# Abstractions in Judgment: Does Construal Level Influence the System Specific Reasoning of Dual Process Theory?

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*Recent research have proposed a link between two large theoretical bodies, namely the Construal Level Theory (CLT) and the Dual Process Theory (DPT). The proposed connection is that DPT systems share characteristics with CLT constructs; that systems operate at different levels of abstraction. While these claims have been made, there has been no direct attempt to scrutinize the implication. The hypothesis that a link between these theories exists is examined empirically in this paper. We investigate whether people respond in a DPT system specific way when primed with different levels of construal. 89 high school students were primed with different levels of construal and performed binary choice judgments of either easy or hard difficulty. We expected that the percent of correct judgments that participants made while primed with a low-level construal would be higher than participants primed with a high-level construal, in the easy condition. Conversely, we expected that the percent of correct judgments that participants made while primed with a high-level construal would be higher than participants primed with a low-level construal, in the hard condition. The results indicate that there is no such connection. We discuss whether this result is due to diminishing priming and/or a failure to replicate other studies.*

## 1 Introduction

As humans, we have the ability to look at the world around us, study what we see, interpret our perceptions and reason about our surroundings. Therefore, it is unsurprising that our attempt to understand this ability to reason and make decisions at least stem back to the Enlightenment philosopher Condorcet (1793). Since then, a plethora of theories about judgment and decision-making (JDM) have been put forward trying to shed light on this process. The drive to develop theories about JDM is understandable since it affects our everyday life at both the micro and macro scale. For example: "I am about to take a walk, should I bring an umbrella? "Which of these two municipals had the best budget balance five years ago?" The above questions differ in a temporal domain, and one could argue that different modes of reasoning are involved when faced with these two questions.

One of the front-line theories regarding JDM is the Dual Process Theory (DPT: Stanovich & West, 2000; Evans, 2003; Stanovich & Toplak, 2012) which describes cognitive processes as belonging to two separate systems. These systems, usually called System 1 and System 2, are characterized as the intuitive and concrete system (System 1) and the deliberate and decontextualized system (System 2) respectively (Evans, 2008). However, these systems lack a depiction of the temporal domain described in the questions above.

Alongside DPT, there is another front-line theory in social psychology regarding the ability to mentally traverse the temporal domain, namely the Construal Level Theory (CLT: Trope & Liberman, 2003). The main idea behind CLT is that people adopt different levels of abstraction when thinking about entities that are close or far away (Trope & Liberman, 2003). The levels of abstraction are divided into low- and high-level construal, where the low-level represent the close (proximal) and concrete whereas the high-level represent the far away (distal) and abstract (Trope & Liberman, 2003). Proximal events makes an individual adopt a low-level construal, which makes objects seem more contextualized and concrete. Conversely, distal events make an individual prone to adopt a high-level construal, which makes objects more decontextualized and abstract (Trope & Liberman, 2010).

Despite the prominence of these two theories, there have been few attempts to build bridges between them regardless of the similarities of the theoretical constructs (Amit & Greene, 2012). In Amit and Greene's (2012) study about DPT of moral judgment, they found that some predictions were shared with CLT. The study differentiated between *deontological* judgments (favoring the rights of the individual, which is an automatic emotional response, eg. "It is wrong to shove her") and *utilitarian* judgments (which favors the greater good and supported by controlled cognition, eg. "The needs of the many outweighs the needs of the few."). In a suite of three experiments, Amit and Greene (2012) examined the relationship between cognitive style (verbal vs. visual) and moral judgment. A working memory task examined whether participants had a visual or verbal cognitive style. Those with a visual style made more deontological judgments than those with a verbal style. Furthermore, they showed that visual interference decreases deontological judgments, and finally they showed that visual imagery supports deontological judgments.

Amit and Greene (2012) exemplifies the above findings with the analogy of closing ones eyes. Caruso and Gino (2011; in Amit & Greene, 2012) showed that people became more selfish when they did so. The most interesting part of the story is the similarity between CLT and DPT when describing moral judgment: the distinction between ends and means. Ends and means differ in their level of abstraction according to CLT (Amit & Greene, 2012) and, as discussed above, also in whether one makes deontological or utilitarian judgments according to DPT.

Amit and Greene (2012) suggest that a theoretical link could be developed between DPT and CLT, since these theories make the same predictions regarding the role of visual imagery in moral psychology. Hence, it could be argued that concrete features elicit System 1 and abstract features elicit System 2. The notion that the two Systems use either abstract or concrete processes has been proposed before, making Amit and Greene's (2012) claims plausible (Evans, 2003, 2008; Stanovich & West, 2000; Klaczynski & Lavallee, 2005).

If such a link exists then the question is: How can we test that proposition? One approach would be to induce participants with a high or low construal. This kind of priming is a recurring theme in CLT (Trope & Liberman, 2003). Secondly, we create environments in which participants can make judgments. Not all judgments in life are of equal difficulty, and a System's efficacy is not generalizable to all situations (Stanovich & West, 2000; Evans, 2008). For instance, it seems plausible that when judging what is the most prevalent name in a distribution of names, that distribution matters. If the names are distributed in a linear fashion, it becomes harder and requires more computational power. But if the names follow a power-function, more intuitive, or heuristic, strategies are successful (Hogarth & Karelaia, 2007). System 1, for example, would thrive in an environment where heuristic strategies can be employed successfully, while System 2 would be the benefactor in an environment which requires more computation and where biases can lead to erroneous judgments. Thus, if construal level evoke system specific reasoning, we can observe how that system performs in our environments.

We are able to change the level of difficulty and the level of construal. This allows us to estimate the proportion of correct answers when manipulating both difficulty and construal. If a question category is derived from an easy (power function like) distribution, we propose that both systems would perform well. If, however, the question category is derived from a hard distribution, there would be noticeable differences in the systems' performances. Thus the percentage of correct answers will differ between System 1 and System 2.

*Dual Process Theory*

By dividing cognitive processes into two systems, System 1 and System 2, the proponents of DPT suggest models for various cognitive processes such as reasoning, judgment and decision-making (Evans, 2008). The consensus about the features of the two systems is that System 1 is a fast, automatic and unconscious system, while System 2 is a slow, deliberate and conscious system (Evans, 2008).

While the consensus, in a broad sense, about the properties of the Systems is well established, they have been attributed multiple properties in the narrow sense. The distribution of attributes that these systems possess sometimes varies from author to author. Evans (2008) tries to untangle the attributes to get a general picture regarding what has been done in DPT research[1]. In addition to the properties above, System 1 is concrete, contextualized and heuristic while System 2 is abstract, decontextualized and analytic. For example, bias based reasoning is the default and employed by System 1, but System 2 can override (or overcome) System 1 to provide analytic reasoning (Evans, 2008; Kahneman & Frederick, 2002).

Klaczynski and Lavallee (2005) elaborate on how such a process is possible. They argue that the analytic System 2 attempts to construct decontextualized task representations which remove characteristics that can hinder the use of an underlying logical structure. These representations then facilitate the effective use of decision-making abilities (Klaczynski & Lavallee, 2005). In contrast, System 1 is highly contextualized (rich in semantic content, dependent on salient memories). This can lead to a violation of rules of inference and decision-making as well as activating stereotypes, strong beliefs and vivid memories (Klaczynski & Lavallee, 2005). An example of such an inference violation is the classic ice cream example in which you get caught in an endless loop: You get offered strawberry, which you take, then banana which you like more than strawberry. Then you get offered vanilla, which you like more than banana. But then you get offered strawberry again, which you like more than vanilla. This results in a $A > B > C > A$ loop which violates laws of logic.

When describing DPT above, one can get the impression that we must avoid System 1 as much as we can: this is not the case. System 1 is assumed to be old from an evolutionary standpoint but should not be viewed as a System that emerged from the primordial soup in an instant. It is more accurate to regard it as a module that has built upon old modular cognitive processes (such as vision and attention) and added human specific modules (such as language and theory of mind, Evans (2008)). The heuristic nature of System 1, and especially its belief system (Evans, 2008), makes it inherently effective in situations where a huge computational load is undesirable and would not have led to an increase in species fitness.

*Construal Level Theory*

The main idea behind Construal Level Theory (CLT) is that people adopt different levels of abstraction when thinking about entities that are close or far away (Trope & Liberman, 2003). The levels of abstraction are divided into low- and high-level construal, where the low-level represents the close (proximal) and concrete and the high-level represents the far away (distal) and abstract (Trope & Liberman, 2003). Proximal events in time makes an individual adopt a low-level construal, which make objects seem more contextualized, focusing less on peripheral features. Conversely, distal events make an individual prone to adopt a high-level construal, which makes objects more decontextualized and with focus on peripheral features (Trope & Liberman, 2010).

Since its emergence, CLT has been attributed to various psychological processes such as judgment of moral transgressions (Eyal, Liberman, & Trope, 2008a), self-control (Fujita, Trope, Liberman, & Levin-Sagi, 2006; Fujita & Han, 2009), and emotional intensity (Van Boven, Kane, McGraw, & Dale, 2010). Since it is a social phenomenon, few studies have examined what effect, if any, construal level has on judgment and decision-making. In addition, few studies have examined probability assessment as a function of construal level. However, there are some studies made about the subject, such as the probability of an event occurring as a function of construal level (Todorov, Goren, & Trope, 2007; Wakslak, 2012), and the unattainable attractive alternative‘s effect on choice in different temporal dimensions (Borovoi, Liberman, & Trope, 2010).

In a series of studies, Wakslak (2012) examined how we perceive probability as a function of spatial and temporal distance. Wakslak (2012) suggests that if an event have a higher probability of occurring (relative to another event), it appears to be closer to us. In the first study a cat, $X$, had a probability $P_X$ of having a specific protein and cat $Y$ had probability $P_Y$ of having another protein, where $P_X > P_Y$. The participants were asked whether one of their two friends, one who lived 3 miles away and another who lived 3000 miles away, owned cat $X$ or $Y$. The results suggest that cat $X$ is more often allocated to the close fiend rather than the far away friend.

Wakslak (2012) findings that probability is related to closeness and thus interrelated with other psychological distances, are not unheard of. Temporal distance (Eyal et al., 2008a; Broemer, Grabowski, Gebauer, Ermel, & Diehl, 2008; Carter & Sanna, 2008), social distance (Eyal et al., 2008a; Broemer et al., 2008) and emotional intensity (Van Boven et al., 2010) have all been suggested as legitimate distance measures. The findings of Wakslak (2012) seem to suggest that probability in itself could be a legitimate distance measure according to CLT

[1]Recently, Evans and Stanovich (2013) have moved away from this supposition and has rejuvenated the dual-process perspective.

framework.

Todorov et al. (2007) enforce the proposal that probability can be compared to the spatial or temporal distance dimension. They argue that low probability outcomes are viewed as mentally distant conforming with studies by Wakslak (2012) and thus enable individuals to better discriminate whether a choice is important to them or not.

Wakslak and Trope (2009) found that priming people with low- or high-level construals influence unrelated probability assessments. When primed with a high-level construal a participant is more likely to rate an event on an unrelated questionnaire as less likely to occur. This study is of methodological importance to us, since we can use it as a manipulation check when we manipulate participants' construal level.

What we can conclude is that spatial and temporal "closeness" have an effect on how people tend to perceive probabilities, and that a manipulation of a construal can "spill over" into completely unrelated judgment tasks. However, what we have not seen is if people respond in a DPT system specific way when primed with different levels of construals.

*Decision Environment*

The frequency distribution of a phenomenon has proven to be important when it comes to how good people are at judging which alternative is the most prevalent (Pachur, Rieskamp, & Hertwig, 2005). Hogarth and Karelaia (2007) made an extensive study that examined different heuristics and decision rules as a function of environment cues weight (noncompensatory[2] , compensatory or equal weighting), cue redundancy, predictability of the environment and more. Hogarth and Karelaia (2007) found that heuristics (typically placed in System 1) perform better in noncompensatory environments. This is in line with Pachur et al. (2005) who found that their heuristic also performed better in nonc ompensatory environments. Regarding the environment, it has been common to speak of "J-shaped" and "not J-shaped" environments. This refers to whether the frequency distribution of an environment is formed as a J rotated clockwise or not. Examples of such environments are shown in Figure 1 and 2. J-shaped environments can be considered as noncompensatory in that some events occur frequently whereas most occur rather infrequently (Pachur, Hertwig, & Rieskamp, 2013). When the environment is not J-shaped (or uniform), the performance of heuristics decrease (Hogarth & Karelaia, 2007; Pachur et al., 2013). Thus, one can consider the J-shape to signify an environment where judgments are more easily made than in a not J-shaped environment. Compared to System 1, System 2 will not be punished in a compensatory environment due to its analytic nature and use of decision rules (Tversky & Kahneman, 1983; Stanovich & West, 2000; Evans, 2003; Kahneman, 2003). Eyal, Liberman, and Trope (2008b) argues that heuristic judgment leads to bias, and that this resides in System 1. Analytic reasoning may override this process, which resides in System 2. Hence, System 1 will be fast to make decisions in every environment but its bias can punish it in either one of the environments.

*Hypotheses and Requirements*

Firstly, if priming a low-level construal leads to System 1 specific behaviour, it can be assumed that the participants are more prone to use heuristics, which thrive in non-compensatory environments. Consequently, participants will have a higher proportion of correct judgments in a non-compensatory environment when primed with a low level construal. System 2 requires more cognitive capacity and may thus interfere in non-compensatory environments, leading to erroneous judgments.

Secondly, the same logic as above applies for compensatory environments and high-level construals. Hence, participants will have a higher proportion of correct judgments in a compensatory environment when primed with a high-level construal. Our two hypotheses are thus:

**H1**. Participants who are primed with a low-level construal should behave in a System 1 specific manner. If they do, participants will report more correct judgments in the easy judgment environment compared to what participants primed with a high-level construal in the same environment will.

**H2**. Participants who are primed with a high-level construal should behave in a System 2 specific manner. If they do, participants will report more correct judgments in the hard judgment environment than participants primed with a low-level construal in the same environment will.

Above we have implicitly set up some requirements for our study; (1) That the construal level priming is successful; (2) That this manipulation is maintained throughout the experiment; (3) That it is possible to manipulate first high and then low level construal or vice versa; and (4) that the easy questions generate more correct answers than the hard questions and that those questions constitute environments that are easy and hard respectively. Those assumptions are examined and reviewed in the Result section.

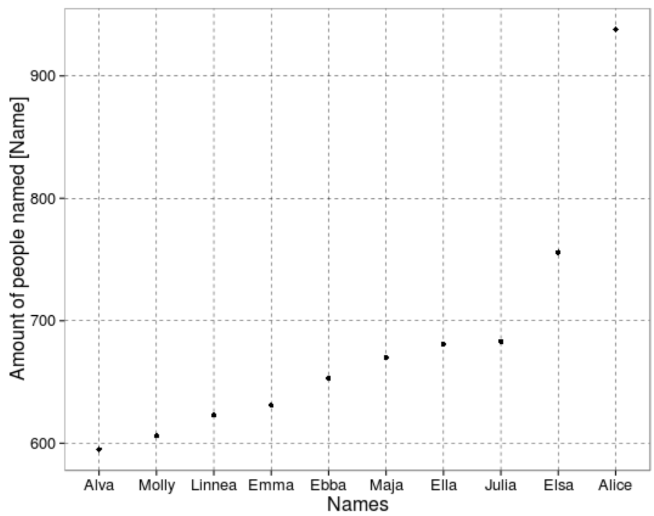


**Figure 1:** A sample of the data used in the Name (Hard) category. Note that the distribution of names is almost linear, with an exception of the two most common.

[2]A strict definition of a noncompensatory environment is an environment in which the validities of each cue are greater than or equal to the sum of those smaller than it (Martignon & Hoffrage, 1999). Other environments are mostly compensatory.

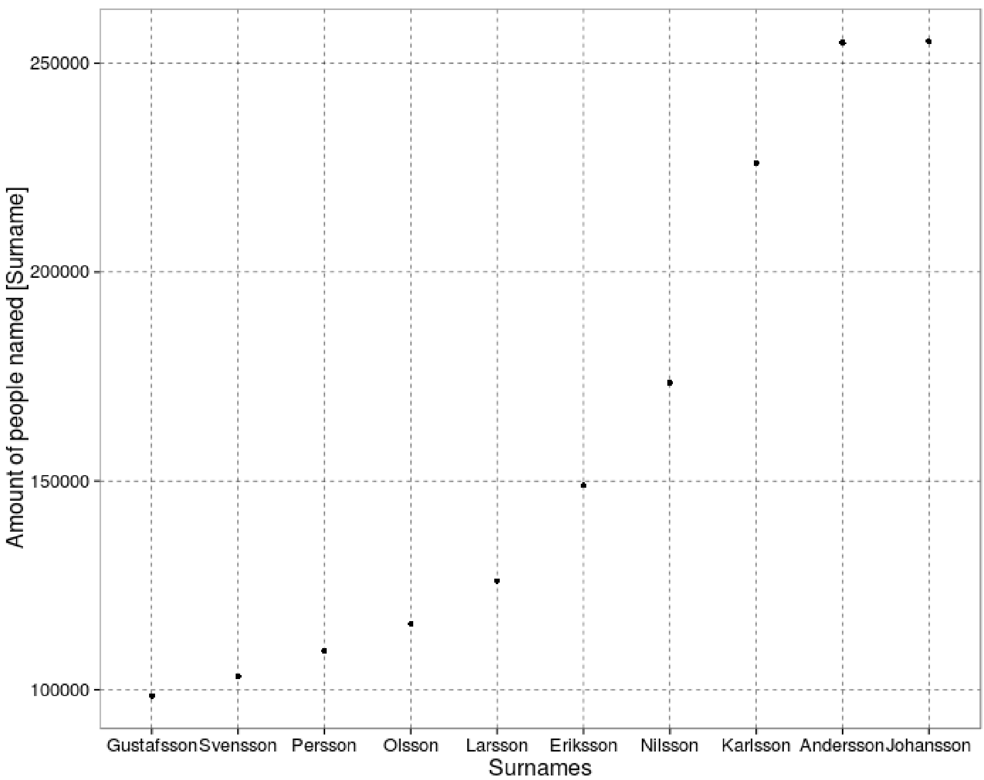


**Figure 2:** A sample of the data used in the Surnames (Easy) category. Note that the distribution of surnames is more shaped like a power-function.

# 2 Materials and Method

*Procedure*

One questionnaire, the experiment leaders contact information, a consent form and a contact form was given to the participants. The consent form explained their rights as a research participant and the contact form gathered the contact information that was necessary in order for participants to get compensation. When compensation had been given in the end of the study, the contact form was destroyed in order to preserve participant integrity. The questionnaire consisted of binary choices, construal manipulation and manipulation checks, described below. For an example of a form see the Appendix, where form A is attached in its entirety.

**Binary Choice Questionnaire**

The questionnaire is composed of two construal manipulations, two manipulation checks and 6 x 2 question categories. Furthermore, the questionnaire is divided in two parts, each with its own construal level manipulation. The first part begins with either a low- or high-level construal manipulation. Succeeding these are six question categories and a manipulation check. Then part two begins with either a low- or high-level construal manipulation, 6 question categories and a manipulation check. Four versions of the questionnaire was used due to counterbalance reasons. These versions are displayed in Table 1.

In each category, there is a series of binary questions where one alternative is correct, the other is not. The categories used were Names, Surnames, Crimes, Education, Population, and Profession. The question categories were gathered from data retrieved from the Swedish Bureau of Statistics[3] (SCB). These categories are either hard or easy, as shown in Table 2. Note that the categories are selected so that they maintain their difficulty when changing construal condition. Thus, the most recent data (low-level) and data from five years ago (high-level) are both linear (hard condition) or both power-function like (easy condition). For example, Names are always hard regardless of construal condition and Crime is always easy.

Data regarding Surnames and Education was not available on SCB's website. Surname data was obtained by contacting SCB, who forwarded the requested data. Education data was obtained by dividing the number of high school students (Skolverket[4]) in a municipal with the number of inhabitants (SCB, 2013) in that municipal. A review of the properties of each category can be seen in Table 2.

Questions were constructed so that they would maintain a level of primed abstractness. This was done by applying a temporal dimension to each question. An example of this temporal dimension in the high-level condition would be; "Which of the two following surnames was most common in Sweden *5 years ago*? Gustavsson or Svensson?", Conversely, in the low-level condition it would be; "Which of the two following surnames is the most common in Sweden *today*, Gustavsson or Svensson?". This was done in accordance with Caruso (2010) who manipulated temporal distance by changing the way the question was formulated. In the past condition, his manipulation were "*Last* month..." and in the other condition "*Next* month...". This concept will maintain the level of manipulated construal.

[3]www.scb.se , retrieved February, 2013
[4]www.skolverket.se , retrieved February, 2013

### Construal Manipulation

Construal level was manipulated in accordance with Fujita et al. (2006) where participants were presented with 40 words in a list. In the high-level condition, they were asked to generate a superordinate category of a word (for example, ”fruit” is superordinate to ”banana”). In the low-level condition, they were asked to generate a subordinate example of a word (for example, ”banana” is subordinate to the word ”fruit”).

Two independent judges analyze the abstractness of a 40-word classification task. Judges were asked to assess whether a participants response is a sub-ordinate or a super-ordinate category of a word. If the participants gave sub-ordinate examples of a word it was coded as -1, super-ordinate was coded as 1 and if it fulfilled neither it was coded as 0.

The two judges' responses were correlated for inter-judge reliability and their scores were averaged to create an abstractness index. Higher score on this index suggest a high construal level and a lower score suggest a lower construal level. A comparison is then made between the high and low end of the index. If participant in the high level condition generate significantly more abstract responses than participants in the low level condition the manipulation has succeeded. The values reported by Fujita et al. (2006) for experiment 3a was: $M_{high}$ = 33.3, $M_{low}$ = -34.9, $t(42)$ = 39.5, $p < 0.001$, $r$ = 0.99, and for experiment 3b: $M_{high}$ = 32.8, $M_{low}$ = -37.6, $t(42)$ = 40.5 $p < 0.001$, $r$ = 0.98.

**Table 1:** Method-table: This table describe the four questionnaires components and in what order they are presented.

| Form | Component | Construal | Order |
|---|---|---|---|
| A | Construal Manipulation | High | 1 |
| | Judgment | High | 2 |
| | Manipulation Check 1 | | 3 |
| | Construal Manipulation | Low | 4 |
| | Judgment | Low | 5 |
| | Manipulation Check 2 | | 6 |
| B | Construal Manipulation | Low | 1 |
| | Judgment | Low | 2 |
| | Manipulation Check 1 | | 3 |
| | Construal Manipulation | High | 4 |
| | Judgment | High | 5 |
| | Manipulation Check 2 | | 6 |
| C | Construal Manipulation | High | 1 |
| | Judgment | High | 2 |
| | Manipulation Check 2 | | 3 |
| | Construal Manipulation | Low | 4 |
| | Judgment | Low | 5 |
| | Manipulation Check 1 | | 6 |
| D | Construal Manipulation | Low | 1 |
| | Judgment | Low | 2 |
| | Manipulation Check 2 | | 3 |
| | Construal Manipulation | High | 4 |
| | Judgment | High | 5 |
| | Manipulation Check 1 | | 6 |

### Construal Manipulation Check

The Construal Manipulation Check (CMC) is built on the findings of Wakslak and Trope (2009), in that people who adopt different construal also judge unrelated events as more or less likely to happen. Mainly, this will ensure that the participants have adopted a high or low-level construal when performing the trials. If a high-level construal is adopted, participants are prone to judge an unrelated event as less likely to happen compared to participants who are primed with a low-level construal. Using the framework of Wakslak and Trope (2009) a 7 point scale (1 = very unlikely, 7= very likely) will be used to answer five questions. An example of such a question is ”A mother is thinking about adopting a child. How likely is she to do so?”. Unlike the original likelihood judgment (Wakslak & Trope, 2009) the scale we used consists of five items (compared to seven) and is in Swedish. It is therefore important to examine the validity of this scale. This is done by analyzing the first half of the questionnaire, when only one construal manipulation had taken place, and then compare the mean on this scale for each condition (low/high construal). If there is a significant difference, in favor of Wakslak and Trope (2009), this scale will act as a CMC check. That is, it will make sure that it is possible to quickly shift from high to low construal level (or vice versa).

*Pilot*

A pilot study was conducted with 15 participants (age 20-58 years old). The pilot was mainly conducted to secure that the construal level manipulation and the CMC have an effect.

Participants got a stripped version of the final questionnaire, containing the construal level manipulation and the CMC. Seven of the participants started with high-level manipulation and finished with low-level manipulation. The other eight started with low-level manipulation and finished with high-level manipulation. In all cases, the surrounding environment was quiet, but varied location wise.

An abstractness index was constructed by averaging participants responses. These responses were highly correlated between judges ($r$ = 0.92, $p < 0.05$). Participants that generated high-level attributes had significantly more abstract responses than those who generated low-level attributes ($M_{high}$ = 32.1 vs. $M_{low}$ = -28.5, $t(14)$ = 2.2, $p < 0.05$)

The CMC (which examines if the manipulation above had an impact) can be seen in Figure 3. Notice that the notches are far apart regardless of whether you start with a high or low construal manipulation. But to ensure that the CMC fulfilled its purpose, a Wilcoxon signed-rank test between the high- and low-level condition in first and second half of the CMC was conducted. First: $W$ = 281.5, $p < 0.001$; Second: $W$ = 236.0, $p < 0.001$.

This implies that there is a difference between the abstract and the concrete in both the first and the second part. This implies that the construal manipulation and the CMC could fill its purpose in our main experiment.

**Table 2:** Question Categories

| Category Name | Difficulty | Example Questions |
|---|---|---|
| Names | Hard | What name, in each row, was the most common name given to newborns in Sweden five years ago? |
| Profession | Hard | What profession, in each row, was the most common in Sweden five years ago? |
| Education | Hard | Which municipal, in each row, had the most number of high-school students in relation to the municipal‘s population count five years ago? |
| Crime | Easy | What crime, in each row, was the most common crime in Sweden five years ago? |
| Surname | Easy | Which surname, in every row, was the most common in Sweden five years ago? |
| Population | Easy | Which municipal, in each row, had the most inhabitants five years ago? |

Note that the example questions above are written as they were in the high-level construal condition.

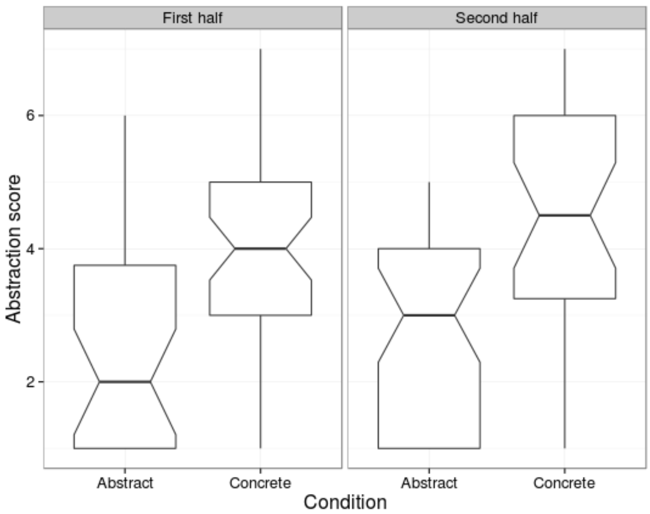


**Figure 3:** Abstraction score for the first and second half of the Pilot questionnaire. The Notches represent the confidence interval of the median, lower and upper whisker represent smallest and largest observed value respectively. The Box represent the Interquartile Range or 50% of the data.

*Participants*

101 participants (age 18-19 years old) were recruited from high schools in the municipal areas of Lund and Malmö. 14 participants could not be used in the analysis due to at least one of the following reasons: (1) A majority of the questionnaire was not completed; (2) It was impossible to interpret the words written in the manipulation section; and (3) The questionnaire was completed, but the participant had misunderstood the binary question section resulting in inability to decode it.

*Method*

**Execution**

The first stage in the recruitment of participants was to contact school principals in order to get permission to perform the questionnaire at the schools. Overall, 16 principals at different high schools in the municipals of Lund, Malmö and Eslöv were contacted. When a principal had given permission he/she forwarded e-mail addresses to the teachers responsible for the 3rd year students (age 18-19). Only 3rd year students were used because it eliminated the possibility that their consent would be invalid by Swedish law. The responsible teachers then got an e-mail regarding the study and a short description of its purpose. A time for data collection was booked with each teacher who showed interest in participating. 6 classes were visited across two schools. Each visit lasted 35 minutes of which five were devoted to asking if the pupils would like to attend the study and to explain the rights they have as possible participants. Pupils who decided to attend signed the consent form and spent the remaining 30 minutes completing the questionnaire. Because of the time restraint, the pupils were informed that there was a possibility that some may not be finished in time. Ethical implications of this method are discussed in the Discussion section.

Rewards have been found to increase motivation in participants, so that they are more likely to maximize their effort and less likely to answer at random (Hertwig & Ortmann, 2001). Before the experiment started, participants were told that the top 20 performers[5] in the experiment would receive a cinema ticket once the results had been examined. Once results were examined, these top 20 participants were contacted and given their cinema ticket. Their contact data was then destroyed.

**Design**

Four counterbalanced forms were randomized across participants. Each form consisted of a 2 (construal condition: low-level vs. high-level) $\times$ 2 (question condition: easy vs. hard) mixed design. The first half of the form consisted of a high- or low-level construal manipulation followed by six blocks of questions with six questions in each block. These blocks were either easy or hard (3 easy and 3 hard) and were presented one after another. This was followed by the CMC, which contained five questions about likelihood judgments. This procedure was then repeated, with the opposite construal manipulation and six new blocks of questions. For a full overview of this process see Table 1.

*Analysis*

Below, the analysis of participants' performance in the judgment task, (Logistic Regression with Random Effect Mixed Models) is reviewed. Raw data for this task was long-coded and contains nine categories (participant nr, raw answer, corrected answer, questionnaire variant, question category, construal manipulation, question order, question difficulty and question id). The data was analyzed using R version 2.14.1.

**Judgment Analysis**

In the judgment analysis we concern ourselves with binary variables. The participant faces a question and then two possi-

[5]More precisely, participants were told that the top 20 who ”guessed” highest proportion of correct answers would get a cinema ticket. The word ”guessed” were used to reduce potential stress or discomfort.

ble answers. One of these are correct, the other is not. What we are concerned about is the proportion of correct answers each participant had as a function of construal level and difficulty. Thus, we have a binary dependent variable and two binary independent variables. Logistic regression is most suitable for analysis of categorical variables. Jaeger (2008) and Baayen, Davidson, and Bates (2008) emphasize that traditional methods (especially ANOVAs) are inferior, because they do not include random effect modeling.

Random effect modeling refers to compensation for random effects, such as participant or item effects. An implication of random effect modeling is that variation is modeled through variance. While variation implies that things are unequal, variance describes the characteristics of a random variable. Random effects are random variables, and hence we model variation through variance. The data set consists of three variables where it is desirable to compensate for random effects: participant number, question category and also question id. Even though these categories are not selected purely at random, one cannot make the argument that they do not, in themselves, affect the result.

When Jaeger (2008) describes this method, he compares it to an ANOVA and explains why that analysis of categorical variables is problematic. Jaeger (2008) continues with an introduction of logistic regression and then introduces the mixed models (see (Baayen et al., 2008)). Below follows a review of the method of choice for our analysis.

### Logistic Regression

Logistic Regression can be viewed as a special case of Linear regression, where independent variables takes a value of either 0 or 1. Linear regression is used to to describe some outcome $y$ as a linear combination of independent variables, $x_1 \dots x_n$, which are commonly called *predictors*. In addition, the regression also consist of a random error $(\varepsilon)$ and intercepts $(\beta_0 \dots \beta_n)$. To predict the value of $y$, we construct a linear combination of our predictors, intercepts and random error:

$$y = \beta_0 + x_1\beta_1 + ... + x_n\beta_n + \varepsilon \tag{1}$$

The issue with this approach is that we have data that is binomially distributed. Consider our binary questions above. They can have two values (yes or no) and these are binomially distributed, which means that for every trial, there is a probability $p$ of an answer being correct. Repeated over $n$ trials, the probability $p$ of having $k$ correct answers are:

$$f(k,n,p) = \frac{n!}{k!(n-k)!}p^k(1-p)^{n-k} \tag{2}$$

From the gathered data, we want to predict the probability, $p$, that the dependent variable takes a value of either 0 or 1. But even when doing so we can end up with probabilities larger than 1. This is because the numerical predictors may have an unlimited range. What we can do is to calculate the *odds* of the probabilities $p$ (correct) and *1-p* (incorrect):

$$odds(p) = \frac{p}{1-p} \implies p(odds) = \frac{odds}{1+odds} \tag{3}$$

We can now describe the odds as an outcome by taking the product of our coefficients, $\beta_n$, and raise those coefficients to their respective predictor value, $x_n$, yielding the equation:

$$\frac{p}{1-p} = \beta_0 * \beta_1^{x_1} * \dots * \beta_n^{x_n} \tag{4}$$

We then introduce the *logit of p*, which is a log transformation of the p values and can be thought of as a link between the log distribution and the normal linear regression equation:

$$logit(p) = ln\frac{p}{1-p} \tag{5}$$

The logit is centred around 0 which correspond to a probability of p=0.5, and ranges from positive to negative infinity. We can now have odds that stretch from positive to negative infinity, but always generate probabilities in the confines 0 to 1. Hence, the logit model is linear regression in a log-odds space. Taking the natural logarithm of these *odds* turn the model back into the linear combination described in Equation 1:

$$\begin{aligned} ln\frac{p}{1-p} &= ln(\beta_0 * \beta_1^{x_1} * \dots * \beta_n^{x_n}) = \\ &= ln\beta_0 + x_1 ln\beta_1 + \dots + x_n ln\beta_n \end{aligned} \tag{6}$$

The logistic regression equation can thus be described as:

$$logit[p(x)] = ln\frac{p(x)}{1-p(x)} = \beta_0 + x_1\beta_1 + ... + x_n\beta_n \tag{7}$$

We also introduce the *logistic* function, which takes log-odds scores and transform them into probabilities. It is worth noting that the *logit* is the inverse of the *logistic* function, giving us:

$$logistic(p) = \frac{e^p}{e^p+1} \implies logit(p) = ln\frac{logistic(p)}{1-logistic(p)} \tag{8}$$

### Mixed Models

Mixed models are statistical models that are able to contain both fixed and random effects. Furthermore, it is able to compensate for convenience sampling and handle missing values more efficiently than traditional analysis of variances. In this paper, we will compensate for random effects that can occur among participants and items. The mixed model method is based on maximum likelihood methods. Baayen et al. (2008) formalize a mixed model in the following manner

$$y_{ij} = X_i j\beta + S_i s_i + W_j w_j + \varepsilon_{ij} \tag{9}$$

where the vector $y_{ij}$ represent the response of participant $i$ to item $j$. $X_{ij}$ is a design matrix, comprised of columns containing factors and covariates. $\beta$ is a population coefficient, and together with $X_{ij}$ provide the model's best guess about eventual unseen subjects and items. These, in turn, are normally distributed around zero. However, this is a statistical model, so we must have some uncertainty and account for random effects. $S_i$ is a matrix (or random effect structure) that is a copy of $X_{ij}$ . This is then multiplied with a vector-specifying participant $i$. The same is done for $W_j$ which is a matrix that corresponds to the random effect that various items (e.g. questions) can have. Lastly, we introduce $\varepsilon_{ij}$ as residual errors.

A simplification of this model can be written as follows:

$$y = X\beta + Zb + \varepsilon \tag{10}$$

The variable $y$ is predicted by $X\beta$ and $Zb$ where $Z$ is a combination of subject matrix $S$ and item matrix $W$, and $b$ is subject and random item effects combined.

Our hypothesis 1-2 is dependent on the estimated proportion of correct judgments, thus that is our dependent variable. Our first model take a baseline and then introduces random effect adjustment to the intercept.

Model A (Is only accounting for whether participants answered correct or not, i.e. the intercept, and the random effects that participants, question id's and question categories had.):

$$ln\frac{p}{1-p} = \beta_0 + \gamma_i + q_j + f_k \quad (11)$$

where

$$a_{i,j,k}(p) \sim Binominal(0, \gamma_{oi}, q_{oj}, f_{ok}) \quad (12)$$

11 describes a baseline $\beta_0$ and then introduces three categories namely, participants $(\gamma_{0i})$, question categories $(q_{0j})$, question id's $(f_{0k})$ as design matrices associated with the random effects. The next step is to create models that can test our hypotheses. To investigate whether difficulty, construal and/or the interaction between them fit the hypotheses, we construct 4 additional models.

Model B (In addition to Model A, this model introduce Difficulty as a variable and the effect that participants could have on Difficulty) :

$$\beta_o + x_1\beta_1 + \gamma_{0i} + x_1\gamma_{1i} + q_j + f_k \quad (13)$$

Model C (In addition to Model A, this model introduce Construal as a variable and the effect that participants could have on Construal) :

$$\beta_o + x_2\beta_2 + \gamma_{0i} + x_2\gamma_{2i} + q_j + f_k \quad (14)$$

Model D (In addition to Model A, this model introduce Difficulty and Construal, without interaction, as variables and the effect that participants had on these two variables) :

$$\beta_o + x_1\beta_1 + x_2\beta_2 + \gamma_{0i} + x_1\gamma_{1i} + x_2\gamma_{2i} + q_j + f_k \quad (15)$$

Model E (In addition to Model A, this model introduce Difficulty and Construal, with interaction, as variables and the effect that participants had on these two variables) :

$$\beta_o + x_1\beta_1 + x_2\beta_2 + \gamma_{0i} + x_{1i}\gamma_{1i} + x_{2i}\gamma_{2i} + x_{1i}\gamma_{1i} * x_{2i}\gamma_{2i} + q_j + f_k \quad (16)$$

Where $x_1$ and $x_2$ are dummy coded representing "Difficulty" and "Construal" separately. $\varepsilon$ is residual errors and $\gamma$ is the random effect that participants have. $\gamma_{0i}$ is the random effect a participant has in general and $\gamma_{1i}$ and $\gamma_{2i}$ is the random effect a participant has on Difficulty and Construal separately.

Next, we shall describe how models are tested against each other to see which the superior model is.

#### Likelihood Ratio Test

To assess which model is superior to another we conduct Likelihood Ratio Tests. The test compares two models, one of which is a null model (a special case, or simplification, of the other model) and shows if the alternative model fit the data significantly better than the null model. Consider two models, A and B, where A has 1 free parameter and B has 2. B will always fit as least as good as A (it has more parameters), but the question is if it performs significantly better. Model A and B are separately fitted to the data and log-likelihoods are calculated. They are then compared following a chi-square distribution, calculating whether B performs significantly better than A.

#### Akaike Information Criterion

If we were to encounter some models which are better than the null model but do not differ from one another we consult the Akaike Information Criterion (AIC; Akaike (1974)). AIC is an asymptotic estimate of the predictive performance in cross validation. That is, it compares two or more models and discern which of them best predict the data. Being an asymptotic estimate, it is only valid if the number of data points are numerous enough. It is important to note that AIC is not a hypothesis test. An AIC test does not warn if the data fit poorly, it can only be interpreted in relation to another model. It is therefore useful for our purpose if two or more models are tied and inseparable, AIC can then compare these and tell us which of the models that is preferable.

# 3 Results

*Construal Level Manipulation*

An abstractness index was constructed by averaging participants responses. Participants that generated high-level attributes had significantly more abstract responses than those who generated low-level attributes (*Mhigh* = -31.6 vs. *Mlow* = 25.2, respectively), $t(86) = 32.1$, $p<.001$. That is, participants in the high level condition generated significantly more abstract responses than participants in the low level condition. The two judges' scores were strongly correlated ($r = 0.83$).

*CMC*

In Figure 4, a boxplot reviewing the scores from the first half of the questionnaire and the second half of the questionnaire are depicted. Note that the scores are almost identical; medians in the first half are equal, although the concrete condition has a smaller standard deviation. In the second half there appears to be a difference. However, looking at the scale (1-7) it is doubtful that there could be a difference, due to the high standard deviation. To be sure, we perform a Wilcoxon signed-rank test. First half: $Z = 22366$, $p = 0.6184$; Second half: $Z = 20378$, $p = 0.08$. Thus, there is no difference between the abstract and the concrete condition in either the first or the second half of the questionnaire.

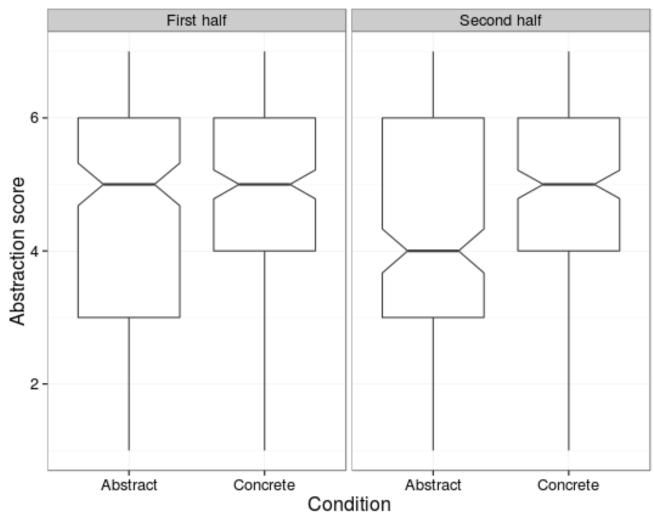


**Figure 4:** Abstraction score for the first and second half of the Pilot questionnaire. The Notches represent the confidence interval of the median, lower and upper whisker represent smallest and largest observed value respectively. The Box represent the Interquartile Range or 50% of the data.

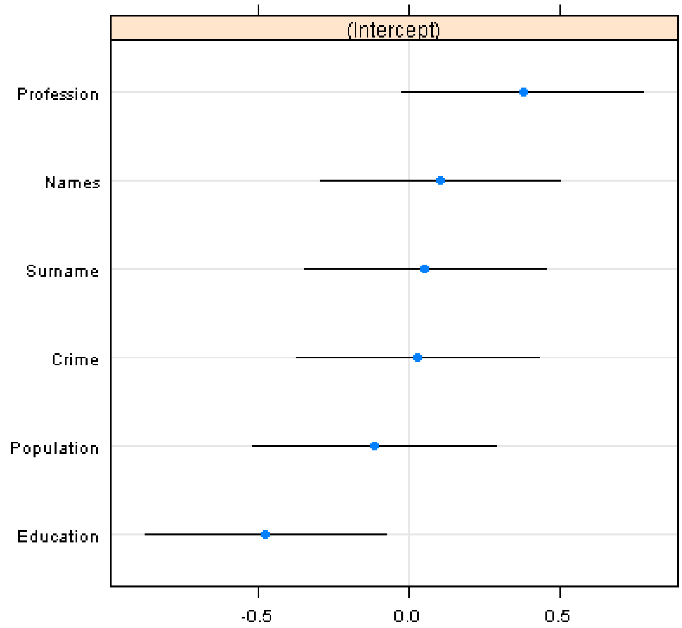


**Figure 5:** Estimated proportion of correct answers for every question category (First judgment analysis). Dots represent the log-odds scores of the question categories and lines are the standard error, also measured in log-odds.

*The Questions*

When analysing the data, a deviation among the question categories was revealed. Plotting the six questions categories displays that the ”Education” category differs markedly, in terms of correct answers produced, compared to the other categories (see Figure 5). Participants answered 38% correct on average in this category. This remarkable feat is discussed in the discussion section. The question was designed to be hard, but this seems to be an unexplainable bias. We thereby feel that it is necessary to perform two analyses of the Judgment task: In the first, the category is included in the models and in the second it is excluded.

*First Judgment Analysis*

This section examines the models described in the Methods section. A review of each models' characteristics in terms of intercepts, estimated predictors and standard deviation are found in Table 3. Some of the key values for our discussion are presented below.

Model A (baseline and random effects) displays the estimated proportion of correct answers across all conditions. The log-odds intercept is 0.30. Transforming this to percent is done by Equation 8, which is always used when transforming the log-odds score to the proportion of correct answers. Reviewing the log-liklihood test for all models, we see that every model fits the data better than model A (baseline and random effects only). However, model A reveals that the estimated proportion of correct answers across the experiment 56%.

Model B (added difficulty) estimates that participants answered 64% correct in the easy environments and 46.7% in the hard environments.

Model C (added construal) estimates that participants answered 56.4% correct in the high-level construal condition and 54.3% correct in the low level construal condition.

Model D (difficulty and construal without interaction) estimates that participants in the high-level condition in an easy environment answered 65.1% correct. If they were manipulated with a low-level construal, in an easy environment, they answered 66.9% correct. In the hard environment they answered 47.5% correct in the high-level condition and 49.6% in the low-level condition.

Model E (added difficulty and construal with interaction) estimates that participants in the easy environment answered 65% correct if they were manipulated with high construal and 67% if they were manipulated with low construal. In the hard environment, participants answered 48% in the high level condition and 49.5% in the low level condition.

Looking at Table 4 we see that every model fits the data better than model A (baseline and random effects). Comparing model E (added diffficulty and construal with interaction) with A (baseline and random effects), B (added difficulty) and C (added construal) yields that E fits the data much better in comparison. But it is not the best model according to the Akaike-table (Table 5); that would be model D (added difficulty and construal without interaction). A comparison between model E and D yields no significant difference between the models. Consulting the Akaike-table result in D being the model of choice and a basis for our discussion.

**Table 3:** Log-odds scores for the Models, with and without the Education category. Models without the Education category has the subscript *NoEdu*. Numbers within parentheses display the standard error.

| Models | Intercept | Difficulty | Construal | Difficulty x Construal |
|---|---|---|---|---|
| A | 0.30 (0.23) | | | |
| B | 0.66 (0.25) | -0.71 (0.34) | | |
| C | 0.26 (0.26) | | 0.08 (0.22) | |
| D | 0.63 (0.27) | -0.72 (0.34) | 0.08 (0.21) | |
| E | 0.63 (0.30) | -0.71 (0.41) | 0.08 (0.31) | 0.02 (0.43) |
| $A_{NoEdu}$ | 0.52 (0.12) | | | |
| $B_{NoEdu}$ | 0.66 (0.15) | -0.31 (0.24) | | |
| $C_{NoEdu}$ | 0.50 (0.17) | | 0.06 (0.24) | |
| $D_{NoEdu}$ | 0.63 (0.20) | -0.33 (0.24) | 0.06 (0.24) | |
| $E_{NoEdu}$ | 0.63 (0.23) | -0.30 (0.34) | 0.09 (0.31) | -0.06 (0.48) |

**Table 4:** Log-likelihood comparisons and Chi-test for Model A-E (With Education)

| Models | df | logLik | Chi-square | Chi-df | Chi-p |
|---|---|---|---|---|---|
| A vs | 4 | -3811.6 | | | |
| B | 7 | -3805.1 | 13.015 | 3 | <0.01 |
| C | 7 | -3798.7 | 25.896 | 3 | <0.0001 |
| D | 11 | -3792.2 | 38.836 | 7 | <<0.0001 |
| E | 16 | -3788.5 | 46.269 | 12 | <<0.0001 |
| E vs | 16 | -3811.6 | | | |
| B | 7 | -3805.1 | 33.253 | 9 | <0.001 |
| C | 7 | -3798.7 | 20.372 | 9 | 0.015 |
| D | 11 | -3792.2 | 7.4322 | 5 | 0.190 |

**Table 5:** AIC-table for Model A-E (With Education)

| Models | dAIC | df | weights |
|---|---|---|---|
| D | 0 | 11 | 0.7344 |
| E | 2.6 | 16 | 0.2034 |
| C | 4.9 | 7 | 0.0621 |
| B | 17.8 | 7 | <0.001 |
| A | 24.8 | 4 | <0.001 |

**Table 6:** Log-likelihood comparisons and Chi-test for Model A-E (Without Education)

| Models | df | logLik | Chi-square | Chi-df | Chi-p |
|---|---|---|---|---|---|
| A vs | 4 | -3174.8 | | | |
| B | 7 | -3172.5 | 4.473 | 3 | 0.214 |
| C | 7 | -3165.8 | 17.825 | 3 | <0.001 |
| D | 11 | -3163.6 | 22.275 | 7 | <<0.01 |
| E | 16 | -3158.8 | 31.836 | 12 | <<0.01 |
| E vs | 16 | -3158.8 | | | |
| B | 7 | -3172.5 | 27.362 | 9 | <0.01 |
| C | 7 | -3165.8 | 14.011 | 9 | 0.121 |
| D | 11 | -3163.6 | 9.5608 | 5 | 0.088 |

**Table 7:** AIC-table for Models A-E (Without Education)

| Models | dAIC | df | weights |
|---|---|---|---|
| E | 0 | 11 | 0.544 |
| D | 5.2 | 16 | 0.2034 |
| C | 4.1 | 7 | 0.0621 |
| B | 14.8 | 7 | <0.001 |
| A | 24.8 | 4 | <0.001 |

*Second Judgment Analysis*

This section examines the five models constructed above without the Education category. Values are presented in the same fashion as above, with the exception that the models in this analysis have the subscript *NoEdu*. A review of each model‘s characteristics in terms of intercepts, estimated predictors and standard deviation are found in Table 3. Some of the key values for our discussion are presented below.

Model $A_{NoEdu}$ (baseline and random effects) display the estimated proportion of correct answers across all conditions. The intercept is 0.52, which is the log-odds intercept. Transforming this, we obtain the estimation that participants had 62.9% correct on average.

Model $B_{NoEdu}$‘s (added difficulty) intercept is 0.57 and the predictor estimation is -0.29. Transforming these, we obtain the estimation that participants answered 64% and 57% correct in easy and hard environment respectively.

Log-likelihood and Chi-square tests are found in Table 6. AIC values for the models are found in Table 7.

In summation, the only effect removing the Education category had was that participants’ had a higher proportion of correct answers overall and that they had a higher proportion of correct answers in the hard environment. There are still differences when comparing environments but no effects are found when adding the Construal variable. The models of choice for our discussion below will be model D (added difficulty and construal without interaction) and E (added difficulty and construal with interaction), which depicts that construal had no effect on the proportion of correct answers and that the easy environment generated more corrected answers than the hard environment.

# 4 Discussion

Does the of priming construal level facilitate the activation of different modes, or Systems? Our data suggest that there is a possibility this might not be the case. Below we will discuss various interpretations of the results and suggest future experiments that could shed light on these processes.

When discussing the main findings below, we only concern ourselves with the models that include the Education category (First Judgment Analysis). This is because categories were chosen to belong to either a hard or an easy category. Hence it can be argued that since Education was in the hard category *and* was inherently hard for the participants it should be included in the discussion of our main findings. The only difference between the the First and Second Analysis was that the proportion of correct answers across every decision environment increased. Acknowledging this and presenting the alternative results above (Second Judgment Analysis) and in the Appendix, we move forward to discuss our main findings.

*Main Findings*

Our hypotheses, **H1** and **H2**, suggest that priming participants’ construal levels should produce a change in the proportion of correct answers across environments. As a basis for our discussion we have chosen model D (added construal and difficulty without interaction), but we feel the need to also discuss the closely related model E (added construal and difficulty with interaction) because of the interaction term. These models are very similar and the latter might shed some light on the underlying processes.

The result obtained by model D (added construal and difficulty without interaction) tells us two things: (1) Questions in the easy environment always have a higher proportion of correct answers in comparison with questions in the hard environment; (2) Changing the construal level does not change the proportion of correct answers significantly. This suggests that the criterion that the easy environment would generate more correct answers compared to the hard environment, is fulfilled. It does not, however, support our hypotheses **H1** and **H2**; there is nothing to suggest that there is an interaction between the variables.

This is why it is worthwhile to review model E (added construal and difficulty with interaction). Patterns regarding the decision environments, that the easy environment generates a higher proportion of correct answers than the hard environment, remains. In fact, it does so in every model. What we also find is that the introduction of varying construal does not change the frequency of correct responses. The observed effect in both these models is too small with a too high standard error in order for us to jump to a conclusion, other than that an effect is absent.

What we can conclude is that there is no support in any of these models for our hypothesis **H1** and **H2**.

*Examining the Requirements*

Priming occurs frequently in the CLT literature, and manipulation checks are next-to-never used (Fujita et al., 2006; Fujita & Han, 2009; Trope & Liberman, 2010; Wakslak & Trope, 2009; Wakslak, 2012). At least we can conclude that we followed the standard given for construal level manipulation. We also did conduct a pilot study which examined if it indeed was possible to manipulate one construal after another *and* if that manipulation influenced unrelated probability assessments (manipulation check). What we found was that using this kind of manipulation and measure on a larger scale seemed plausible.

If this is the case, we have a non-finding, which would suggest that construal levels do not facilitate the activation of different modes, or DPT Systems. A non-finding could also be due to a tendency to ignore the seriousness of the experiment and complete it at random. This is not the case, because if it were true, the effect of changing difficulty would not have differed from chance. In addition, there was also the potential of receiving a reward, which would deter such behaviour (Hertwig & Ortmann, 2001). Hence, one can assume that participants in general read, reasoned and analyzed the judgments to be made.

Another possible interpretation is that the manipulation check is correct and therefore suggests a failure to prime participants. This contradicts the judges who deemed the manipulation successful. It would suggest an initial successful priming which diminishes over the course of the experiment. Since the questions are constructed in a manner that would maintain an adopted construal (near the present vs. far from present) this, again, seems unlikely. Sadly, there is no data to support either claim, but the ”diminishing construal” seems less likely than the manipulation being incorrect. However, the Pilot suggest that the ”diminishing construal” explanation seem more likely as it was successful but lacked the binary choice questions between construal manipulation and the CMC.

Lastly, we acknowledge that hard and easy questions did indeed constitute hard and easy environments respectively (see model B for reference).

## The Manipulation of Construal

In this study, we are manipulating construal according to a method used by Fujita et al. (2006). In the original paper by Fujita et al. (2006), there were 40 words in which participants either gave sub or superordinate examples of. These 40 words were never published, only examples from the original paper were available (such as singer, king, pasta, bag and soap). This study required 80 such words per participant, and hence the author constructed a new version of the task. There are other construal level manipulations available, such as the ”Maintaining Good Health” manipulation (Fujita et al., 2006), but this cannot be used in a consecutive order, priming first high and then low-level construal (or vice versa). The level of similarity between high and low level manipulation is too high, risking participant awareness. The construal manipulation was measured in the same manner as in Fujita et al's. (2006) paper. Comparing the results to Fujita et al's. yields a satisfactory resemblance with the original paper. The main difference was a lower inter-judge reliability: Fujita et al., (2006) Experiment 3a: $r=0.99$ and Fujita et al., (2006) Experiment 3b: $r=.98$; compared to this study: $r=0.83$.

Although this study is not an exact replica of Fujita et al's. (2006) or Wakslak and Trope's (2009), it does follow the same principles. Others have also used the Fujita et al. (2006) technique to manipulate the level of construal. In an imaging study by Gilead, Liberman, and Maril (2013) it was used successfully to manipulate construal level.

Wakslak and Trope (2009) found support for their claim that construal levels influenced unrelated probability assessments in several sub-studies, each of them manipulating construal by different means (Attribute alignment, Categorization Priming, ”Why” vs ”How” priming, etc). The overall effects on the reported likelihood that an event would happen strongly suggested that priming participants with level of construal had an effect on probability assessment.

The thoroughness of the studies above put us in a delicate predicament. Clearly, the priming method has been proved to work (Fujita et al., 2006; Gilead et al., 2013) as has the unrelated probability assessment (Wakslak & Trope, 2009). A bold statement would be suggesting that we have failed to replicate their findings. Before such a statement, we must acknowledge in what ways our studies differ.

## Variations of Measure and Method

Wakslak and Trope (2009) used two set of questions in their probability assessment questionnaire, one with seven and one with six questions. These questions were preceded by various kinds of construal level priming. None of the sets contain the same items, that is, there are 13 questions in total. Our study contained two sets with five questions, differing from the original study, in each. In addition, our study contained the judgment segment with 36 items between manipulation and the Wakslak and Trope (2009) inspired segment. One could argue that the construal manipulation might ”diminish” during the longer 36-item segment, making the last segment obsolete. Studies regarding the endurance of construal level priming is scarce at best. Magee, Milliken, and Lurie (2010) examined the aftermath of the 9/11 catastrophe, finding that people in power experience less social distance than people who are powerless. In other words, they construe the event in different levels of abstraction years after the catastrophe. However, that construct happened then and has, in a manner of speaking, formed the perception and memory of the event. It does not display that these individuals have been primed for all these year. The endurance of priming also seem not to be researched, the above study is as close as it gets. Hence we leave this to further research.

Fujita et al. (2006) only reviewed 36 items in their construal manipulation. Since this study had 40 x 2 items it is obvious that the author constructed 44 additional items. The impact this had on the judges score are minimal; the inter-judge correlation and the mean values for high and low construal level are within acceptable limits (comparing to Fujita et al.; see Results section).

*Pilot Recap*

The author was aware that the methodology regarding both construal level manipulation (Fujita et al., 2006) and CMC (Wakslak & Trope, 2009) differed from the originals, as discussed above. It is because of this that the pilot was conducted. The results indicated that generating subordinate and superordinate categories had an effect on the CMC. Although the sample size was 14 participants and the questionnaire was stripped, it provided guidance in the construction of the experiment. Based on the research done by Fujita et al. (2006); Wakslak and Trope (2009) and the Pilot results, the author felt confidence in the experimental layout.

However, the Pilot had some shortcomings. Firstly, the age group (20-58 years old) did not match the target audience for the main experiment. Secondly, only one participant at a time performed the Pilot, as opposed to a class of 15 to 30 pupils in the main experiment. A more accurate Pilot study would have taken the age and the environment into account, as well as the binary choice segment between the construal manipulation and the CMC.

*Strenghts and Limitations*

## Procedure

The procedure is, as far as the author is aware of, rather unique. Participants did not conduct the experiment in a classic experimental setting. Instead, they completed it in a classroom with their classmates surrounding them. The main advantage of this procedure is that the theories is tested outside the confines of a controlled environment. It has been fully established that CLT and DPT have support in controlled environments, which makes it necessary (and exciting) to examine them in other, less controlled, environments.

However, there is a practical and ethical concern regarding this procedure. When the participants were finished, they left the classroom, and that could make their classmates uneasy, especially participants with writing or reading difficulties. Participants who were left after the time limit had been reached were asked if they felt violated because they could not complete the experiment. No participant reported that this was the case, but the risk can never be discarded completely. In hindsight, it is questionable whether this procedure was optimal to test the hypotheses. The design is the only one the author is aware of that primes two different consecutive construal levels in one. Therefore, it could have been beneficial to test the hypothesis in a controlled environment before committing to field trials.

## Design

Some of the weaknesses described above are resolved by the design. First, the design allows both within and between-subject analysis. This is especially important because: (1) It allows analysis of results from questionnaires where only the first half is complete; (2) The impact of a potential failure regarding the priming of a second construal level is diminished. The design itself has no apparent flaws. Participants were able to understand what was to be done and in what order. As far as the author is concerned, the design is more than sufficient to test the hypotheses of this study.

## Analysis

The author believes that logistic regression is the proper method for analysing the judgment data. Mixed models are used to compensate for parameters that might have an influence on the data. One example is the diversity of the participants, where diversity can be a variable such as socio-economic status. We are not concerned with what influence different socio-economic status has on our result, but we are not denying that it may have an influence. The ”knowledge” problem displayed above and the reading or writing difficulties are variables that can influence our results. The use of mixed models with random effects minimize such influences but does not eliminate them (Baayen et al., 2008; Jaeger, 2008).

*Further Research*

This thesis has generated a lot of questions and not that many answers. There are several ways in which one might proceed and I will outline a few of those.

**1**. *Replicate Wakslak and Trope's (2009) study*. Although Wakslak and Trope's (2009) findings are supported in the form of sub-studies, no replication of that study has been made. One of the fruits of this study is that if construal level was manipulated, according to Fujita et al's. (2006) standards, then either we have failed to replicate Wakslak and Trope (2009) study *or* the binary choice element disrupted construal level priming. Which lead us to:

**2**. *The element of disruption*. Traditionally, when manipulating construal level, the independent variable is measured directly after manipulation (Trope & Liberman, 2003; Fujita et al., 2006; Wakslak & Trope, 2009). But for how long does construal manipulation endure? It is possible that the binary choice element disrupted construal level manipulation so that it fades over time. If that is true, it would explain the CMC results. There are no studies that have examined construal level endurance, to the authors knowledge. A proposal for such a study is to manipulate construal and then give the participants a task which takes various amounts of time until completed. A variable that has a strong correlation with construal level could be measured at the end of such a study to discern at what time interval construal level diminishes. There are also unanswered DPT questions to be accounted for, leading to:

**3**. *Conventionalize the study*. When trying to build a bridge, the end result might be better if you stay with conventional methods instead of novel techniques. A classic DPT rationality measure, such as the conjunction problem (Tversky & Kahneman, 1983), might have been a better option. The conjunction problem refers to a participant‘s ability to apply the conjunction rule when ranking how likely it is that e.g. Linda is $X, Y$ or $X \wedge Y$ given a description of Linda. If construal levels were primed, with a ”Linda” acceding priming, and the outcome was that low-level construals led to more fallacies then one would have a strong case concerning a bridge between CLT and DPT. There are various other classic DPT measures at ones disposal (see Osman (2004) for a review).

*Conclusions*

In the introduction we exemplified two questions in which we thought that two modes of reasoning were involved. Looking at our results above we find a non-result, but this non-result has generated a lot of questions. Some of these questions can be answered by conducting some of our concrete (and doable) experiments in the Further Research section.

Another thought concerns the use of priming (not the particular priming used in this study, but priming in general). The love of priming when it comes to manipulating behaviour is unprecedented and Bargh (2006) raises a lot of questions on this topic. Priming has been used for almost 50 years (Higgins, Rholes and Jones, 1977; in Bargh (2006)), and according to Bargh (2006) it is time that priming leaves its infancy, and that we start to ask second generation questions. Such questions range from: (1) Are there individual differences in priming effectiveness, to; (2) Which ones are more likely to occur in natural, complex, environments? The latter question is of real interest. This study was made in an environment which was close to everyday routine, but the task itself and the fruit of the harvest was not. Fischhoff (1996) says that the choice of methodology is a gamble between the experimental cave and the real world. If one narrows and constrain the experiment within this cave, there is a better chance to make science of what is found, but the application of it might be solely missed. Conversely, if one enters the real world and conduct experiments in it, one might find interesting phenomena. These findings will be easier to apply, but it becomes harder to make science of what is found. This study is somewhere in the trenches, and it is the authors' view that making this experiment in a more controlled condition could have benefited the study, since its hypotheses is within the experimental cave. In retrospect, it would have been entertaining to leave this cave and enter the world of applied research.

But what is our main conclusion? It seems reasonable to suggest, based on the Pilot, priming, and data that construal level does not elicit system specific reasoning. This statement, however bold it seems, is not unreasonable. But it does beg to ask the question: How can we be equally good at judging which of two entities are the most common from a distribution of entities ranging from five years ago to today? Sadly, we cannot answer this question based on the data presented. A possibility is that the categories are static, which means that the distribution today is the same as it was five years ago. A review of the material confirms that this is not the case: the entities move, decreasing or increasing in frequency, across the distribution in every environment we have examined.

I have made an ambitious study, which generated more questions than it laanswered. Another study that examines this subject, and its sub-subjects, is highly desirable.

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# 6 Appendix

Nr ___

## En undersökning om

# Bedömningar

Tack för att du vill delta i denna undersökning! Nedan ber vi att du fyller i din ålder.

Jag är _____ år gammal.

Högst upp på varje följande sida finns instruktioner om vad du ska göra på just den sidan. Om någon förvirring eller otydlighet uppstår kan du kontakta experimentledaren. Det är viktigt att du gör enkäten i den ordning som den är ordnad och inte hoppar över några sidor. När du är klar kan du lämna in den till experimentledaren.

*Observera att enkäten är dubbelsidig!*

**Lycka till!**

# Abstrakta Kategorier

Nedan så ska du efter varje ord ange en så **abstrakt** eller **övergripande** kategori av det ordet som du kan komma på. Exempelvis så kan du skriva ”Djur” efter ordet ”Hund”, eller ”Köksredskap” efter ordet ”Gaffel”.

| | | | |
|---|---|---|---|
| Banan | ___ | Spade | ___ |
| Tratt | ___ | Stol | ___ |
| Staket | ___ | Skylt | ___ |
| Orm | ___ | Byxor | ___ |
| Megafon | ___ | Soffa | ___ |
| Fiol | ___ | Flygplan | ___ |
| Fluga | ___ | Bandyklubba | ___ |
| Tåg | ___ | Säng | ___ |
| Sedel | ___ | Bänk | ___ |
| Serie | ___ | Cykel | ___ |
| Fotboll | ___ | Mikroskop | ___ |
| MP3-spelare | ___ | Tatuering | ___ |
| Tidning | ___ | Schampo | ___ |
| Ananas | ___ | Lyftkran | ___ |
| Skida | ___ | Oxe | ___ |
| Staty | ___ | Golfboll | ___ |
| Tå | ___ | Bro | ___ |
| Hammare | ___ | Anteckningsblock | ___ |
| Penna | ___ | Sköldpadda | ___ |
| Docka | ___ | Pyramid | ___ |

# Vilket är vanligast/störst?

Nedan finns 6 rader med förnamn. Vilket förnamn, i varje rad, tror du var det vanligaste namnet bland nyfödda i Sverige **för 5 år sedan**? Kryssa i det alternativ du tror var vanligast/störst **för 5 år sedan.**

| | | | |
|---|---|---|---|
| Hannes | ☐ | ☐ | Melvin |
| Emmy | ☐ | ☐ | Edith |
| Rasmus | ☐ | ☐ | Loke |
| Alma | ☐ | ☐ | Josefin |
| Noah | ☐ | ☐ | Colin |
| Saga | ☐ | ☐ | Anna |

---

Nedan finns 6 rader med brott. Vilket brott, i varje rad, tror du var det vanligast förekommande i Sverige **för 5 år sedan**? Kryssa i det alternativ du tror var vanligast/störst **för 5 år sedan.**

| | | | |
|---|---|---|---|
| Sexuellt tvång/utnyttjande | ☐ | ☐ | Hemfridsbrott, olaga intrång |
| Bidragsfusk mot kommunerna | ☐ | ☐ | Kontakt med barn i sexuellt syfte, s.k. "grooming" |
| Inbrottsstöld | ☐ | ☐ | Mordbrand |
| Falskt larm | ☐ | ☐ | Vållande till annans död |
| Skadegörelse | ☐ | ☐ | Hets mot folkgrupp |
| Stöld och snatteri | ☐ | ☐ | Misshandel, ej med dödlig utgång |

# Vilket är vanligast/störst?

Nedan finns 6 rader med yrken. Vilket yrke, i varje rad, tror du var det vanligast förekommande i Sverige **för 5 år sedan**? Kryssa i det alternativ du tror var vanligast/störst **för 5 år sedan**.

| | | | |
|---|---|---|---|
| Datatekniker | ☐ | ☐ | Grundskolelärare |
| Lastbilsförare | ☐ | ☐ | Programmerare |
| Fastighetsskötare | ☐ | ☐ | Hotell- och kontorstädare |
| Sjuksköterskor | ☐ | ☐ | Kockar |
| Kontorssekreterare | ☐ | ☐ | Undersköterskor |
| Lagerassistenter | ☐ | ☐ | Förskolelärare |

---

Nedan finns 6 rader med kommuner. Vilken kommun, i varje rad, tror *du hade flest antal invånare* **för 5 år sedan**? Kryssa i det alternativ du tror var vanligast/störst **för 5 år sedan**.

| | | | |
|---|---|---|---|
| Botkyrka | ☐ | ☐ | Solna |
| Eskilstuna | ☐ | ☐ | Trelleborg |
| Gotland | ☐ | ☐ | Växsjö |
| Tyresö | ☐ | ☐ | Karlstad |
| Sollentuna | ☐ | ☐ | Norrköping |
| Göteborg | ☐ | ☐ | Malmö |

# Vilket är vanligast/störst?

Nedan finns 6 rader med kommuner. Vilken kommun, i varje rad,tror du hade störst andel *gymnasiestudenter* i förhållande till kommunens folkmängd för 5 år sedan? Kryssa i det alternativ du tror var vanligast/störst **för 5 år sedan.**

| | | | |
|---|---|---|---|
| Botkyrka | | | Eskilstuna |
| Borlänge | | | Norrtälje |
| Helsingborg | | | Hässleholm |
| Gävle | | | Linköping |
| Skövde | | | Falun |
| Täby | | | Norrköping |

---

Nedan finns 6 rader med efternamn. Vilket efternamn, i varje rad, tror du var det vanligaste förekommande i Sverige **för 5 år sedan**? Kryssa i det alternativ du tror var vanligast/störst **för 5 år sedan.**

| | | | |
|---|---|---|---|
| Lundgren | | | Nilsson |
| Månsson | | | Norberg |
| Bengtsson | | | Åkesson |
| Olsson | | | Lundquist |
| Axelsson | | | Holmquist |
| Bergman | | | Engström |

Nedan så finns 5 handlingar beskrivna. Din uppgift är att tala om hur sannolikt du tror det är att dessa kommer att utföras. Du kanske känner att du inte har tillräcklig information för att ge en riktigt bra bedömning; Ingen fara. Svara genom att kryssa i en ruta för varje fråga nedan.

---

Jana funderar på att börja banta. Hur sannolikt är det att hon gör det?

Extremt osannolikt Extremt sannolikt

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

Kristina tänker på att renovera sitt hus. Hur sannolikt är det att hon gör det?

Extremt osannolikt Extremt sannolikt

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

Johan funderar på att bli kock. Hur sannolikt är det att han blir det?

Extremt osannolikt Extremt sannolikt

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

Sven överväger om han ska träffa sin släkt. Hur sannolikt är det att han gör det?

Extremt osannolikt Extremt sannolikt

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

Nils funderar på om han ska träffa en kompis. Hur sannolikt är det att han gör detta?

Extremt osannolikt Extremt sannolikt

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

# Konkreta Kategorier

Nedan så ska du efter varje ord ange ett så **konkret** exemplar av det ordet som du kan komma på. Exempelvis så kan du skriva ”Pudel” efter ordet ”Hund”. Känner du att det är svårt att komma på ett konkret exemplar räcker det med att exempelvis skriva ”Min mammas hund”.

| | | | |
|---|---|---|---|
| Bil | ____________________ | Pappersvara | ____________________ |
| Lampa | ____________________ | Flagga | ____________________ |
| Hatt | ____________________ | Huvudbonad | ____________________ |
| Bok | ____________________ | Tröja | ____________________ |
| Tavla | ____________________ | Sked | ____________________ |
| Blomma | ____________________ | Torn | ____________________ |
| Boll | ____________________ | Båt | ____________________ |
| Glas | ____________________ | Hus | ____________________ |
| Flaska | ____________________ | Bulle | ____________________ |
| Instrument | ____________________ | Grönsak | ____________________ |
| Sko | ____________________ | Motor | ____________________ |
| Katt | ____________________ | Mynt | ____________________ |
| Kopp | ____________________ | Bär | ____________________ |
| Möbel | ____________________ | Form | ____________________ |
| Matta | ____________________ | Fågel | ____________________ |
| Golv | ____________________ | Motorcykel | ____________________ |
| Handtag | ____________________ | Hygienartikel | ____________________ |
| Påse | ____________________ | Rör | ____________________ |
| Dator | ____________________ | Träd | ____________________ |
| Behållare | ____________________ | Kalender | ____________________ |

# Vilket är vanligast/störst?

Nedan finns 6 rader med förnamn. Vilket förnamn, i varje rad, tror du är det vanligaste namnet bland nyfödda i Sverige **idag**? Kryssa i det alternativ du tror **är** vanligast/störst **idag.**

| | | | |
|---|---|---|---|
| Daniel | ☐ | ☐ | Sixten |
| Ida | ☐ | ☐ | Sofia |
| Felix | ☐ | ☐ | Erik |
| Lina | ☐ | ☐ | Elise |
| Casper | ☐ | ☐ | Neo |
| Matilda | ☐ | ☐ | Vilda |

---

Nedan finns 6 rader med brott. Vilket brott, i varje rad, tror du är det vanligast förekommande i Sverige **idag**? Kryssa i det alternativ du tror **är** vanligast/störst **idag.**

| | | | |
|---|---|---|---|
| Innehav av Narkotika | ☐ | ☐ | Fullbordat mord/dråp/misshandel med dödlig utgång |
| Utpressning/ocker | ☐ | ☐ | Olaga hot |
| Bidragsfusk mot A-kassorna och Arbetsförmedlingen | ☐ | ☐ | Dataintrång |
| Bidragsfusk mot Försäkringskassan | ☐ | ☐ | Grov vårdslöshet i trafik |
| Olovlig körning | ☐ | ☐ | Människorov/olaga frihetsberövande |
| Allmänfarlig vårdslöshet | ☐ | ☐ | Sexuellt ofredande |

# Vilket är vanligast/störst?

Nedan finns 6 rader med yrken. Vilket yrke, i varje rad, tror du är vanligast förekommande i Sverige **idag**? Kryssa i det alternativ du tror är vanligast/störst **idag**.

| | | | |
|---|---|---|---|
| Skötare och Vårdare | | | Undersköterskor |
| Universitets och Högskolelärare | | | Banktjänstemän |
| Maskinoperatörer | | | Försäljare |
| Barnskötare | | | Bokförings- och redovisnings assistenter |
| Administrativa Assistenter | | | Köks- och Restaurangbiträden |
| Byggnadsarbetare | | | Maskinverktygsoperatörer |

,

Nedan finns 6 rader med kommuner. Vilken kommun, i varje rad, tror du *har flest antal invånare* **idag**? Kryssa i det alternativ du tror är vanligast/störst **idag**.

| | | | |
|---|---|---|---|
| Nacka | | | Borås |
| Huddinge | | | Karlskrona |
| Gävle | | | Borlänge |
| Nyköping | | | Uppsala |
| Helsingborg | | | Stockholm |
| Kungsbacka | | | Kalmar |

# Vilket är vanligast/störst?

Nedan finns 6 rader med kommuner. Vilken kommun, i varje rad,tror du har störst andel *gymnasiestudenter i förhållande till kommunens folkmängd* **idag**? Kryssa i det alternativ du tror är vanligast/störst **idag**.

| | | | |
|---|---|---|---|
| Sigtuna | ☐ | ☐ | Nyköping |
| Haninge | ☐ | ☐ | Tyresö |
| Falun | ☐ | ☐ | Jönköping |
| Lund | ☐ | ☐ | Umeå |
| Kungsbacka | ☐ | ☐ | Skellefteå |
| Luleå | ☐ | ☐ | Uddevalla |

Nedan finns 6 rader med efternamn. Vilket efternamn, i varje rad, tror du är det vanligast förekommande i Sverige **idag**? Kryssa i det alternativ du tror är vanligast/störst **idag**.

| | | | |
|---|---|---|---|
| Danielsson | ☐ | ☐ | Berg |
| Lindberg | ☐ | ☐ | Isaksson |
| Lindström | ☐ | ☐ | Sandström |
| Löfgren | ☐ | ☐ | Johansson |
| Abrahamsson | ☐ | ☐ | Viklund |
| Öberg | ☐ | ☐ | Mattson |

Nedan så finns 5 handlingar beskrivna. Din uppgift är att tala om hur sannolikt du tror det är att dessa kommer att utföras. Du kanske känner att du inte har tillräcklig information för att ge en riktigt bra bedömning; Ingen fara. Svara genom att kryssa i en ruta för varje fråga nedan.

---

Allan funderar på att köpa en ny bil. Hur sannolikt är det att han gör det?

Extremt osannolikt | | | | | | | Extremt sannolikt

Katarina tänker på att skaffa en hund. Hur sannolikt är det att hon gör det?

Extremt osannolikt | | | | | | | Extremt sannolikt

Stina funderar på att söka till Juristprogrammet. Hur sannolikt är det att hon gör det?

Extremt osannolikt | | | | | | | Extremt sannolikt

Tina överväger om hon ska skaffa en ny dator. Hur sannolikt är det att hon gör det?

Extremt osannolikt | | | | | | | Extremt sannolikt

Jacob funderar på om han ska på en fest. Hur sannolikt är det att han går?

Extremt osannolikt | | | | | | | Extremt sannolikt

# Tack för din medverkan!