The effect of romantic rejection on subjectively perceived pain through online dating

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Abstract

Online dating is becoming an increasingly popular way to find a romantic partner. The present study examined whether being romantically rejected in an online setting would evoke pain among individuals. To test this, an online dating site was set up in which pictures and dating profiles of males and females were presented. Participants consisted of heterosexual singles (N = 82) that had to judge these online dating profiles of potential romantic partners of the opposite sex. They had to state whether they would like to go on a date with these individuals or not. Afterwards, they were shown the profiles again, but this time with their own judgement and the judgement they had gotten from the potential partners. They had to indicate how painful and rewarding these received judgements were to them. For every potential partner one of the four following conditions could be presented: rejection, a match, an unrequited condition and a disinterest condition. Every condition showed to evoke pain. However, rejection showed to evoke significantly more pain compared to the other conditions. Therefore, it can be concluded that being rejected through online dating by someone you are interested in is painful to individuals. Gender, levels of social anxiety and levels of depression did not influence the pain experienced after rejection.

Love has been identified to be one of the basic human needs (Maslow, 1943). According to the evolutionary theory of love, the function of love is to attract and retain a partner with the intent of reproducing and after that caring for the offspring (The Evolutionary Theory of Love: Definition, Examples & Predictions, 2013). In other words, our ultimate goal is to successfully reproduce, and the romantic love we feel is a tool to help us get there. In the last few years people have increasingly been turning to online dating sites to meet new people and build these kinds of relationships (Huang, Stringhini & Yong, 2015). In 2017, approximately 14 percent of all couples in the Netherlands met each other through the internet (Tankovska, 2021). It is expected that the number of users of online dating services will increase over the upcoming years. According to Blumtritt (2021) in 2024 there is expected to be about 8.7 million users of online dating services in Europe alone.

Seeking a romantic date through the web offers different advantages such as control, convenience and affordability (Ellison, Heino, & Gibbs, 2006). But just like in person dating, online dating also means there is a chance to get rejected by the person you are interested in. In many situations, rejection can be painful and powerful, but being rejected by the person you like or even love, is perhaps the most painful of them all (Leary, 2006). Nevertheless, when compared to, say, social rejection, there has been a limited amount of research done into

romantic rejection. This is most likely due to the fact that it is difficult to create a research design that can investigate romantic rejection.

However, there have been some studies that have tried to investigate romantic rejection in a laboratory setting. These studies primarily look at the neural effects of romantic rejection. Fisher, Brown, Aron, Strong and Mashek (2010) have looked at the neurological state of healthy individuals that were recently rejected by their romantic partner. The participants were given a photograph of their ex-partner and a neutral photograph of a familiar person that had the same sex as their ex-partner. This study showed that the photograph of the ex-partner, compared to the neutral photo, triggered higher activation in different brain areas, including areas that are associated in the dopaminergic reward system. Additionally, reminiscing about an ex-partner activated the dorsal anterior cingulate cortex (dACC) and the anterior insular cortex (AI). Both of these regions are involved with the affective component of pain. This applies to both social and physical pain (Eisenberger, 2012).

This is supported in the experiment of Cooper, Kreps, Wiebe, Pirkl and Knutson (2010). In this experiment participants had to go on a face-to-face speed date with several potential romantic partners. After the date participants had to state whether they would like to go on a second date with the individuals they had seen. During the fMRI screening, the participants were shown their own answers and the answers of the individuals they went on a date with. Cooper et al. (2010) also found that romantic rejection elicited a higher dACC activity, which supports the result of the study of Fisher et al. (2010).

While there has been little research done into the neural effects of romantic rejection, there is even less research about the effects of romantic rejection through online dating. This while online dating is gaining more and more popularity (Blumritt, 2021). One of the few studies that have been done into this specific area of romantic rejection, has been executed by Van der Veen, Burdzina and Langeslag (2019). Van der Veen et al. examined whether romantic rejection through online dating would evoke differential electrocortical and cardiac responses. They created a database that was similar to an online dating website, where personal information and photographs of the participants were shown. Participants had to decide whether they would like to go on a date with the potential romantic partner or not. Subsequently, the participants engaged in an EEG session and were shown their own responses and the responses they had gotten from the potential partners. The cardiac and electrocortical responses of the participants were measured. This study found a significantly larger P3 response when participants received a positive evaluation compared to negative evaluations. Earlier studies about the effects of reward on the P3 amplitude have shown that a larger P3 is shown in response

to positive rewarding outcomes (Bellebaum, Polezzi, & Daum, 2010; Hajcak, Moser, Holroyd, & Simons, 2007; Van den Berg, Shaul, Van der Veen, & Franken, 2012). The study of Van der Veen et al. (2019) supports these findings. In addition, Van der Veen et al. found a significantly larger cardiac deceleration when participants received a negative evaluation when compared to positive evaluations, which is in line with results of earlier research about social rejection. Earlier research has shown that cardiac deceleration is related to an activation of the dACC (Gunther Moor, Crone, & van der Molen, 2010). As has been stated earlier, the dACC is involved with the affective component of social and physical pain (Eisenberger, 2012). Thus, it can be implied that romantic rejection through both online dating and in person dating can cause physiological reactions that can also be seen with physical and social pain.

Although these neural and physical effects of romantic rejection have been found, these responses can vary between people. Like stated earlier, there is a limited amount of research done into romantic rejection. In addition, the studies that have looked at romantic rejection mostly focus on the effects caused by romantic rejection. For example, it has been found that romantic rejection is associated with a wide range of negative psychological consequences, such as anxiety, mood swings depression, and sometimes even suicide (Monroe, Rohde, Seeley & Lewinsohn, 1999; O'Donnell, Farmer, & Catal, 1996). However, there is a limited amount of research that looks at individual differences that can cause some people to have a predisposition for the negative effects of romantic rejection. It is important that we look at these individual differences, because this can help us identify vulnerable individuals. Subsequently, we can use this information to adapt our treatments to these vulnerable people, so that the negative consequences of romantic rejection can be alleviated or even prevented.

The variations between individuals in response to romantic rejection, can be attributed to different variables, such as gender. Literature often suggests that there are gender differences regarding (subjective) pain experience. According to the study of Unruh (1996), females are more prone than males to experience a variety of persistent pains. Pain perception and behaviour may be influenced by underlying biological differences in pain processes, which may predispose women to have more pain and affect recovery, but pain perception and behaviour are also influenced by social and psychological factors. Role obligations, psychological distress, economic position, level of self-satisfaction, contact with young children, and the social support network have all been found to have a role in gender variance in health outcomes in sociological studies (Heloe & Heloe 1975; Davis, 1981; Verbrugge, 1985; Klonoff & Landrine, 1992). Van der Veen,Van der Molen, Van der Molen and Franken (2016) have argued that females could also be more prone to pain experience after social and romantic rejection,

because these types of rejections are related to negative outcomes and females are more sensitive to these outcomes than males. This is supported by the study done by Benenson et al. (2013). They have studied gender differences in response to social exclusion. It has been found that females register cues revealing social exclusion more quickly than males do. In addition, females' heart rate rises faster than males' in response to social exclusion. According to Benenson et al. (2013) females are more sensitive to social exclusion, because they have a stronger dependence on isolated one-on-one relationships than males. To reach these one-on-one relationships, social exclusion of others is an effective technique. Considering this explanation, it would make sense to expect the same results for romantic rejection. However, in the 2019 study of Van der Veen et al. contradictory results have been found for romantic rejection compared to social rejection. Van der Veen et al. found that there were no differences between males and females when it comes to their response to romantic rejection. Although the social rejection and romantic rejection experiments were different, these differences do not provide an adequate explanation for the different results. Therefore, it is important that there is further research done into the gender differences when it comes to romantic rejection.

In addition to gender differences, individual psychopathological differences could possibly influence the response to pain after rejection. One of the most prevalent mental disorders, are anxiety disorders with around 284 million diagnosed individuals in 2017 worldwide (Ritchie & Roser, 2018). This makes up for about 3.8% of the world population. One of the most common and well-known anxiety disorders is the social anxiety disorder (The Recovery Village, 2020). Social anxiety disorder is also referred to as social phobia. It is characterized by a strong fear for social settings, which causes significant distress and impairs a person's ability to function normally in different aspects of their daily life (National Collaborating Centre for Mental Health (UK), 2011). Individuals with social anxiety disorder are afraid that they will be judged, humiliated, and rejected (National Institute of Mental Health, 2016). This fear of being rejected can in turn influence the relationships of people with social anxiety. For example, it has been found that individuals with higher levels of social anxiety are less open in their romantic relationships (Cuming & Rapee, 2010; Sparrevohn & Rapee, 2009), are more critical of their partners during negative situations (Wenzel, Graff-Dolezal, Macho, & Brendel, 2005), and feel less close to their romantic partner when they are in pain or discomfort (Kashdan, Volkmann, Breen, & Han, 2007). Afram and Kashdan (2015) investigated whether people with greater social anxiety responded more defensively when there was a threat of rejection, compared to people with less social anxiety. In this experiment, 51 couples were assigned to either a rejection condition or a neutral condition. In the rejection condition, the

participants were made to think that their spouse was listing a large amount of negative qualities about them. In the neutral condition, participants were given a non-threatening task. Before each participant started the experiment, they had to fill in a number of surveys that included different measures like measures of social anxiety, depression and rejection sensitivity. The findings of this study demonstrated an association between social anxiety and fears about rejection that could not be explained by depressive symptoms, rejection sensitivity, attachment patterns or trust. Following the rejection condition, individuals with higher social anxiety scores coped with these fears, by devaluing their romantic partners. In contrast, participants in the neutral condition adopted an overly positive perception of their partners. These results show that people with higher levels of social anxiety use defensive strategies for risk management in aversive relational contexts. This experiment however mainly focuses on the coping mechanisms of people with social anxiety when there is a threat of romantic rejection by their partner. There has not yet been a study that has looked at the subjectively experienced pain that people with social anxiety experience when they are dealing with actual romantic rejection from strangers.

Another prevalent mental disorder is depression, with about 264 million people affected worldwide (Ritchie & Roser, 2018). The term depression is used to describe a variety of mental health issues that are characterized by a lack of positive affect (a loss of interest and enjoyment in everyday activities), a low mood, and a variety of cognitive, physical, emotional and behavioural symptoms (Kendrick & Pilling, 2012). Depression differs from normal mood swings and short-term emotional responses to ordinary difficulties (World Health Organization, 2020). Depression can be dangerous to one's health, especially if it lasts for a long period of time and has a moderate to severe intensity. The person who suffers from depression can be affected in their performance at work, at school and in their interpersonal functioning. Being excluded socially and romantically, in addition to suffering from depression, could possibly worsen these symptoms. Because of the negative effects that depression can cause, it is possible that people with depression experience romantic rejection differently from non-depressed people. Most research done into depression and rejection, only investigates whether rejection can cause (symptoms of) depression. However, there are very little studies that look at the effect of depression on the experiences people have after being rejected. Nezlek, Kowalski, Leary, Blevins and Holgate (1997) have executed one of these studies. In their experiment a group of depressed and a group of non-depressed females were recruited. Every session consisted of five participants and each one of them was told that they were part of an experiment about decision making. They were told that information about them would be reviewed by other participants

in the session. Subsequently, every participant had to choose three other participants to work in a group with. The remaining participant had to work alone. After every participant was told whether they were chosen or not, they had to fill in some questionnaires. The results showed that depressed participants felt less accepted than the non-depressed participants. This is in line with the social exclusion perspective on depression. However, a limitation of this study is that only females were examined. Furthermore, this study only looks at social rejection and has not looked into romantic rejection.

When we combine all of these research results and theories, it is clear that there has been very little research done into the subjective experienced pain that people feel after being rejected romantically. Even less research is done into romantic rejection through online dating, while this form of dating is increasingly used worldwide. Because of the negative effects that romantic rejection can cause, it is important that we look further into this. Therefore, the main goal of this study is to investigate what the effect of romantic rejection through online dating is on the subjectively perceived pain of individuals. There will be four conditions in this study: the romantic rejection "yes/no"- condition (the participant wants to go on a date with the other person, but the other person says no to the date), the match "yes/yes"- condition (both individuals want to go on a date with each other), the unrequited "no/yes"- condition (the participant does not want to go on a date with the other person, but the other person wants to go on a date with the participant), and lastly the disinterest "no/no" condition (neither of the individuals want to go on a date with each other). Given previous brain research, it is expected that romantic rejection will cause significantly more subjective pain to the participants than the other conditions. Additionally, the influence of gender on the subjectively experienced pain after romantic rejection through online dating will be tested. Despite the contradictory results, it is expected that females will report higher pain scores in response to rejection than males. This is in line with the results and explanation given by Benenson et al. (2013). Furthermore, this study will look into the influence of social anxiety on the subjectively experienced pain after romantic rejection through online dating. Because of the results of earlier research and the fact that most individuals with social anxiety are more scared of rejection than healthy people, it is assumed that higher levels of social anxiety will show more subjectively experienced pain after romantic rejection than lower levels of social anxiety. Finally, we look at the influence of depression on subjectively experienced pain after romantic rejection through online dating. Although there is not much research done into this topic, it is expected that individuals with higher levels of depression will report higher levels of pain in response to romantic rejection.

This is assumed because individuals with depression have a lack of positive affect, possibly causing negative affects to be reinforced.

To answer these research questions, we will use an online dating paradigm. Before starting the experiment, participants will complete questionnaires that look at demographic variables, social anxiety and depression. Afterwards, the participants will look at different online dating profiles and decide whether they would go on a date with that person or not. In the last part of the experiment, participants are shown their own judgement and how they were judged by their counterparts. For each person they have to indicate how painful and rewarding the results are.

Method

Participants

This study consisted of 110 healthy, heterosexual males and females that had completed the experiment completely. These participants were between the ages of 18 and 37 years old (M = 21.5 en SD = 2.17). They could not have had any family or personal history of diagnosed psychiatric or neurological diseases. Furthermore, the participants could not have any somatic illness and did not use any medication that could affect their brain function. At the end 28 participants did not meet these criteria and were excluded from the experiment. That left this study with 82 participants (see Table 1). Psychology students could register for the experiment through the Erasmus Behavioral Lab administration system. Students that had completed the entire experiment, were rewarded two participant hours. In addition, participants were recruited by means of flyers on social media platforms like Instagram and Facebook. This study was approved by the Ethics Committee of the Erasmus University. Before starting the experiment, participants were given an online informed consent form.

Table 1

Descriptive Statistics per Gender

Gender		N	Minimum	Maximum	Mean	Std. Deviation
Female	Age	64	18	27	21.27	2.155
Male	Age	18	18	25	22.39	2.033

Materials and Procedure

This study had a cross-sectional repeated measures design. The study was carried out online. This means that the participants could use either a computer or smartphone to complete the experiment. Participants had to perform a romantic judgment paradigm (RJP). The participants who had signed up for the study were asked to send in a photograph and a short description of themselves. They were informed that they had to evaluate participants of the opposite sex based on their dateability and that they would be receiving similar feedback on their photograph and biography. The experiment was supposed to be an online dating experience, so the picture and biography of the participants had to be judged based on the first impression. After sending in their photograph and biography, the participants were sent the first link to the experiment. Before starting the first part of the experiment, they had to sign their informed consent. Thereafter, they had to complete a number of questionnaires (see section questionnaires) using Qualtrics. Subsequently, the participants had to rate 60 pictures of fellow participants of the opposite sex in Qualtrics. The judgement options were "yes/no, I would (not) like to go on a date with this person". The profiles that the participants had to judge were photos of people from different ethnic backgrounds taken from a face database. There were 20 Dutch profiles, 20 Turkish profiles and 20 Chinese profiles to be judged. These faces were selected based on similar facial features, such as people smiling with no teeth and no facial hair. This way these characteristics would not intervene with the results as confounding variables. The profiles were shown in the same sequence for every participant, in which the sequence of the different ethnicities was alternated. Participants were not aware of the fact that the profiles they judged and the feedback they had received were fake.

About a week after completing the first part of the experiment, participants received a link to the second part of the study. In the second part of the experiment the participants were shown their initial ratings and the ratings that they had gotten from their counterparts. The profiles and ratings were shown in the same sequence as the first part of the experiment for every participant. The amount of positive and negative ratings that the participants received, were manipulated to be equal for all participants (50% "like" and 50% "do not like"). The feedback responses were presented in a randomized order consisting of the four conditions. The first condition being the matches (Yes-Yes condition, match). The second condition consisted of "like" evaluations that were not returned (Yes-No condition, romantic rejection). The third condition consisted of "do not like" evaluations followed by "like" evaluations from the other party (No-Yes condition, unrequited). In the fourth condition the participants were presented with "do not like" evaluations that were returned (No-No condition, disinterest). After each response, the participants had to indicate how rewarding and painful their experience of the

feedback was on a ten-point Likert scale. There was no time limit for finishing either part of the experiment. The pain and reward ratings were transformed into data that could be used in SPSS.

After completing the second part of the experiment, participants got a debriefing about the experiment. In the debriefing participants were told that the people they judged were taken from a face database and that the feedback was randomly generated to test the effect of romantic rejection and acceptance on perceived reward and pain.

Questionnaires

Participants had to complete a number of questionnaires before starting the experiment. Personality traits were assessed with the revised and shortened 48-item version of the Eysenck Personality Inventory (EPQ-rss) (Eysenck & Eysenck, 1975). Each of these items consisted of a question to which the participant had to answer with "Yes" or "No". An example of one of these items was "Do you enjoy meeting new people?". The EPQ-rss had an internal consistency between $\alpha = .66$ and $\alpha = .86$.

Social anxiety was assessed through the Liebowitz Social Anxiety Scale (LSAS) (Liebowitz, 1987). The LSAS was a self-report questionnaire that was made up of 24 items. Each item contained of a statement that described a certain situation that could cause anxiety. The items had to be scored in two different ways: first the participants had to rate how much anxiety they felt in that situation, secondly the participants had to score how often they avoided this situation. Both anxiety and avoidance had to be rated on a four-point-Likertscale. The scale for anxiety ranged from "None" to "Severe". For avoidance the scale ranged from "Never (0% of the time)" to "Usually (67 – 100% of the time)". An example of one of the statements was "Calling someone you don't know very well". The participants had to score how much anxiety they would feel when you had to perform this activity and how often they tried to avoid it. The LSAS had a high internal consistency between $\alpha = .61$ and $\alpha = .98$.

To measure the existence and severity of symptoms of depression, the Beck Depression Inventory (BDI-II) was used (Beck, Steer & Brown, 1996). This self-report questionnaire consisted of 21 items. Each of these items corresponded with a symptom of depression. For almost each of the items there was a four-point-Likert scale ranging from 0 to 3, with 0 indicating that the item was least applicable to the participant and 3 indicating that the item was most applicable to the participant. For two of the items there were seven options to choose from. An example of one of the items of the BDI-II was to rate how much sadness the participant felt ranging from 0 (I do not feel sad) to 3 (I am so sad and unhappy that I can't stand it). This

questionnaire had an internal consistency between $\alpha = .92$ and $\alpha = .94$ and construct validity of .93.

Lastly, self-esteem was measured using the Rosenberg Self-esteem Scale (RSES) (Rosenberg, 1965). The RSES was also a self-report questionnaire that consisted of ten statements. Every statement had to be rated on a four-point-Likertscale, ranging from "Strongly agree" to "Strongly disagree". For example, the participants had to indicate to what extent they agreed with the statement "On the whole, I am satisfied with myself". The internal consistency of this questionnaire was high, with $\alpha = .86$.

For each questionnaire separately, the scores of the items were added up, resulting in every participant having a total score for each questionnaire.

Statistical Analysis

The results of the four different conditions (yes/yes, yes/no, no/yes, no/no) were analysed by carrying out a General Linear Model (GLM) two-way repeated measure in SPSS. Before carrying out this analysis, the assumptions of the GLM had to be checked. First, the assumption of independence was checked. Every participant had received the parts to the experiment separately and were asked to perform the experiment by themselves. Therefore, it was safe to assume that the measurements of the participants were separated from each other and the assumption of independence had been met. Subsequently, the assumption of normal distribution was checked. The degrees of freedom were greater than 20 in every condition. Therefore, it was assumed that the mean scores of the pain ratings had a normal distribution. Sphericity did not apply in this experiment, because every condition only had two factor levels. The Levene's test was used to assess homoscedasticity. The values that were found through the Levene's test were not significant, which meant that the assumption of equal error variance in the groups were met. It could be concluded that the assumption of normality was met.

After it was confirmed that the assumptions were met, the GLM analysis could be carried out. In this analysis the own judgement and the judgement of the counterparts were used as within-subject factors. In addition, gender was analysed with a GLM two-way mixed measure in which the own judgement and the other's judgement were used as within-subject factor while gender was used as between-subjects factor. For depression, social anxiety and self-esteem a GLM two-way repeated measure was used again, but this time the total scores of the BDI-II, LSAS and RSES were each used as covariates. Partial eta squared (η^2) was used to describe the effect size of every analysis. Scores were deemed significant when $p < .050$.

Results

Participants

For the analysis of the data, 28 participants had been excluded. These participants were excluded because they had a diagnosed mental disorder and/or were using medication that could affect their brain functioning. Participants that had only judged the profiles with the "no date" option were also excluded, because this data could not be used to examine rejection since there was no "yes/no" feedback for the participants to respond to. To detect any other outliers, the descriptive statistics were evaluated. It was found that two participants had a standardized residual value that was higher than 3. For all the mean scores, the Cook's distance was more than 1 and the uncentered Leverage values were under .10. Based on this information, these participants were not labelled as outliers. Eventually, the data of 82 of the participants has been used.

Questionnaire Analysis

A total BDI-II score of 0 to 13 was considered to be in the minimal range of depressive symptoms, a score of 14 to 19 was considered to be in the mild range, a score from 20 to 28 was considered to be in the moderate range, and finally a score of 29 to 63 was considered to be in the severe range. The mean score on the BDI-II questionnaire in this experiment was 10.67 (minimum = 0, maximum = 34, SD = 7.44). The mean score for the LSAS was 35.22 (minimum = 0 and maximum = 100, SD = 19.54). Participants that had scored between 0 and 29 on the LSAS were considered to be healthy and not have social anxiety. Participants that had scored between 30 to 49 were considered to have mild social anxiety. A score between 65 and 79 indicated social anxiety. A score between 80 and 94 was indicated to be severe social anxiety and lastly a score from 95 and up was considered to be very severe social anxiety.

Assumptions

Because the assumptions of the General Linear Model had been met, the analysis for the pain ratings, depression and social anxiety could be performed.

Pain Ratings

To check the effect of romantic rejection on subjectively perceived pain, a GLM two-way repeated measure was performed. The first main effect that was found, was a significant main effect for the own judgement of the participants, $F(1, 81) = 61.34$, $p < .001$, $partial\ \eta^2 =$

.43. Participants gave higher pain ratings when their own judgment was "yes" (M = 1.77), compared to scenarios where their own judgement was "no" (M =.89).

Subsequently, another main effect was found. It was found that the judgement of the other person had a significant effect on the pain rating given by the participants, $F(1, 81) = 77.34$, $p < .001$, *partial η^2* = .49. Participants noted lower pain ratings when they were judged with a "yes" by the other person (M = .55), in comparison to when they were judged with a "no" (M = 2.12).

Finally, an interaction effect between the own judgement and the judgement of the others was found, $F(1, 81) = 167.51$, $p < .001$, *partial η^2* = .67. To look further into this interaction effect, two paired samples t-test were performed. This analysis showed that the own judgement was significant regardless of the judgement that was given by the other person, $t(81) = -4.67$, $p < .001$. The judgement of the other person was not significant when the own judgement was "no", $t(81) = -.12$, $p = .91$. However, when the own judgement was "yes" the judgement of the other person was significant, $t(81) = -13.10$, $p < .001$.

Table 2

Descriptive Statistics of the Different Pain Conditions

|	N	Minimum	Maximum	Mean	Std. Deviation
Mean score pain yes/yes	82	0	3.08	0.22	0.49
Mean score pain yes/no	82	0	7.50	3.33	2.11
Mean score pain no/no	82	0	6.32	0.90	1.34
Mean score pain no/yes	82	0	5.17	0.88	1.42

Gender and Pain Ratings

A second GLM two-way for repeated measures was performed in which the influence of gender on pain ratings was examined. The results of this analysis show that both males and female experience more pain when they are rejected (yes/no – condition), compared to the other conditions (Figure 1). However, the difference between the four conditions was not significant. These results indicated that gender had no significant influence on the pain ratings given by the participants, $F(1, 80) = 0.03$, $p = .867$, *partial η^2* = .00. There was no significant interaction effect found between gender and own judgement, $F(1, 80) = 0.00$, $p = .965$, *partial η^2* = .00. Also, there was no significant interaction effect between gender and the judgements of others, $F(1, 80) = 0.38$, $p = .538$, *partial η^2* = .01. Lastly, the results showed no significant interaction

effect between gender, own judgement and the judgement of others $F(1, 80) = 0.00$, $p = .975$, *partial $\eta^2 = .00$*.

Figure 1

*Gender Differences between the Mean Scores of the Subjectively Experienced Pain in every Condition*
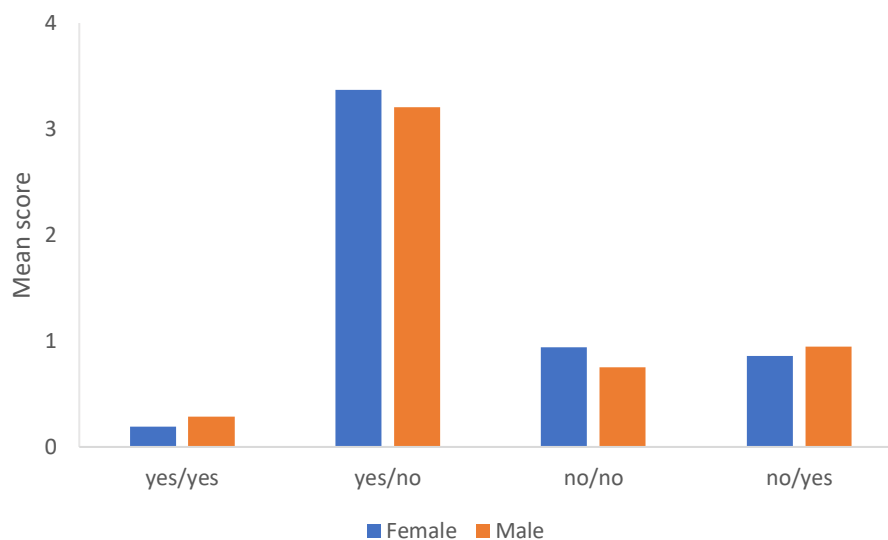
Social Anxiety and Pain Ratings

To test the influence of social anxiety on the pain ratings given by participants, another GLM two-way repeated measure was conducted. The results showed no main effects for the LSAS score, $F(1, 80) = 0.59$, $p = .445$, *partial $\eta^2 = .01$*. No correlation was found between the score obtained on the LSAS and the subjectively perceived pain experienced after rejection (Figure 2). The interaction effect between the LSAS score and own judgement was also not significant $F(1, 80) = 1.13$, $p = .292$, *partial $\eta^2 = .01$*. The same could be said for the interaction effect between the LSAS score and the judgements of others $F(1, 80) = 0.69$, $p = .409$, *partial $\eta^2 = .01$*. Lastly, the interaction between the LSAS score, the own judgement and the judgement of others, was also not significant, $F(1, 80) = 0.75$, $p = .390$, *partial $\eta^2 = .01$*.

Figure 2

*Scatterplot Demonstrating the Correlation Between Social Anxiety and the Pain Experienced After Rejection*
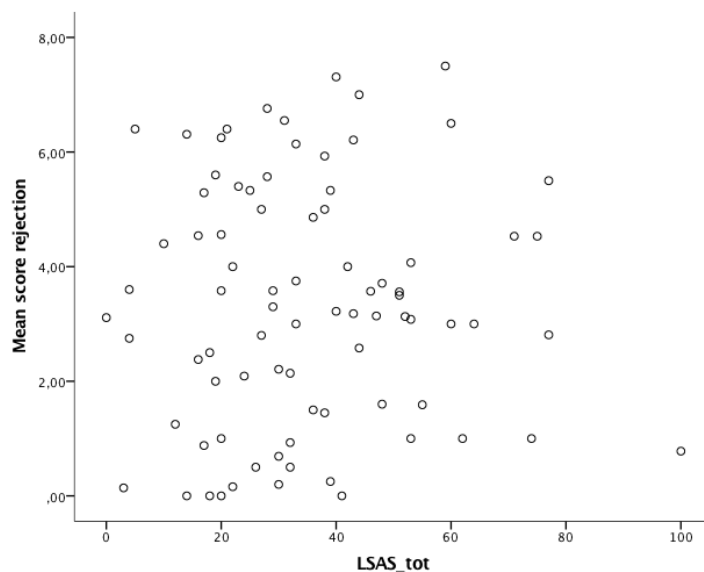
Depression and Pain Ratings

Lastly, a GLM two-way repeated measure was conducted to analyse the influence of depression on the given pain ratings. No main effects were found in this analysis, $F(1, 80) = 0.21$, $p = .650$, *partial η^2* = .00. There was no correlation found between the obtained depression scores and the subjectively perceived pain after rejection (Figure 3). The interaction between depression scores and own judgement was not significant, $F(1, 80) = 1.03$, $p = .312$, *partial η^2* = .01. The same was found for the interaction between depression scores and the judgement of others $F(1, 80) = 0.03$, $p = .866$, *partial η^2* = .00. For the interaction between depression scores, own judgement and the judgement of others, also no significant effect was found $F(1,80) = 0.09$, $p = .762$, *partial η^2* =.00.

Figure 3

Scatterplot Demonstrating the Correlation Between Depression and the Pain Experienced After Rejection Rejection
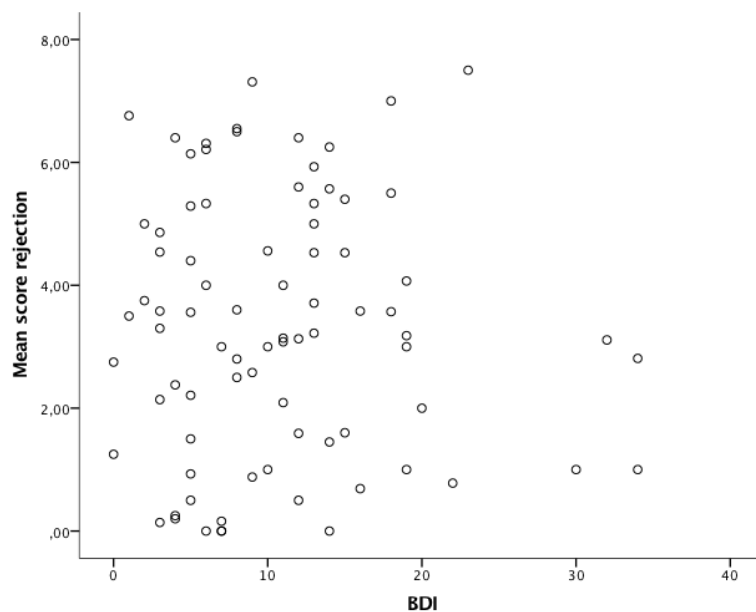
Discussion

The goal of this study was to investigate the effect of romantic rejection through online dating on the subjectively perceived pain of individuals. The present experimental design was largely based on a study done by Van der Veen et al (2019). Participants had to judge online profiles of individuals of the opposite sex and decide whether they would like to go on a date with them or not. To ensure that participants were truly invested in the assignment, they were told that the individuals they had judged, would also judge their online profiles. During the second part of the experiment, the participants were shown the same profiles again, however this time they also saw their own judgement and the judgement that they had gotten from the potential romantic partners. These judgements resulted in either one of these conditions: a match, rejection, an unrequited condition or disinterest from both parties. Participants then had to indicate how painful or rewarding the presented judgements were. In addition to the main goal of the experiment, gender, social anxiety and depression were also taken into consideration

to investigate whether variation in these variables could lead to different results regarding subjectively perceived pain after romantic rejection. It has been found that every condition causes pain. However, rejection (yes/no-condition) causes the most pain, compared to the other conditions. Gender, symptoms of social anxiety, and symptoms of depression do not influence the pain experienced after being romantically rejected.

Rejection being the most painful condition is in line with the results found by Van der Veen et al. (2019). Their study showed that rejection causes the most cardiac declaration compared to the three other conditions. Gunther Moor et al. (2010) have argued that cardiac declaration could be related to an activation of the dACC. In addition, Cooper et al. (2010) have found that romantic rejection in an in-person speed date setting elicits a higher dACC activation. The dACC is involved with the affective component of both social and physical pain (Eisenberger, 2012). Therefore, it was predicted that romantic rejection through online dating would cause the most pain. This was confirmed by the present study.

After rejection, the disinterests condition has shown to cause the most pain compared to the match and unrequited conditions. Van der Veen et al. (2019) have found the same results. Their study showed that there was more cardiac declaration in the disinterest condition compared to the match and unrequited conditions. Due to the possible relationship between cardiac declaration and an activation of the dACC, these results suggest that receiving negative romantic evaluations cause more pain than positive romantic evaluations. This can be explained by the evolutionary theory of love that suggests that love is used to obtain a romantic partner to reproduce with (The Evolutionary Theory of Love: Definition, Examples & Predictions, 2013). When we feel like potential romantic partners are not interested in us, it is possible that we feel pain because this means that our chances to reproduce are reduced. Due to the fact that the rejection and disinterest conditions are associated with negative evaluations, it makes sense that these conditions have caused more pain than the other conditions.

Considering the results found relating to negative romantic evaluations, it would make sense that positive romantic evaluations are wanted and do not cause any pain. However, the results of this study show that the unrequited condition (no/yes) and the match condition (yes/yes) also cause some pain, even though these conditions state that the potential partner is interested in you, thus providing a positive romantic evaluation. The pain experienced in the unrequited condition can be explained in two ways. First, this phenomenon can be explained by the research done by Gilovitch and Medvec (1995). They have found that inaction and errors of omission produce more regret in the long run, compared to actions or errors of commission. Therefore, it is possible that individuals experience pain in the unrequited condition because

they feel regret of having missed an opportunity to have a match and a possible romantic partner. Secondly, individuals can experience pain in this condition, because they feel offended that the other person likes them. For instance, when the person feels like they are more attractive than the potential partner, it can feel humiliating for them to be liked by their counterparts. Pain experienced in the match condition can be caused because the participant does not feel attracted to the potential partner after all. This may have been the case in the current study, because we had asked the participants to judge at least half of the profiles with "yes". In this case participants could have experienced pain because of the regret of picking the wrong answer, which can also be linked back to research done by Gilovitch and Medvec (1995). In their research it has been found that regret of action or errors of commission also cause regret, even if this is less that in the case of inaction. Finally, participants may have experienced pain in the match condition because they felt guilty towards the other party for rejecting them.

Contradictory to the expectations, it has been found that gender does not influence the pain experienced after romantic rejection. This is also in line with the study done by Van der Veen et al. (2019). Comparing these studies with the social exclusion study done by Benenson et al. (2013) it can be argued that males and females respond differently to social rejection compared to romantic rejection. The results from the current study possibly could be explained by the feedback we have received from some of the participants. At the end of the experiment, some female participants indicated that they did not think that the male profiles were attractive. Therefore, the pain ratings were lower than they would have been if they were shown more attractive profiles. The male participants in this study did not give similar feedback about the female profiles, which suggests that the female profiles were possibly seen as more attractive than the male profiles. This difference could have caused the mean scores of the male and female participants to be brought closer together.

Furthermore, symptoms of social anxiety have also shown to have no influence on the experienced pain after romantic rejection. Previous studies have found that individuals with higher levels of social anxiety behave less favourably in romantic relationships than individuals with less social anxiety (Cuming & Rapee, 2010; Kashdan et al., 2007; Sparrevohn & Rapee, 2009; Wenzel et al., 2005). In addition, the study executed by Afram and Kashdan (2015) found that individuals with higher levels of social anxiety cope differently when they expect to be romantically rejected, compared to individuals with less social anxiety. Given these findings, it was predicted that higher levels of social anxiety would cause more pain after being romantically rejected. The contradictory results found in the present study could possibly be explained by the experimental design of this study. This study was conducted online. It is

possible that individuals, who usually have higher levels of social anxiety, feel less anxious when they are in an online dating setting. This is because they have no face-to-face contact with the potential partner. This can be supported by the research done by Pierce (2009). Their research had examined the use of social interactive technologies and the role that social anxiety plays in the way teenagers communicate with each other. Results showed that the individuals who reported more social anxiety, felt more comfortable using social interactive technologies compared to face-to-face communication. In addition, research done by Weidman et al. (2019) showed that undergraduate students with more social anxiety also reported to be more comfortable and there to be more self-disclosure when they were socializing online compared to socializing face-to-face. Therefore, it can be argued that individuals are less tense in an online dating setting and do not feel extra anxious while judging their counterparts. As a result, possible romantic rejection could cause less negative affect than it would have caused in an in-person setting. Thus, causing the experienced pain after romantic rejection in online dating to be similar between individuals with different levels of social anxiety.

Finally, it was predicted that individuals with higher levels of depression would experience more pain when they were romantically rejected. Depression causes a lack of positive affect and a low mood (Kendrick & Pilling, 2012). Therefore, it was proposed that romantic rejection could possibly cause these negative affects to be reinforced. However, contradictory results have been found in the present study. It was found that depression had no influence over the amount of pain that was experienced after being romantically rejected. This can be explained by analysing the data that has been used in the current study. About 91,5% of the participants had minimal to mild depressive symptoms. Only 8.5% of the participants had moderate to severe depressive symptoms. It is possible that the current study did not have enough power to detect the effect of depressive symptoms on the experienced pain, due to an uneven distribution of participants with lower and higher depressive symptoms. Furthermore, research has shown that depressive scores can be predicted by rejection sensitivity (Mellin, 2008). Higher rejection sensitivity is associated with higher levels of depression. Due to the fact that most participants in this study had minimal to mild depressive symptoms, it is possible that rejection sensitivity was not very prominent in this study. As a result of these low depressive scores, it is probable that most participants were not very sensitive to romantic rejection. Therefore, possible depressive symptoms present in this study may not have influenced the pain experienced after being romantically rejected. Causing the experienced pain of individuals with different levels of depression to be similar.

The findings of this study need to be considered, while keeping some limitations of the current study in mind. First, the population investigated in this study, largely consisted of psychology students. This was due to the fact that the study was made available to psychology students through the ERAS-database. In general, psychology students are familiar with the kind of studies that are done within our field. Therefore, it is possible that they realized we were using a database for the profiles and they could have figured out what the true purpose of this study was. This could have influenced the outcomes. However, there is no indication that this might have been the case. We have tried to keep the impression of a real online dating task, by having the participants wait between the different parts of the experiment. This gave them the belief that their counterparts were actually judging their profiles. Furthermore, we have also tried to make the profiles look as realistic as possible, by using biographies that are actually being used on dating sites. Moreover, the results show there to be a differential impact between the stimuli. Therefore, it can be assumed that the paradigm was credible and taken seriously by the participants. Another limitation could be the population we have used, because this consisted of healthy participants. That is to say that these participants were not diagnosed with depression or social anxiety disorder. Therefore, it can be questioned whether the compared levels of psychopathology are sufficient enough to answer the research questions. For example, comparing diagnosed depressed individuals to non-depressed individuals, may have given us a better understanding of the differences in pain experience after romantic rejection between these groups. However, the data collected has given us participants with different levels of depression and anxiety. It is important to compare these different levels among each other and not only look at the extremes, because there are plenty of individuals whose psychopathology falls in between these extremes. Additionally, this study consisted of significantly more females than males. Especially the comparison between male and females in their pain experience after romantic rejection, could have been influenced by this fact. Although this may have been the case, it is assumed that the data presented included sufficient male and female participants to draw conclusions regarding gender differences in pain experience after romantic rejection. It has been stated earlier that the study being conducted online, could have possibly been disadvantageous to the results. However, the fact that this was an online study, also had some benefits. First, this online study gave us the possibility to reach more participants. This was important, especially because of the fact that the experiment was conducted during the lockdown following the Covid-pandemic, which made it difficult to investigate individuals in-person. Additionally, online studies can cause more people to be willing to take part in the experiment, because they can complete these studies in their own time and they do not have to

schedule a meeting on location to complete it. Therefore, for many people it is more convenient to take part in an online study rather than an in-person study.

The present study showed that romantic rejection causes pain among individuals. Hereby it does not matter whether you have feelings of depression or social anxiety or which gender you have. This shows that many people value the romantic opinion that others give them, whether it be through online dating or in-person dating. It would be interesting if future research would expand the current study by using real dating profiles instead of a database and look at different populations. With these results we can determine whether there are individuals that need more protection or guidance from romantic rejection. By identifying for which individuals this might be the case, we can develop therapies to help them cope with (possible) rejection. In addition to these sensitive individuals, advice on how to cope with rejection could be useful for every individual.

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