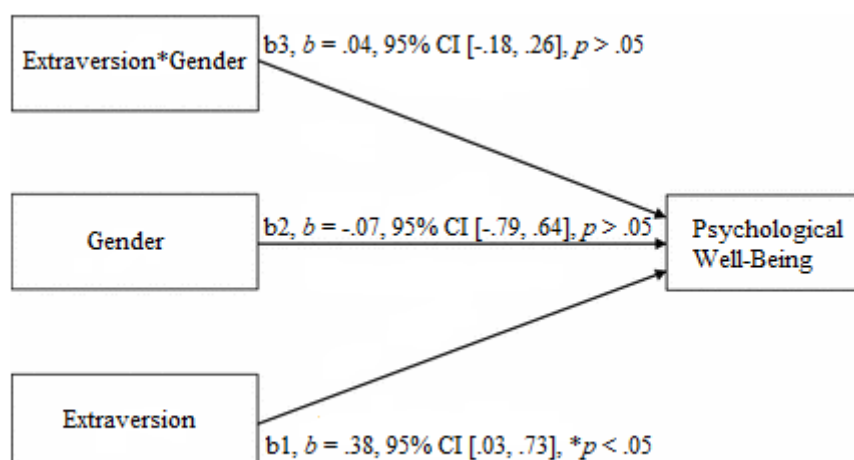
Psychological well-being

It was found that the effect of extraversion (X) on psychological well-being (Y) was significant (see Figure 5). Gender (W) did not significantly predict psychological well-being (Y). The interaction effect between extraversion (X) and gender (W) was non-significant. Hence, unlike hypothesized, it was concluded that the relationship between extraversion and psychological well-being was not moderated by gender.

Figure 5

The moderating effect of gender on the relationship between extraversion and psychological well-being

Figure diagram: Extraversion*Gender → Psychological Well-Being, b3, *b* = .04, 95% CI [-.18, .26], *p* > .05. Gender → Psychological Well-Being, b2, *b* = -.07, 95% CI [-.79, .64], *p* > .05. Extraversion → Psychological Well-Being, b1, *b* = .38, 95% CI [.03, .73], *p < .05.
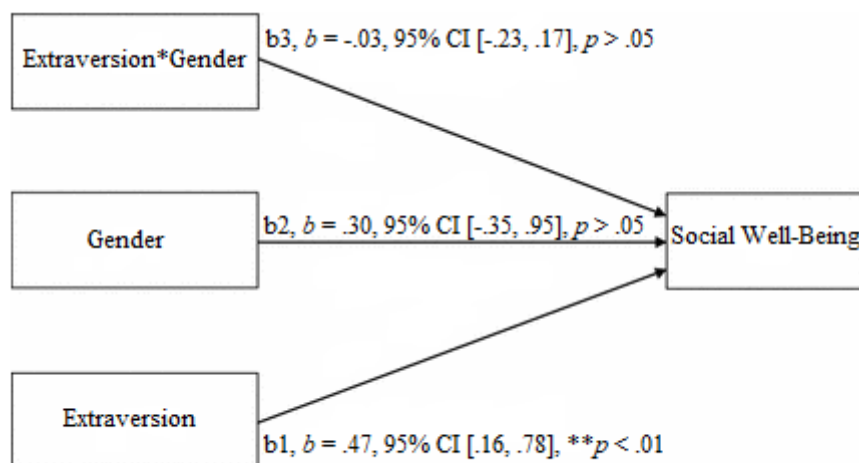
Social Well-Being

It was found that extraversion (X) significantly predicted social well-being (Y) (see Figure 6). The effect of gender (W) on social well-being (Y) was non-significant. The interaction effect between extraversion (X) and gender (W) was also non-significant. It was concluded that, unlike expected, gender did not moderate the relationship between extraversion and well-being.

Figure 6

The moderating effect of gender on the relationship between extraversion and social well-being

b3, $b = -.03$, 95% CI [-.23, .17], $p > .05$ (Extraversion*Gender)

b2, $b = .30$, 95% CI [-.35, .95], $p > .05$ (Gender → Social Well-Being)

b1, $b = .47$, 95% CI [.16, .78], **$p < .01$ (Extraversion)

Discussion

The overarching aim of the current study was to determine to which extent extraversion affected the participants' emotional, psychological, and social well-being in times of corona (1). A subsequent aim was to examine whether the adherence to social distancing measures mediated the relationships between extraversion and the three dimensions of well-being in times of corona (2). Another subsequent aim was to determine to which extent gender moderated the relationships between extraversion and the three dimensions of well-being in times of corona. (3) It was found that higher levels of

extraversion had a positive effect on the participants' emotional, psychological, and social well-being (1). There was no mediating effect of adherence to social distancing measures on the relationships between extraversion and the three dimensions of well-being (2). Finally, the participants' gender did not moderate the relationships between extraversion and emotional, psychological, or social well-being (3).

Interpretation

Considering the first research question, there was contradicting evidence about whether extraversion causes increased levels of well-being in times of the pandemic (Folk et al., 2020) or decreased levels of well-being (Gubler et al., 2020). It was concluded that higher levels of extraversion positively influenced emotional, psychological, and social well-being during the pandemic. A possible explanation for the positive effect of extraversion on the dimensions of well-being might be that extraversion serves as a buffer in crisis situations such as COVID-19 because extraverts have higher levels of perceived support than introverts (Folk et al., 2020), which could positively affect their mental well-being. Through the distinction between the dimensions of well-being, two other conclusions could be made. First of all, the levels of overall mental well-being were lower in times of corona compared to prior to the pandemic. In their study using the MHC-SF, Lamers and colleagues (2011) also used a sample from the LISS panel. The means that they found for overall, emotional, and psychological well-being were higher than the means in the current study, while the mean for social well-being was similar. It could be concluded that overall, emotional, and psychological well-being dropped compared to pre-corona times, while social well-being appears to be quite stable across time. Secondly, it was found that extraversion predicted emotional well-being to a somewhat smaller extent than the other dimensions, while it predicted psychological and social well-being to a similar extent. This finding is comparable to the results by Lamers and colleagues (2012), who studied the relationship between

personality and well-being using the LISS panel. They found that extraversion did not predict emotional well-being, while it contributed significantly to psychological and social well-being. It could be concluded that despite COVID-19, similar relations can be found nowadays between extraversion and psychological and social well-being, respectively. Extraversion appears to be a strong trait that maintains its positive effect on psychological and social well-being across crises such as COVID-19.

Considering the second research question, contrary to the expectation, it was found that the adherence to social distancing measures did not mediate the relationship between extraversion and the three dimensions of well-being. This finding contradicted with other research findings (Brouard et al., 2020; Stieger et al., 2020; van Zyl, 2021). In their study on personality and the adherence to corona restrictions, Brouard and colleagues (2020) presented their participants with at least 7 items and 10 response options to measure adherence. Van Zyl (2021) used seven weekly self-assessments and a final assessment after one month to measure their participants' adherence. Stieger and colleagues (2020) used experience sampling to measure the participants' levels of adherence and well-being over the course of 21 consecutive days. More detailed data was collected in these studies, especially considering that in the current study, the participants' adherence and well-being were assessed solely at one point in time. The main issue could be that the instrument that was used to measure adherence in the current study was only administered once and was less differentiated and reliable compared to the ones used in previous studies. Furthermore, there might be other factors that affect adherence to social distancing measures that are more predictive than personality traits or extraversion in particular. For instance, according to Canning and colleagues (2020), people who are above the age of 50 or experience symptoms such as shortness of breath are more likely to adhere to social distancing guidelines. Therefore, it could be the case that age and the presence of symptoms are perceived risks that convince

people to adhere more strictly to such restrictions. Being younger and free of symptoms might then be more indicative for not adhering to social distancing measures than extraversion.

Considering the third research question, gender did not moderate the relationship between extraversion and the dimensions of well-being. Therefore, the hypothesis that gender acted as a moderator was rejected. It is possible that equating women's reliance on social support and valuing social relationships with extraversion was an assumption that was too far-fetched and left out other aspects of extraversion. There are more facets that belong to extraversion, such as assertiveness or sensation-seeking (Aluja et al., 2003; McCrae & Costa, 1999), which were not considered in the hypothesis. It was hypothesized that women experience a steeper decrease in well-being because they value social relationships and interaction more than men and tend to regulate their stress levels by using social support strategies (Joshanloo, 2016; López-Madrigal et al., 2021), which can be done to a lesser extent during the pandemic. This information may not explicitly imply that the relationship between extraversion and well-being is stronger for women. As suggested by Modersitzki and colleagues (2020), it stands to reason that personality traits such as extraversion influence well-being independently of demographic characteristics such as gender. Moreover, the regulation of stress levels, which was assumed to happen through social support strategies in women (López-Madrigal et al., 2021), could play a role in well-being that was not investigated further in the current study. For instance, Gubler and colleagues (2021) found that in times of corona, maladaptive cognitive strategies such as rumination are associated with lower levels of mental well-being in introverts, while emotion suppression is associated with lower levels of well-being in extraverts. Hence, another potential moderator for the relationship between extraversion and well-being could be the kinds of strategies that people use to regulate their emotions in times of corona. Another possible moderator for the relationship between extraversion and well-being could be so-called extraversion-deficit beliefs. Extraversion-deficit beliefs indicate that a person wishes to be more extraverted than

they currently are (Lawn et al., 2019). Lawn and colleagues (2019) found that introverts experienced greater levels of well-being when they accepted their introversion and did not wish to be more extraverted even though extraversion tends to be desired in Western cultures. Therefore, the extent of the participants' extraversion-deficit beliefs might be another potential moderator of interest.

Limitations and Strengths

There are a number of limitations and strengths to this study that should be taken into consideration. First of all, a large number of participants was excluded from the sample, which could have led to an underestimation of possible effects. However, a strong point was that there was no selection bias involved in the participation, which was shown through a series of t-tests and chi-square tests between the excluded and the final sample. The respondents' inclusion in the current study did not depend on their gender, age, educational level, domestic situation, or level of extraversion. Selection bias is a kind of systematic error that negatively affects the study participation and subsequently negatively affects the internal validity of the study (Tripepi et al., 2010). In the current study, the lack of selection bias speaks for adequate internal validity.

An additional limitation was that there was only one specific scale available in the LISS panel to measure the adherence to social distancing measures, which had a low reliability value. The Cronbach's alpha was increased by excluding items with a low item-rest correlation, but it was still relatively low and barely managed to cross the threshold to being an acceptable value (α=.52). It appears that the measure is not quite consistent and might not yield the same or similar results if used again. The extraversion and well-being scales, however, had high reliability coefficients. This means that, for the well-established extraversion scale, the previous reliability value could be confirmed, and for the revised MHC-SF, it was discovered that the questionnaire is reliable.

Another limitation was that a number of items of the revised MHC-SF did not load on the intended factor. This implies that there was a problem with construct validity. Construct validity refers to the representational accuracy of scales (McGrath et al., 2005). It appears that the items did not accurately capture the intended constructs. Hence, it might be the case that the relationships between the dimensions of well-being and the other variables, as well as the mediating and moderating effects, were affected by the lack of construct validity in the items. Nevertheless, it is worth mentioning that the factor analysis showed that, as intended, the items measured three separate constructs. In addition, it was found that three of the four novel items on social well-being accurately loaded on the intended factor, thus proving to measure the intended construct to a large extent.

Moreover, gender and adherence were not included in a single analysis but kept separate. This is a limitation because social distancing measures were an implicit part of the moderation analysis that was not explicitly tested. The assumption was that the lack of social interaction in times of corona specifically has a stronger negative effect on women's well-being. This lack of social interaction is directly linked with social distancing, which was not taken into account in the moderation analysis. A solution to this could have been a moderated mediation analysis including both gender and adherence to social distancing measures, which exceeded the scope of the current study.

One final limitation is that while using extraversion levels from 2019 and well-being levels from 2020, it could not be assessed whether well-being has changed due to the pandemic. It is not clear whether levels of well-being changed within the sample, and if they did, if the pandemic was related to the change. However, through the longitudinal design of the current study, it was possible to determine that trait measures of extraversion from 2019 predicted levels of well-being in 2020. The longitudinal design is one of the strengths because

it distinguishes the current study from previous studies about mental well-being in times of corona, which were cross-sectional.

Implications for Future Research

Based on the limitations of the current study, suggestions can be made for future research. First of all, the participants' adherence to social distancing measures should be measured differently. It might be an option to use a repeated measures design such as experience sampling to measure adherence as well as well-being over a certain period of time rather than just one retrospective point in time. In experience sampling, the participants fill in the same self-reports repeatedly (van Berkel et al., 2017). This makes the data less biased and more meaningful than self-reports that are filled in only once in retrospect (Naab et al., 2019), which was done in the current study.

Since no mediating effect of adherence on the relationships between extraversion and the dimensions of well-being could be found in times of corona, it is recommended to study other factors that could play a role. For example, Canning and colleagues (2020) found that people who develop symptoms such as shortness of breath and are above the age of 50 tend to adhere more strictly to restrictive measures. It might be the case that being younger and free of symptoms is more predictive for not adhering to social distancing measures than being extraverted. It might also be useful to include mediators other than adherence, such as resilience. McDonnell and Semkovska (2020) studied the extent to which resilience mediated the relationship between extraversion and depressive symptoms in Irish university students. They concluded that resilience indeed explained the relationship between extraversion and depressive symptoms. According to Yıldırım and Arslan (2020), resilience positively influenced people's levels of well-being during the pandemic. Hence, it might be worth investigating whether resilience mediates the relationship between extraversion and the dimensions of well-being in times of corona.

Since no moderating effect of gender on the relationships between extraversion and the three dimensions of well-being in times of corona could be found, it is also recommended to study other moderators that could be of importance. According to Gubler and colleagues (2021), emotional regulation strategies such as rumination lead to lower levels of well-being in introverts and strategies such as emotion suppression lead to lower levels of well-being in extraverts. It might be worth investigating to which extent different kinds of emotion regulation strategies influence the dimensions of well-being and if they possibly moderate the relationship between extraversion and well-being. Another possible moderator for the relationship between extraversion and well-being could be extraversion-deficit beliefs. Lawn and colleagues (2019) studied whether wishing to be more extraverted moderated the relationship between extraversion and overall mental well-being. They found that introverted participants had higher levels of overall mental well-being when they were satisfied with their introversion and did not have extraversion deficit-beliefs. Lawn and colleagues (2019) summed the three subscales of the MHC-SF to explore overall levels of mental well-being. A possible further step could be to investigate the moderating role of extraversion-deficit beliefs in the relationships between extraversion and emotional, psychological, and social well-being, respectively. That way, it could be determined whether the extent to which the participants wish to be more extraverted plays a role in the experience of all three kinds of well-being. An according next step could be to investigate these possible mediators and moderators that might contribute to the relationship between extraversion and the dimensions of well-being.

Conclusion

The current study suggests that extraversion predicts all dimensions of well-being in times of the corona pandemic. Additionally, it suggests that extraversion predicts emotional well-being to a somewhat smaller extent than psychological and social well-being. Despite corona, the positive effect of extraversion on psychological and social well-being remained

stable across time. Moreover, while overall, emotional, and psychological well-being dropped compared to pre-corona times, levels of social well-being remained stable despite COVID-19. It is advised to investigate factors other than adherence and gender that could influence well-being or the relationship between extraversion and well-being in times of corona. Potential factors could be age, the presence of COVID-19 symptoms, resilience, emotion regulation strategies, or extraversion-deficit beliefs. Through such research, risk factors for decreased levels of well-being could be collected, based on which further measures to preserve especially the population's emotional and psychological well-being could be taken. For future restrictive corona measures, policy makers are advised to keep in mind that introversion is linked with decreased support-seeking behavior and rumination. Such individual differences should not be overlooked by policy makers due to the crucial difference they could make to the population's well-being in times of corona.

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Appendix A: Factor Analysis

A factor analysis was conducted on the revised MHC-SF using a principle component analysis and varimax rotation (see Table 4). The Kaiser-Meyer-Olkin Measure (KMO) showed a value of .934, confirming that the sampling was adequate and the data was suited for a factor analysis. The scree plot revealed that the items loaded onto three separate factors with an Eigenvalue higher than 1. Factor 1 was equated with emotional well-being, factor 2 with social well-being, and factor 3 with psychological well-being. The three items on emotional well-being accurately corresponded to factor 1. However, not all items corresponded to the intended factors according to the revised MHC-SF. Items 4, 5 and 8 loaded on psychological well-being rather than social well-being. Items 9, 10 and 14 loaded on emotional well-being rather than psychological well-being. Item 11 loaded higher on social well-being than on psychological well-being. Moreover, item 15 loaded on psychological well-being rather than social well-being. This leaves items 6, 7, 16, 17 and 18 to accurately correspond to social well-being, and items 12 and 13 to accurately correspond to psychological well-being. The theoretical distribution of items was maintained in the analysis, so that the results remained comparable to other studies.

Table 4

Factor loadings of the 18 items of the revised MHC-SF

Factor	Item	1	2	3
	In the past week, how often did you feel…?			
Emotional Well-Being (1)				
	1. I am happy.	**.770**	.240	.164
	2. I am interested in life.	**.719**	.287	.196
	3. I am satisfied with my life.	**.825**	.303	.168

Social Well-

Being (2)

4. I make a valuable contribution to our society.	.201	.189	**.749**
5. I think our country is developing well.	.220	.245	**.492**
6. I accept others as they are.	.315	**.431**	.125
7. I belong to a group of people.	.144	**.596**	.300
8. I understand how our society works.	.355	.124	**.576**

Psychological

Well-Being (3)

9. I accept myself as I am.	**.714**	.230	.269
10. I have mastery of my life.	**.697**	.216	.333
11. I share love and sorrow with some people.	.273	**.701**	.263
12. I can develop myself.	.076	.214	**.762**
13. I dare to express my ideas.	.290	.337	**.587**
14. I feel my life has meaning.	**.574**	.361	.487

Additional Items

on Social Well-

Being (2)

15. I can mean something to others.	.221	.453	**.633**
16. I am satisfied with my social contacts	.364	**.667**	.211
17. I feel related to other people.	.237	**.818**	.308
18. I can count on others to help me.	.279	**.811**	.237

Note. **Bold** = Highest factor loading for the item.

Appendix B: Questionnaires

Questionnaire 1: The Extraversion Scale from the IPIP by Goldberg (1999)

1. I am the life of the party.

2. I don't talk a lot.

3. I feel comfortable around people.

4. I keep in the background.

5. I start conversations.

6. I have little to say.

7. I talk to a lot of different people at parties.

8. I don't like to draw attention to myself.

9. I don't mind being the center of attention.

10. I am quiet around strangers.

Questionnaire 2: The Revised Version of the MHC-SF by Westerhof and ten Klooster (2020)

1. I am happy.

2. I am interested in life.

3. I am satisfied with my life.

4. I make a valuable contribution to our society.

5. I think our country is developing well.

6. I accept others as they are.

7. I belong to a group of people.

8. I understand how our society works.

9. I accept myself as I am.

10. I have mastery of my life.

11. I share love and sorrow with some people.

12. I can develop myself.

13. I dare to express my ideas.

14. I feel my life has meaning.

15. I can mean something to others.

16. I am satisfied with my social contacts.

17. I feel related to other people.

18. I can count on others to help me.

Questionnaire 3: The Item on Social Distancing Measures from the LISS Panel Module

"Effects of the Outbreak of COVID-19"

Which of the following recommendations did you act upon in the past week?

1. Avoid crowded places.

2. Avoid public spaces.

3. Keep a distance from others (1.5 meters).