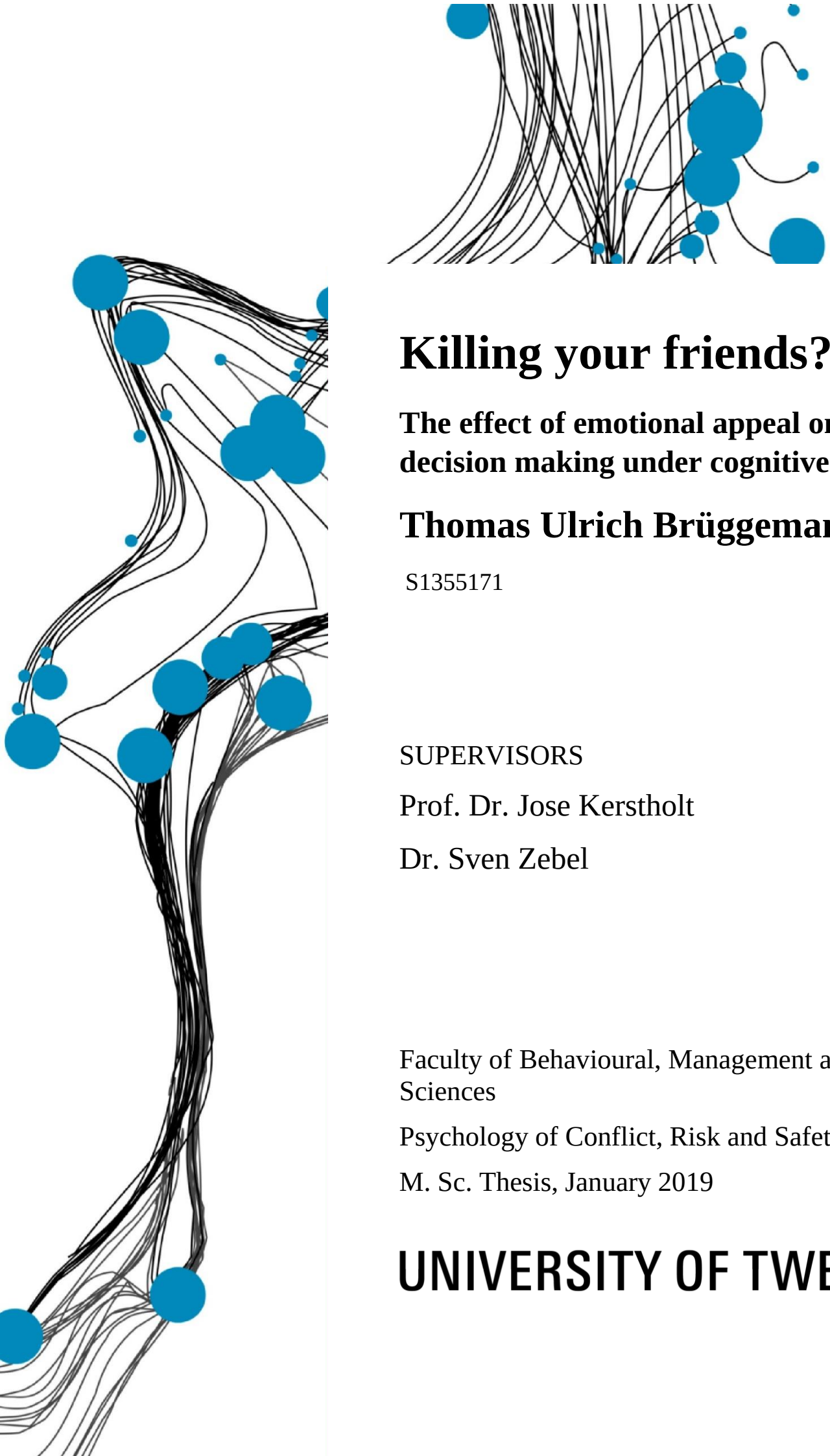

Killing your friends?

The effect of emotional appeal on moral decision making under cognitive load

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Abstract

Research on the dual process theory of moral judgement often makes use of the answer to a moral dilemma to assess if the action was deontic or utilitarian. Equating an answer to a moral dilemma with an underlying moral conviction has recently come under criticism. This study used a different approach in investigating the explanatory power of the dual process theory of moral judgement by manipulating the emotional appeal of a decision in the trolley problem. It investigated how cognitive load and the emotional appeal of people on the tracks in the trolley problem affected the reaction time to answer the dilemma. This study found that people took considerably longer to answer the trolley problem if the person on the single track was a young person or a friend than if they were a stranger. Cognitive load did not affect the reaction times. The increase in reaction time is attributed to an increased level of difficulty and a decreased level of confidence of the emotionally appealing scenarios. Implications for the dual process theory of moral judgements are discussed.

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1. Introduction

Understanding human decision making in moral situations has been an important issue of moral psychology. Judging whether an action is immoral or not has been a longstanding subject of philosophical debate. There are two main approaches to morality: *Utilitarianism* and *Deontology*. *Utilitarianism* judges the morality of actions based on their consequences, attempting to maximize "utility" (Mill, 1863). This means that an action is morally justified if its consequences increase or maximize the well-being of society, in comparison to the alternatives. On the other hand, deontology judges an action's morality by its intrinsic nature. Here, any moral action needs to adhere to some kind of overarching moral law or duty (deon). Since these two principles can be in conflict with each, actions can be both moral from one standpoint while also being immoral from the other. If an action maximizes the well-being for society while violating an overarching moral law, for instance by hurting or killing someone for the betterment of others, it becomes difficult to objectively judge the morality of the action. In the same vein, making a decision in a moral crisis where both approaches cannot be satisfied at the same time is a difficult task. So how do people make decisions in such situations? Early theories on moral decision making were focussed on the rationality and reason of the actor (Kohlberg, 1971). Here, actors were thought to be mostly rational, weighting the pros and cons against each other to then make a decision. However, this approach got criticised by Damasio (1994) who observed this type of decision-making process by a patient that suffered from damage to the temporal lobe which removed the patients' ability to feel emotions. Hence, Damasio (1994) formulated his somatic marker hypothesis that argues that decision making is strongly affected by bodily feelings. Haidt (2001) goes even further and argues that moral decisions are entirely based in emotionally driven intuitions and rational moral reasoning only occurs to justify the moral judgement after it has already been made.

One theory that looks at both these influences in general human decision making is the dual process model of thinking (Kahneman, 2011). The dual process model of thinking suggests that people utilize two different systems in order to make decisions. System 1 refers to decisions that are made quickly, emotionally, unconsciously, and intuitively, whereas system 2 decisions are deliberate, slow, and calculating. Evans (2008) argues further that a distinction in the usage of working memory exists, so that system 1 thinking does not make use of working memory, while system 2 draws into it. Greene (2007) extended this view to

moral decision making. Using the example of the trolley problem which is based on the footbridge dilemma (Foot, 1967), Greene suggested that a connection between the deontological or utilitarian judgements with system 1 or 2 thinking, respectively, exists. The trolley problem is a classic moral problem where a runaway trolley is rolling down a hill threatening to overrun and kill five people that are bound on the track. However, one could instead pull a lever to change the course of the trolley to a second track where only one person would be killed.

A prototypical utilitarian would pull the lever because the benefits of saving five people outweigh the cost of killing one person. On the other hand, a prototypical deontologist would not pull the lever because that would involve actively killing another person, an action that is inherently immoral. Greene (2007) argued that deontological thinking comes from strong intrinsic feelings that tell us which things "simply cannot be done" and which "simply must be done", and that these feelings developed through societal evolution over time. He argues that in the trolley problem people would feel a natural emotional aversion towards deciding to kill one person, while also rationally calculating that they would save five. As such, people that face moral dilemmas with a deontic and a utilitarian option experience an internal conflict between their emotions and their cognition. In order to decide for the utilitarian option, they need to override their emotional (system 1) by engaging in analytic (system 2) thinking (Kahnemann, 2011, Białek & De Neys, 2016). Based on that line of thought, Greene et al. (2008) decided to test if impairing rational reasoning would affect moral decision making by putting participants under cognitive load. While they could not find conclusive evidence for their theory, they found that people under cognitive load would take slightly longer to choose the utilitarian solution than people that are not under cognitive load. Other studies did show more support for the dual process model of moral judgement: Moore, Clark, and Kane (2008) found that people with higher working memory capacity are more likely to make utilitarian decision and Suter and Hertwig (2011) found that people are less likely to make utilitarian decisions when put under time constraints.

Most of the support for the dual process model stem from studies that attempt to utilize the divide between deontological and utilitarian decision making. However, a recent study by Białek and De Neys (2016) found that people making deontic decisions were aware of the aforementioned intrinsic conflict. This suggests that they did not choose the deontic option by blindly trusting system 1 cues but instead they weighted the deontic and the utilitarian options against each other and then actively choose the deontic option. Therefore,

it can be argued that instead of using two distinct systems in moral decision making, all moral decision making comes from a single process instead of two (Kruglanski & Gigerenzer, 2011). This single process could for instance be rule-based, where people have a set of *if-then* conditionals that they use to heuristically gather preference for one option (Kruglanski & Gigerenzer, 2011).

A different approach by Bartels and Pizarro (2011) suggests that utilitarian judgements do not stand on their own but are simply non-deontic judgements. Put differently, the difference between deontic and utilitarian judgement is not that they are independent and struggling to overrule each other, but two sides of the same coin. A person with deontic values would choose the deontic option, whereas a person that *lacks* these deontic values would choose the utilitarian option. This idea is based on the finding that a preference for utilitarian options correlates with higher levels of psychopathy, Machiavellianism, and life meaninglessness (Bartels & Pizarro, 2011). However, Conway and Gawronski (2013) responded by arguing that utilitarian judgements are rooted in genuine moral concerns.

Since people are aware of the internal conflict between utilitarian and deontic judgements (Białek & De Neys, 2016), it means that people may use system 2 thinking to come to a deontic conclusion based on moral convictions. Furthermore, inferring moral convictions from an output variable as such as the decision itself is highly unreliable (Krajbich, Bartling, Hare, & Fehr, 2015). Therefore, looking at the outcome of a moral dilemma in order to understand the underlying processes and systems might be misleading. Instead, it could be wise to look at the dual process theory of moral judgement by using a different measurement than the answers to the dilemmas. The dual process theory predicts an increase in deontic answers under cognitive load, which was not observed in previous studies (Greene, 2007; Valdesolo & DeSteno, 2006). Hence, instead of looking at the answers to moral dilemmas, one could focus on the explanatory power of the theory and attempt to elicit system 1 reactions by using emotional triggers. One such approach was undertaken by Valdesolo and DeSteno (2006), who used videos to manipulate the mood of their participants and found that a positive affect increased the likelihood of choosing the utilitarian option in the footbridge dilemma. The footbridge dilemma is equivalent to the trolley problem, but instead of pulling a lever one has to throw a large man from a bridge onto the tracks to save the five people. According to Valdesolo and DeSteno (2006), the aforementioned internal conflict can be eased by reducing the perceived aversion to a deontic immoral action by inducing feelings of positivity. However, they did not find the same effect in the trolley

problem. They argue that in the trolley problem the utilitarian action is not as violating and emotion-inducing as in the footbridge dilemma (Valdesolo & DeSteno, 2006). Still their findings show that a person's mood can play a role in moral decision making.

This thesis suggests a slightly different approach to induce intuition driven responses to moral dilemmas. Since the system 1 process is quick, intuitive and emotional (Kahneman, 2011), options that are more intuitively or emotionally appealing to a person should improve system 1 responses. Hence, system 1 responses should be quicker and less deliberate, people should be faster to respond to these intuitively appealing scenarios.

Manipulating the intuitive appeal of victims can be done by utilising Hamilton's (1964) formulation of inclusive fitness. For evolutionary reasons, people aim for the well-being of people they are related to, people that can reproduce in general, and people that are reproductively viable for an individual. This means that people are less likely to pull the lever in the trolley problem if the lone person on the track was related to them and also if they were younger than the people on the other track (Bleske-Rechek, Nelson, Baker, Remiker, & Brandt, 2010). Similarly, social identity also affects this decision making in that people are less willing to sacrifice a single member of the in-group, not only if the people on the other track are not members of an out-group, but also if they belong to an extended in-group (Swann Jr, Gómez, Dovidio, Hart, & Jetten, 2010).

That people are less willing to sacrifice young people or in-group members like friends can be used to manipulate the intuitive appeal for the victims on the tracks. In combination with the dual process theory of moral judgement, it should be possible to find a relationship between the intuitive appeal of the people on the tracks and the speed with which people respond to the question. If the person on the track appeals to them, their affect should elicit an intuitive system 1 response that is quicker than when all persons are strangers. Therefore, two hypotheses can be posed:

H1: *People should react faster in their decisions if the victim in a moral dilemma emotionally appeals to them.*

H2: *The effect described in H1 should be more pronounced under cognitive load.*

2, Method

2.1 Design

These hypotheses were tested by means of an online survey, in which a participants' reaction time was measured while they were working on a number of moral dilemmas, all the while being put under different levels of cognitive load. In the survey, two different manipulations were used: Cognitive load and intuitive appeal. Intuitive appeal was manipulated by asking participants to answer three moral dilemmas with similar problems based on the aforementioned trolley dilemma. These problems manipulated intuitive appeal by changing the description of the person on the single track. Participants should feel closest to the victim on the single track when they were described as a friend or a young person, while being more intuitively distant to the victim on the single track when it was an undescribed stranger. The scenario with the undescribed strangers can be seen as a control condition. The cognitive load was manipulated by showing participants a combination of numbers and letters before each dilemma and asking them to remember them after they answered the dilemma. Participants were randomly assigned to one of two groups: a low load group with two digits and a high load group with seven digits. This manner of manipulating cognitive load has been applied in the past, often using seven numbers without any letters in them (Duffy & Smith, 2014). In addition, seven digits appears to be near the limit of a subjects' memory (Miller, 1956).

The research design was hence set up with reaction time as the dependent variable and cognitive load and intuitive appeal as the independent variables. The study was set up in a three (intuitive appeal) by two (cognitive load) design, with intuitive appeal being varied within-subjects and cognitive load being varied between-subjects.

2.2 Materials

The original wording of the trolley problem was taken from the trolley conflict version of Białek and De Neys (2016). One of the dilemmas used the same wording as Białek and De Neys (2016), whereas the two others changed the description of the victims on the tracks. In one case the person that lies on the single track is described as a friend of the participant, in the other case the person is described as a teenager, while the five persons on the main track are described as elderly persons. The exact wording can be found in Appendix A. The differences between the scenarios were marked with bold text to ensure participants

noticed them. The order in which the scenarios were displayed in the online survey was randomized.

For simplicity, the scenario in which the person on the single track was a friend of the participant will henceforth be referred to as the "friend scenario", the scenario in which the age difference between the teenager on the single track and the group of five elderly people on the other one will be called the "age scenario", and the scenario in which the people on the tracks are not described will be the "stranger scenario".

Cognitive load was manipulated by asking participants to memorize a set of numbers and letters. In the low load condition, the combination had two digits (i.e..: 22), in the high load it had seven. A letter and number combination was chosen because Duffy and Smith (2014) found that people were surprisingly accurate in memorizing sets of only numbers. A possible reason for this is that people are able to chunk a long number into sets of smaller numbers (Gobet et al., 2001). For instance, instead of remembering "2412100" as seven separate numbers, they instead chunk them into smaller pieces, like "2412" and "100", and then remember the pieces instead. Thus, instead of getting to Miller's limit of seven, they only use two chunks which reduces the memory load. Hence, a combination of letters and numbers was instead used in order to make the task more difficult and increase the load on the participants. During the survey, respondents did not get any feedback on their accuracy in remembering the numbers. Furthermore, respondents did not get incentives for their performance on the recollection task.

Response time was measured using the timer of the Qualtrics program. It measures how long it takes respondents to click for the first time, the last time, and when they leave the current question page. Respondents were first presented with the moral dilemma before they could go to the next page where they were asked the question: "Would you pull the lever and change the tracks?". This question was timed and the time of the last click was used as the response time.

Participants were also tasked to answer a brief questionnaire after each moral dilemma for a self-report measure on a 5-point Likert scale reaching from 1 "Fully Agree" to 5 "Fully Disagree" on the following six statements:

1. I am confident in my decision.
2. I found it difficult to make a choice.
3. It was hard for me to focus on the task at hand.

4. I had to make trade-offs in my decision.
5. I did not choose the right option.
6. Memorizing the numbers and letters was distracting.

Lastly, their age, gender, country of origin were collected.

2.3 Procedure

The survey was distributed online using social media channels. Participants were invited to take part in a short questionnaire for a psychology thesis. When accepting, participants were first asked in which language they would prefer to answer the questionnaire, either in English, German, or Dutch. Afterwards, a brief text was displayed informing the participants on the general subject of the survey, what they would have to expect, how to navigate the survey, as well as how their data would be used and asking for their informed consent. The full introduction to the survey, as well as its debriefing can be found in appendix B. The main survey then followed consisting of two blocks. In the first block, participants where first shown a number and letter combination, then a text of one of the scenarios of the moral dilemma. Thereafter, they were asked how they would solve the dilemma, prompted to recall the number and letter combination and finally asked the evaluation questions. This was repeated two more times for the other two scenarios. The order of the scenarios was randomized. In total, there were six different orders in which the scenarios could appear. In the second block, participants were asked to give their age, gender, and country of origin before being debriefed by a short text outlining the study's general design including that there are load groups as well as that their reaction times were measured (see Appendix B). This concluded the survey.

2.4 Participants

In total, 292 people took part in the survey. Of these 292, only 220 fully completed the survey and answered all questions. The data of 40 further respondents were removed because their response times were considered statistical outliers, having reaction times longer than the mean plus two times the standard deviation. This means that for the "stranger" dilemma 13 responses that took longer than 18.60 seconds were removed, for the "age"

dilemma 18 responses that took longer than 26.38 seconds were removed, and for the "friend" dilemma 9 responses that took longer than 29.40 seconds were removed[1].

This left an operational sample of 180 participants, 103 of which were in the low load and 77 in the high load condition. One-hundred-seventy-five (97.2%) of these choose to answer the questionnaire in German, four (2.2%) in Dutch and one (0.6%) in English. The countries of origin were similarly distributed, with 166 (92.2%) selected Germany as their country of origin, three (1.7%) selected The Netherlands, and eight (4.4%) hailed from other countries. Most respondents were female (70.6%), while a little more than a quarter of participants were male (26.7%). The youngest person to answer the survey was eighteen years old, the oldest 72 years old. The mean age was 39 years with a standard deviation of 15 years.

3. Results

3.1. Manipulation check

At first, a manipulation check was done in order to determine if the strategy to manipulate the cognitive load had any effect. This manipulation check used two questions of the self-reflection, as well as the accuracy rating of recollection of the number and letter combinations. From the self-reflection, the two questions that were used were:

3. "It was hard to focus on the task at hand."
6, "Memorizing the letters and numbers was distracting".

A measure of internal reliability indicated that Cronbach's alpha was 0.67 in the low load condition and 0.63 in the high load condition. The mean score for the scale in the low load condition was 4.58 (on a 5-points scale ranging from totally agree to totally disagree) with a standard deviation of 0.53, and in the high load condition the mean score was 3.32 with a standard deviation of 1.05. This difference was statistically significant per an independent-

[1]Including all participants considerably raises the average reaction times from 4.7s (SD 3.7s) to 6.2s (SD 6.58s for the stranger scenario, from 5.65s (SD 4.67s) to 8.62s (SD 12.12s) in the age scenario, and from 6.31s (SD 5.98s) to 16.87s (SD 107.36s). It includes people that take up to 26 minutes to answer one question. If the additional participants were included in the study, the reaction time analysis shows no significant effects. However, only removing six persons with reaction times above one minute nets comparable findings to this analysis, with a similar effect of the scenarios on reaction times ($F(1.96, 414) = 6.29$, $p < 0.01$), but a lesser effect of the cognitive load on reaction times ($F(1, 212) = 0.63$, $p = 0.43$) and a marginally significant interaction effect of cognitive load and the scenarios ($F(1.96, 414) = 2.49$, $p = 0.09$).

sample t-test between the load conditions; $t(103) = 9.58$, $p < 0.01$. Therefore, the self-report measure suggests a successful load manipulation.

In addition to the successful self-report measure the accuracy of participants in recalling the number and letter combination was investigated. The accuracy was measured by comparing the combinations that participants recalled to the original prompt. If the two combinations were identical, then the participant was accurate in his or her recall, if they deviated in any way, the recall was inaccurate.
Accuracy among the low load group was on average very high at 96.44% (SD = 10.35), whereas the high load group was considerably lower, at 67.11% (SD = 30.55). While an independent-sample t-test for the difference of the mean accuracy showed that the high load group was still statistically significantly lower in their accuracy ($t(87) = 8.04$; $p < 0.01$), they were still quite accurate. Based on the findings of comparing the accuracy, as well as the self-report measures, it appears that the cognitive load manipulation was effective.

3.2 Pulling the Lever

There were differences in the decisions participants made when deciding to pull or not to pull the lever in order to kill one person to save five. In the stranger scenario, 135 (75%) of respondents decided to pull the lever, while 45 (25%) did not. In contrast, 66 (36,7%) people in the age scenario and 55 (30,6%) in the friend scenario were willing to pull the lever. A Cochran's Q test shows that this difference is statistically significant; $\chi^2(2) = 97.26$, $p < 0.01$. This displays that people were more likely to pull the lever in the stranger scenario, but conversely less likely to do the same thing if they would sacrifice a young person or a friend.

3.3 Reaction times

Testing the hypotheses of this thesis made use of the participants' reaction times for each of the scenarios. Table 1 shows the mean reaction times for each scenario for the different levels of cognitive load.

Table 1: The reaction times (s) for each scenario under different levels of cognitive load.

Reaction time in seconds	Load	Mean	SD
Stranger	Low	5.00	3.61
	High	4.29	3.76
Age	Low	5.88	5.06
	High	5.35	4.09
Friend	Low	6.76	6.44
	High	5.72	5.98

A repeated analysis of variance was conducted to test this thesis' hypothesis that scenarios of moral dilemmas that appeal to participants on an intuitive level affect their reaction times. when answering the dilemma. The dependent variable was the reaction time, the independent variables were cognitive load, measured between subjects, and the scenarios, measured within-subjects. The repeated measures ANOVA showed that there was a statistically

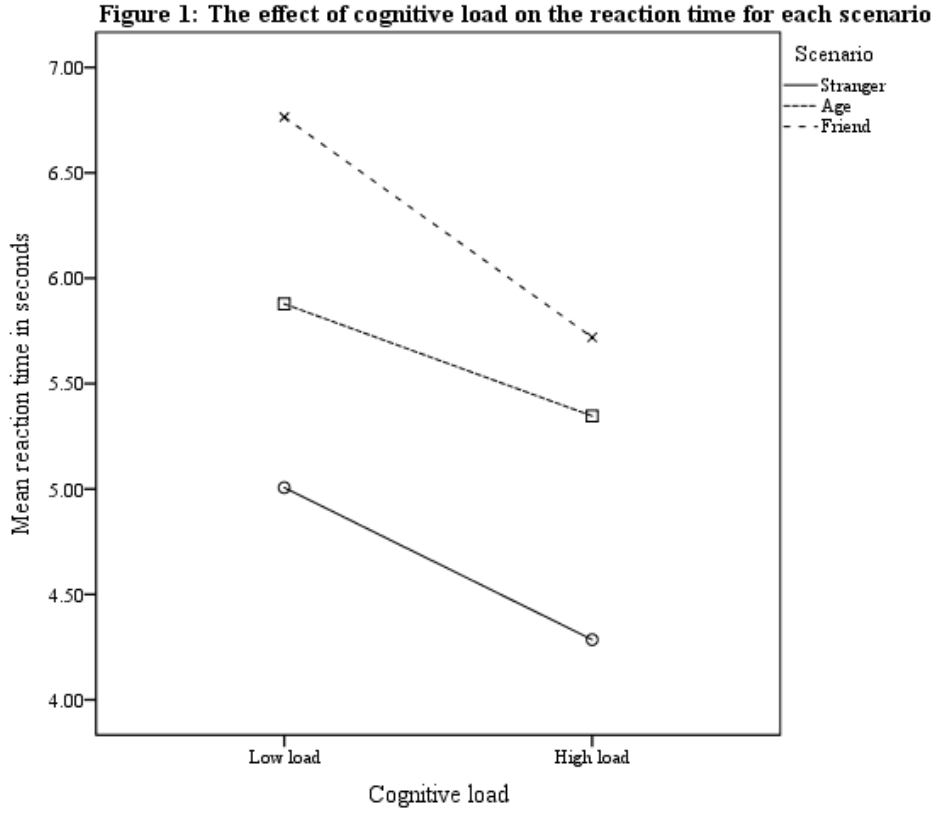

Figure 1: Mean reaction time for the different scenarios as a function of cognitive load

significant difference in reaction time between the different scenarios ($F(1.82, 324) = 4.83$, $p = 0.01$). This difference was tested in a post-hoc analysis in table 2. A significant difference in reaction time exists between the stranger and the friend scenario ($p = 0.01$), while the difference between the stranger and age scenario is marginally significant ($p = 0.08$). In contrast, there is no difference in reaction times between the age and friend scenario ($p = 0.79$). This means that people took on average longer to answer the intuitively appealing scenarios than it took them to answer the stranger scenario.

Table 2: Post-hoc analysis of the means

Scenario 1	Scenario 2	Mean Difference	Error	p(b)
Stranger	Friend	-1.60*	0.55	0.01
	Age	-0.97	0.43	0.08
Age	Stranger	0.97	0.43	0.08
	Friend	-0.63	0.56	0.79
Friend	Stranger	1.60*	0.55	0.01
	Age	0.63	0.56	0.79

*. The mean difference is significant at the 0.05 level.

(b). Bonferroni adjustment for multiple comparisons.

Furthermore, there was a marginally significant difference in reaction times between the cognitive load conditions ($F(1, 178) = 3.25$, $p = 0.07$). Table 1 suggests that people were faster in the high load condition than in the low load condition in answering the dilemma. There was no interaction effect of cognitive load and scenarios ($F(1.82, 324) = 0.13$, $p = 0.86$). Figure 1 shows the mean reaction times as a function of cognitive load and scenarios.

However, it is possible that the choice participants made during the dilemmas affected their reaction times. This possible moderation effect of the decision on reaction time was tested with separate ANOVA's for each scenario, with cognitive load included in the model as well. As can be seen in table 3, there was no effect of the type of decision (i.e. pulling the lever or not) on reaction time nor any interaction with cognitive load in any scenario. In other words, whether people pulled the lever or not did not affect how long it takes for them to decide. Similarly, cognitive load also did not influence a participants' decision. For further context, figures 2 to 4 in Appendix C show the functions for the aforementioned model.

Table 3: Results of the analyses of variance for the effect of the decision on reaction times across cognitive loads for each scenario.

Scenario		Df	Error	F	p
Stranger	Decision	1	176	0.08	0.65
	Decision * Load	1	176	0.20	0.26
Age	Decision	1	176	0.01	0.92
	Decision * Load	1	176	0.25	0.62
Friend	Decision	1	176	0.36	0.55
	Decision * Load	1	176	1.84	0.18

3.4 Confidence, Trade-offs, and Difficulty of choice

Apart from contributing to the manipulation check, the evaluation questions also asked for a participants' confidence in their decision, the difficulty of their decision, and the trade-offs they had to make. Again, participants had to indicate their level of agreement on a 5-point Likert scale reaching from 1 ("I totally agree") to 5 ("I totally disagree") with the following statements:

1. I am confident in my decision.
2. I found it difficult to make a choice.
4. I had to make trade-offs in my decision.

Table 4 shows the means and standard deviations of each of these statements per scenario:

Table 4: Means and standard deviations for the level of confidence, the perceived difficulty to make a decision, and the trade-offs for each scenario.

Statement		Stranger	Age	Friend
I am confident in my decision.	Mean	2.48	2.68	2.80
	SD	1.26	1.26	1.29
I found it difficult to make a choice.	Mean	2.91	2.43	2.34
	SD	1.55	1.45	1.50
I had to make trade-offs in my decision.	Mean	2.77	2.51	2,83
	SD	1.41	1.41	1.46

Three analyses of variance were conducted to see if there were any differences in self-reported levels of confidence, difficulty, and trade-offs between the stranger scenario and the emotionally appealing scenarios. An ANOVA between the scores for the stranger, age, and friend scenario was done for each statement separately.
Table 5 shows the results of the three ANOVAs. A significant difference between the stranger scenario and the age and friend scenario can be found for each of the three statements.

Table 5: Results of the three analyses of variance for the difference between the scenarios in the level of confidence, difficulty, and trade-offs.

Statement	df	Error	F	P
I am confident in my decision.	1.91	332	12.00	<0.01
I found it difficult to make a choice.	1.95	256	5.01	0.01
I had to make trade-offs in my decision.	1.99	339	7.21	<0.01

A post-hoc analysis in table 6 reveals the individual differences between the scenarios for each statement. Participants experienced lower levels of confidence in the age and friend scenario in comparison to the stranger scenario. They also found the age and friend scenario to be more difficult than the stranger scenario. However, while there was a significant difference in the required trade-offs between the scenarios, the post-hoc analysis shows that this difference was mainly between the stranger and the age scenario. There was no difference in the experienced trade-offs between the stranger and the friend scenario.

Table 6: Post-hoc analysis for the difference between the scenarios for the confidence, difficulty, and trade-offs

Statement	Scenario 1	Scenario 2	Mean Difference	Error	p(b)
Confidence	Stranger	Age	-0.25*	0.09	0.02
		Friend	-0.29*	0.11	0.02
Difficulty	Stranger	Age	0.49*	0.11	<0.01
		Friend	0.54*	0.13	<0.01
Trade-offs	Stranger	Age	0.32*	0.11	<0.01
		Friend	-0.4	0.10	1.00

*. The mean difference is significant at the 0.05 level.

(b). Bonferroni adjustment for multiple comparisons.

4. Discussion

The present study aimed to investigate how cognitive load and the intuitive appeal of people on the tracks in the trolley dilemma affects the reaction time to answer the dilemma. It manipulated the description of the people on the tracks to provide a scenario in which the person on the single track was either a stranger, a young person, or a friend of the respondent. Following the dual process theory of moral judgement, it was assumed that the intuitively appealing scenarios of the age and friend scenarios should reduce the time it takes for people to make a decision in the trolley problem in comparison to the stranger scenario. This effect was expected to be stronger when participants were put under higher cognitive load.

The analysis on the decisions that participants made yielded multiple results. First, even though participants were much more likely to save their friend or a young person than a stranger, they generally took longer to make a decision in the intuitively appealing scenarios. Second, the decision to pull or not to pull the lever was not affected by cognitive load. As such, both initial hypotheses should be rejected.

The finding that participants were more likely to save their friend or a young person than a stranger, can be attributed to the theory of inclusive fitness, which states that people try to increase the well-being of people that are reproductively viable, provide reproductive opportunities, and people they share genes with (Hamilton, 1964). These results are consistent with previous research (Bleske-Rechek, Nelson, Baker, Remiker, & Brandt, 2010),

which found that people are more willing to sacrifice five people in the trolley problem if the person they would save was young, a partner, or a genetic relative.

However, on the basis of the dual process theory we argued that saving someone that is more appealing on an intuitive level should trigger more system 1 responses and hence reduce reaction time (Kahneman, 2011; Greene, 2007). Instead, this study observed the opposite of the predicted effect. The same holds for the findings on cognitive load. While the dual process theory implies that increased cognitive load should reduce the number of utilitarian decisions, the results of this study add to the evidence against this idea (Greene, 2007; Moore, Clark, & Kane, 2008; Valdesolo & DeSteno, 2006). A possible reason for this as proposed by Greene (2007) is that cognitive load acts as a hurdle which delays utilitarian judgements until it is ultimately overcome, without influencing the outcome. On the other hand, time-pressure in high-conflict scenarios does seem to increase the frequency of deontic answers (Suter & Hertwig, 2011), indicating that this theoretical implication depends more on the context of time pressure than cognitive load.

Overall, the findings are hard to construe with the dual process theory of moral judgement. The only possible interpretation of this outcome from the perspective of the dual process theory comes from the internal conflict that people experience in moral dilemmas (Białek & De Neys, 2016). This internal conflict between the utilitarian and the deontic response could be higher in the intuitively appealing scenarios than in the stranger scenario. In the stranger scenario, the utilitarian option was dominant with 75% of people choosing to pull the lever. In the age and friend scenario, if the deontic option was stronger, it would require more cognitive work to overcome it, which would lead to a higher required reaction time. Here, only between 30% (friend scenario) and 36% (age scenario) choose the utilitarian option, which can be seen as an indication for a stronger deontic argument. However, this argumentation equates the decision to a moral conviction. It is very difficult to measure underlying psychological mechanics like a person's intrinsic moral conviction with a strict output measure (Krabjbich, Bartling, Hare, & Fehr, 2015). In fact, this thesis set out to avoid the connection of the decision with moral conviction by instead using reaction times. Since people were willing to change their decision between scenarios it is unlikely that their decisions stemmed from moral convictions. Instead, it seems likely that other factors played crucial roles.

By ignoring the dual process theory of moral judgement and focussing on the differences in perceived difficulty, confidence, and required trade-offs in the different dilemmas, the internal conflict approach can still be used to explain the data. The self-reported questions of the level of confidence, difficulty, and the required trade-offs in each dilemma provided a clear difference between the scenarios. In general, participants indicated that the stranger scenario was overall easier than the intuitively appealing scenarios. Similarly, a participant's confidence in their decision was lower in the intuitively appealing scenarios and making a decision in these scenarios required more trade-offs. Evans and Rand (2018) claim that reaction times tend to relate more to feelings of conflict than to intuition or deliberation. This means that the aforementioned intrinsic conflict would still exist, but it would not necessarily pit deontic versus utilitarian judgements against each other. Instead, the scenarios consist of multidimensional problems that relate to aspects of moral conviction, personal choice, and numerical trade-off problems. The difficulty in the stranger scenario stems from the numerical problem of one versus five. This is increased in the intuitively appealing scenarios, as there is also an added dimension of young versus old in the age scenario, and a personal conflict of the friend versus strangers in the third scenario. This explanation would provide support for further arguments against the dual process theory of moral judgement. A meta-analysis by Baron and Gürçay (2017) found that a sequential model in which decisions making starts intuitively before being subject to deliberation was not robust and only worked for specific dilemmas. Instead, reaction times are more dependent on the amount of information in the scenarios, a participants' moral development, or the scenarios themselves (Baron & Gürçay, 2017). Due to the difference in scenarios, this thesis' findings could be explained by ignoring the dual process theory and focussing more on the intrinsic difficulty of the decisions.

4.1 Strengths and limitations

Due to the distribution method of the online survey, the sample is a convenience sample. As a result, the largest majority of respondents appear to be middle-aged women from Germany. This might affect in how far the findings can be generalised.

On the other hand, the cognitive load manipulation worked very well. Future research that attempts to manipulate load should consider the effects of memory chunking on the ability to remember large combinations of letters (Gobet et al., 2001). The method of using a

combination of letters and numbers seemed to be effective at inducing cognitive load, albeit participants indicated that they could be challenged more.

4.2 Future research

This thesis raises a number of questions for future research. First of all, exploring the main finding that reaction times increase with the intuitive appeal of the victims on the tracks could be a major point in understanding moral judgement. A core problem of interpreting reaction time data in the context of intuitive and deliberate decisions is the lack of information on the underlying moral convictions (Krajbich et al., 2015). This thesis attempted to support previous findings that were found using the decisions as indicators of moral convictions by using reaction time as an additional indicator. Since the hypotheses of this study had to be rejected, the underlying processes of moral decisions require further investigation. In fact, the scenarios used in this study underlined how multiple dimensions can play into the decision-making process in moral dilemmas. An investigation on why the scenarios were differing in difficulty would be beneficial, as well as research into the dimensions that affect moral choice.

With regards to the dual process theory, this thesis adds towards Baron and Gürçay's (2017) meta-analysis that found that there is little support for a sequential model of the dual process theory. However, there is indication for a parallel model in which both intuitive and deliberate processes are started at the same time when making a moral decision (Białek & De Neys, 2017).

The premise of this thesis was built upon the findings by Białek and De Neys (2016) that people are aware of the internal conflict between deontic and utilitarian reasoning in the trolley problem. By using a different stimulus rather than the answers to the dilemma, this thesis attempted to elicit system 1 responses through the use of intuitive appeal. If the aforementioned issues are resolved, a different study could use the same approach, for instance by making the five people on the first track more intuitively appealing instead of the single one in order to provide insight into the effects of intuitive appeal for the utilitarian solution.

5. References

Baron, J., & Gürçay, B. (2017). A meta-analysis of response-time tests of the sequential two-systems model of moral judgment. *Memory & cognition*, *45*(4), 566-575.

Bartels, D. M., & Pizarro, D. A. (2011). The mismeasure of morals: Antisocial personality traits predict utilitarian responses to moral dilemmas. *Cognition*, *121*(1), 154-161.

Białek, M., & De Neys, W. (2016). Conflict detection during moral decision-making: evidence for deontic reasoners' utilitarian sensitivity. *Journal of Cognitive Psychology*, *28*(5), 631-639.

Białek, M., & De Neys, W. (2017). Dual processes and moral conflict: Evidence for deontological reasoners' intuitive utilitarian sensitivity. *Judgment and Decision Making*, *12*(2), 148-167.

Bleske-Rechek, A., Nelson, L. A., Baker, J. P., Remiker, M. W., & Brandt, S. J. (2010). Evolution and the trolley problem: People save five over one unless the one is young, genetically related, or a romantic partner. *Journal of Social, Evolutionary, and Cultural Psychology*, *4*(3), 115.

Conway, P., & Gawronski, B. (2013). Deontological and utilitarian inclinations in moral decision making: a process dissociation approach. *Journal of personality and social psychology*, *104*(2), 216.

Damasio, A. R., & Sutherland, S. (1994). Descartes' error: Emotion, reason and the human brain. *Nature*, *372*(6503), 287-287.

Duffy, S., & Smith, J. (2014). Cognitive load in the multi-player prisoner's dilemma game: Are there brains in games?. *Journal of Behavioral and Experimental Economics*, *51*, 47-56.

Foot, P. (1967). The problem of abortion and the doctrine of double effect.

Gobet, F., Lane, P. C., Croker, S., Cheng, P. C., Jones, G., Oliver, I., & Pine, J. M. (2001). Chunking mechanisms in human learning. *Trends in cognitive sciences*, *5*(6), 236-243.

Greene, J., & Kant, I. (2007). The Secret Joke of Kant's Soul.

Greene, J. D., Morelli, S. A., Lowenberg, K., Nystrom, L. E., & Cohen, J. D. (2008). Cognitive load selectively interferes with utilitarian moral judgment. *Cognition*, *107*(3), 1144-1154.

Haidt, J. (2001). The emotional dog and its rational tail: a social intuitionist approach to moral judgment. *Psychological review*, *108*(4), 814.

Hamilton, W. (1964) The Genetical Evolution of Social Behaviour.

Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.

Kohlberg, L. (1971). Stages of moral development. *Moral education*, *1*, 23-92.

Krajbich, I., Bartling, B., Hare, T., & Fehr, E. (2015). Rethinking fast and slow based on a critique of reaction-time reverse inference. *Nature communications*, *6*, 7455.

Kruglanski, A. W., & Gigerenzer, G. (2011). Intuitive and deliberate judgments are based on common principles. *Psychological review*, *118*(1), 97.

Moore, A. B., Clark, B. A., & Kane, M. J. (2008). Who shalt not kill? Individual differences in working memory capacity, executive control, and moral judgment. *Psychological science*, *19*(6), 549-557.

Mill, J. S. (1863). *Utilitarianism*. London: Parker, Son and Bourn.

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological review*, *63*(2), 81.

Suter, R. S., & Hertwig, R. (2011). Time and moral judgment. *Cognition*, *119*(3), 454-458.

Swann Jr, W. B., Gómez, Á., Dovidio, J. F., Hart, S., & Jetten, J. (2010). Dying and killing for one's group: Identity fusion moderates responses to intergroup versions of the trolley problem. *Psychological Science*, *21*(8), 1176-1183.

Valdesolo, P., & DeSteno, D. (2006). Manipulations of emotional context shape moral judgment. *Psychological Science*, *17*(6), 476.

6. Appendix

6.1 Appendix A: Scenarios

6.1.1 Stranger

There is a runaway trolley barrelling down the railway tracks. Ahead, on the tracks, there are **five** people tied up and unable to move. The trolley is headed straight for them. You are standing some distance off in the train yard, next to a lever. If you pull this lever, the trolley will switch to a different set of tracks. Unfortunately, you notice that there is **one** person on the side track. This person will die if you change the tracks, but five others will be saved.

6.1.2 Age

There is a runaway trolley barrelling down the railway tracks. Ahead, on the tracks, there are **five elderly** people tied up and unable to move. The trolley is headed straight for them. You are standing some distance off in the train yard, next to a lever. If you pull this lever, the trolley will switch to a different set of tracks. Unfortunately, you notice that there is **one teenager** on the side track. This person will die if you change the tracks, but the five elderly persons will be saved.

6.1.3 Friend

There is a runaway trolley barrelling down the railway tracks. Ahead, on the tracks, there are **five** people tied up and unable to move. The trolley is headed straight for them. You are standing some distance off in the train yard, next to a lever. If you pull this lever, the trolley will switch to a different set of tracks. Unfortunately, you notice that there is **one of your friends** on the side track. Your friend will die if you change the tracks, but the five others will be saved.

6.2 Appendix B: Survey descriptions

6.2.1 Intro

Dear Participant,
this study investigates the nature of human decision making processes in moral dilemmas under cognitive load, so situations in which people cannot properly focus on the dilemma at hand. It will take approximately between five and ten minutes. You will be presented with three slightly different moral dilemmas. Before each dilemma you are asked to memorize a

set of numbers and letters in your head that you are asked to recall after answering the dilemma. In order to proceed with the questions, please click on the small black arrow (-->) on the bottom right hand corner of your screen.
Participation in this research is completely voluntary and anonymous.
Your information will be treated as confidential and will only be used for research purposes.
If you have any questions regarding this survey please contact Thomas Brüggemann (t.brueggemann@student.utwente.nl).

6.1.2 Outro

Thank you very much for participating in this study.

This study focused on the effect of both cognitive load (remembering the numbers and digits), as well as the intuitive appeal within a dilemma (the differences between the dilemmas). You were randomly assigned to one of two conditions regarding the cognitive load: One group had to memorize a series of seven numbers and digits, the other group a series of two. Furthermore, this survey measured how much time you took to answer each of the moral dilemmas. Hypothetically, people should take longer to answer the moral dilemmas if they had to remember more numbers and letters, and if the people on the tracks are more appealing to them. If you have any questions you can contact me at t.bruggemann@student.utwente.nl

Please click once more on the black arrow to finish the survey.

Thank you very much,
Thomas Brüggemann

6.3 Appendix C: Additional Figures

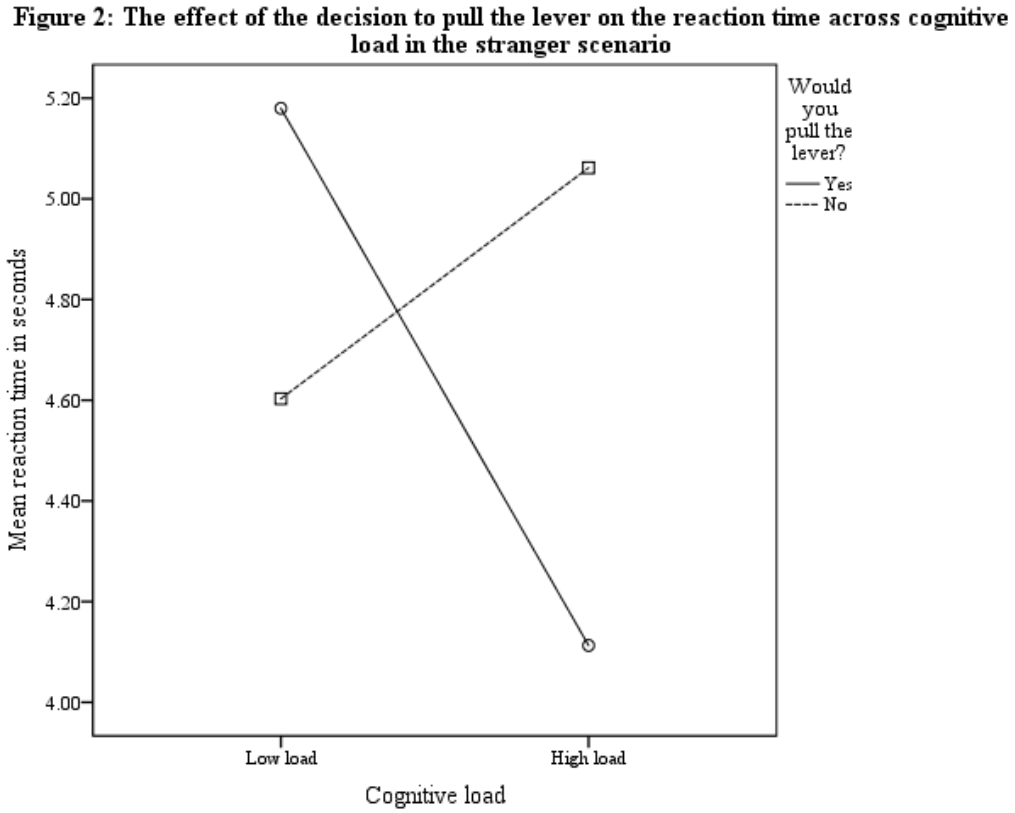

Figure 2: Mean reaction time for the stranger scenario as a function of choice.

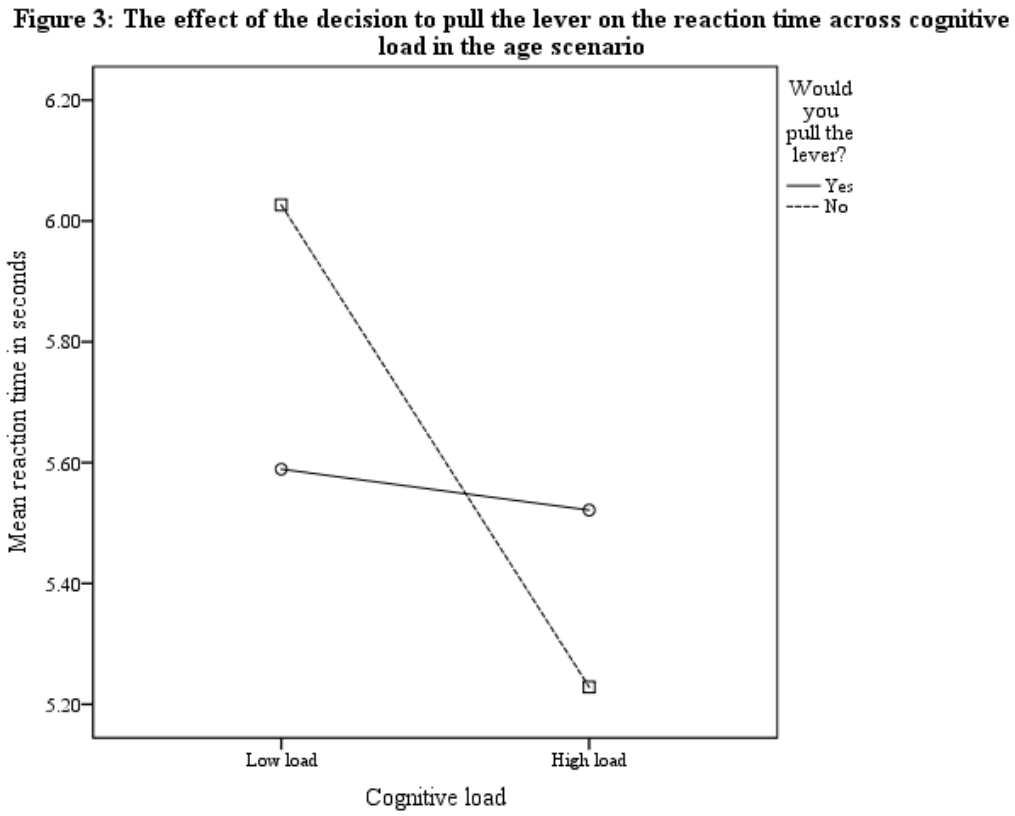

Figure 3: Mean reaction time for the age scenario as a function of choice.

Figure 4: The effect of the decision to pull the lever on the reaction time across cognitive load in the stranger scenario

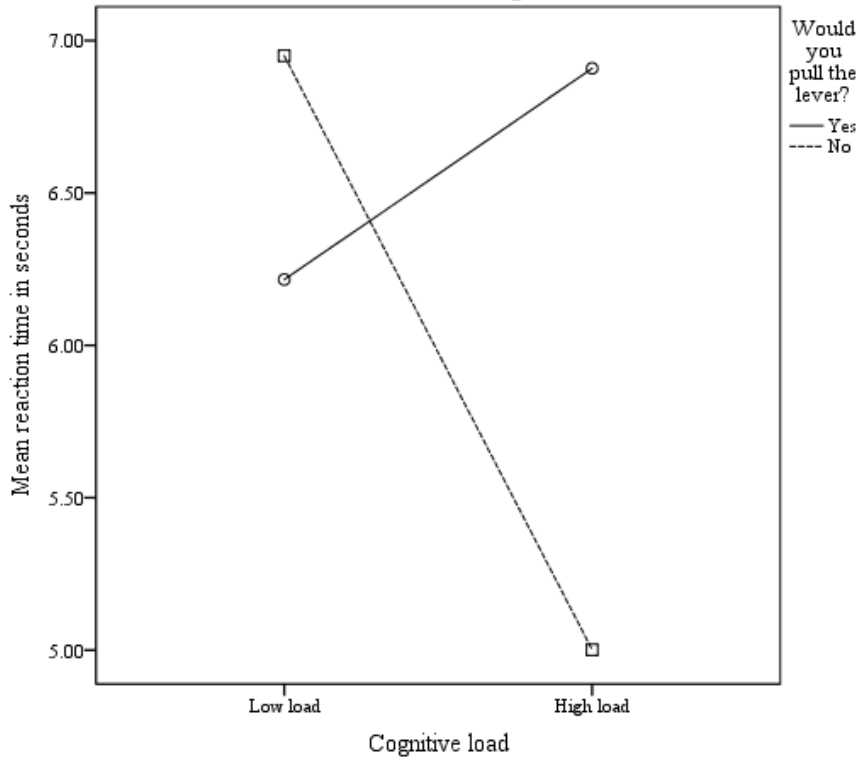

Figure 4: Mean reaction time for the friend scenario as a function of choice.