

The effects of linguistic barriers on time and risk preference on bilingual individuals

A small scale experiment on university students

Abstract:

In this thesis, an investigation has been carried out as to reveal the effects of an individual's spoken language with regards to time and risk preferences. Through a small-scale experiment in which Erasmus University bilingual students were asked to answer a survey concerning certain preferences (such as time, risk and health), the effects of each language was then measured and decoded. The results imply that the speakers of languages with more verbal tenses to describe the future have a higher tendency to act in a risk-loving and impatient manner due to a disassociation of present and future tenses. The opposite applied as well; speakers of languages with few future tenses had a higher propensity for risk-averse and patient behaviour. Many of the results did not have significant effect due to the sample size and possible sample bias since most respondents were male business students. Nevertheless, the results of this research are still noteworthy as it provides additional evidence to K.Chen's claim, in addition to testing his theory on bilingual respondents. This paper can be used as a stepping-stone for further investigation on the topic.

Bachelor Thesis Behavioural Economics

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Preface

Throughout this university year, I have gained invaluable knowledge on experimental economics through studying it as an elective, to applying it to my thesis. Picking this subject for my thesis was a no-brainer, influenced by the class I attended under the teaching of Susanne Neckermann, as well as having attended a lecture by Steven Levitt.

Being bilingual myself, the topic of the effect of language on behaviour is one that fascinated me. I have always felt I possessed alternate personalities when I spoke either French or English due to the culture that encapsulates each language. Thus the opportunity to study this was too great to pass. My intention was further cemented after having watched a TED talk by Keith Chen, a Yale University professor and researcher, whom had started to scratch the surface of this multifaceted topic.

Setting-up the survey/experiment was one of the hardest aspects of this thesis along with finding 40 French/English bilingual in the Netherlands. Analyzing the data and interpreting it was somewhat easier. I feel I have learnt a lot from writing a thesis on a topic that has always fascinated me.

I would like to thank my thesis supervisor, Susanne Neckermann, for helping and guiding me through the experimental and written process even after being hospitalized. I would also like to thank Steven Levitt for providing me with invaluable advice and feedback. Additionally, thanks must go to Leopold Bailby, a great friend who helped me to gather over 20 French/English bilinguals, without which my thesis would not have been possible. Finally, I'd like to thank my wonderful girlfriend, Faith Ng, whose been supportive through this whole process.

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1. Introduction/Theoretical framework

The effect of language on behaviour is reasonably new in economic literature. In the past, little attention was given to the possibility that speaking a certain language would frame the way in which you are led to think, therefore influencing your decision at a behavioural level by modifying your preferences. The economic aspects of this subject are highly unrecognized, and only now are we starting to scratch the surface of this topic.

In the economic literature, the differences in a country's private or public saving rate between different countries were primarily attributed to a country's per capita growth, political stability and economic development. S.Edwards (1995)'s paper for the World Bank illustrates this exactly and created a standard to the way we think about saving rates, as we believed to understand all the factors that influence this variable. However, as you may have already guessed, there are more underlying factors that may be affecting saving rates of countries. The way a language makes you think could influence saving rates as it could streamline behaviour, and thus preferences. Related literature on this subject will be further discussed. Since the experimental design of this thesis comprises of surveys, the design as well as the responses will be discussed. Related literature will also be discussed.

A facet of this topic that is noteworthy is the experimental evidence. Since there is only one piece of literature on the direct effect of language on economic behaviour, the experimental aspects still comprise somewhat virgin territory. So far, the only true experiment was conducted by Keith Chen (2013) who provided evidence that if two families, identical in every aspect but language are matched up, they will have different inclinations with regards to savings, risk and time preferences. The term FTR (Future Time Reference), established by K.Chen will be further developed, which explains how many tenses a language possess for verbs concerning the future. This thesis can be considered an extension of K.Chen's work as it will look at the effect of languages on people who speak several languages, more specifically, English/French and English/Dutch bilinguals. Instead of looking at the pure effect of

a language, this paper will look at the way changing from one language to another can affect one's preferences almost immediately. The central questions that will be looked at are as follow:

1/Can languages actually induce us to act a certain way?

2/ When switching languages, does one act or think differently with regards to his preferences?

In order to answer this, a sample of approximately 80 bilingual French/English and Dutch/English students were approached at the Erasmus university through social media and in person. The experiment was conducted as a survey where the respondents were asked about their time, risk and health preferences. Certain questions were incentivized in order to provide internal validity of the data. Cognitive ability was also tested as to provide a frame of reference of the understanding that the respondents have with regards to a language. These types of questions test the logical reasoning of the respondents, which should indicate how much control one has over a certain language, thereby observing those who can be considered truly bilingual – think and speak in two languages. This is important, as it will be controlled later in the paper.

Once all the data has been gathered, a two-part analysis will be conducted. The first will consist of looking at the overall trends shown by the data through standard data analysis. The second part will conduct a regression analysis where certain variables of interest such as age, occupation and sex will be tested to discern whether or not they influence the time or risk preferences of respondents.

2. Relevant literature

Linguistic determinism of time and risk preference is an under-considered aspect of behavioral economics and macroeconomics. This is partly due to the fact that differences in behaviour are hard to determine and measure when considering different languages, which is why there is little academic literature available in this area. This chapter aims to give an insight into the available literature regarding linguistic determinism and time/risk preferences, all while linking both topics together. This section will start with an overview of the knowledge of linguistic determinism based on two bodies of work, the latter of which is the main driving force behind this paper. Secondly, it will elaborate on time/risk preferences that are the measures used for evaluating the differences between languages. Lastly, it will mention the role of cognitive reflection tests.

2.1. Linguistic determination and relativity on thought

As stated prior, this is the one of most important related papers as it lays the foundations of this thesis. It is interesting to observe, in the context of the paper, how languages can influence or determine thoughts of the person whether he/she is aware of it or not. Additionally, this effect is even more interesting when you consider people who speak multiple languages and how these different languages could potentially induce different behaviours within the same person.

Daniel Chandler (1994) examines the theories of Edward Sapir and Benjamin Lee Whorf, two renowned linguists of the 1930's, more commonly known for the Sapir-Whorf hypothesis. Chandler explains the two main trains of thought that govern linguistic theory as he mentions that there are two extreme positions concerning the relationship between language and thought. The first is referred to as "Mould Theory" that represents language as "a mould in terms of which thought categories are cast". The second theory is referred to as "Cloak theory" that represents the view that "language is a cloak conforming to the customary categories of thoughts of its

speaker". Sapir and Whorf were firm believers of the former ("mould theory") from which they constructed two associated principles. The first is linguistic determinism, where languages may determine our thinking patterns and the way we view and think about the world – language determines thoughts. The other is linguistic relativity, where the structure of a language affects the ways in which its speaker conceptualizes the world – language influences thought process.

On this basis, the Whorfian perspective is that translation between languages is at the very least problematic, sometimes impossible. This stance was supported by the fact that because of the culture and the people that surround a certain language, translation omits the unverbaised thought of the language as well as the potential cultural influencing factors. Thus, the closer the languages and the cultures are to one another, the less should be lost in translation. This was illustrated when Pablo Neruda's poems were translated into many different languages from his mother tongue Spanish. The poet claimed that the Italian translation was the only adequate one since the structure and "feel" highly resembled Spanish. French, English and German lacked in the ways they described and the weights that are applied to words. This is particularly noticeable with art as the incorrect translation of the meaning can be the destruction of a poem. However, this would not apply in the translation of scientific papers or any formal document, as these types of writing are more open to straightforward rewording and re-interpretation. Therefore, there is a difference in the ways one can convey emotions and culturally associated factors (such as metaphors, expressions, humor...) from one language to another, especially if those languages differ in their origins and culture. This goes against the view held by Universalists, who supported the "cloak theory", claiming that anything can be translated and we can express ourselves precisely in any language.

This led to the creation of the moderate Sapir-Whorf theory, which supports the opinions of linguistic relativity, namely that the way we perceive the world may be influenced by the kind of language we use. Thus the language is no longer seen as a constraint but more of a catalyst for specific thought processes since language

reflects cultural preoccupations. This view is more commonly accepted and can be observed in the next section.

2.2. Language on Economic Behaviour

The following paper is the main paper to be evaluated as this thesis can be considered its extension to bilingual individuals. Contrary to the previous paper, this study is recent and is actually still in progress.

Keith Chen (2013) wondered why countries with seemingly similar economies and institutions could display radically different savings behaviours. He thus came up with a hypothesis linking the structure of the language one speaks with that person's savings attitude. To do so, Chen started by introducing what he believes is the fundamental differentiation between languages. He believes that firstly, the language you speak forces you to think a certain way because of the limiting vocabulary and structure of the language; and secondly, the differences of verbal structure between languages affects the way you perceive time.

To elucidate the first difference, K.Chen illustrates with the example of saying "this is my uncle" in English and then in Mandarin. When the sentence is spoken in English, it appears to be a straightforward statement. However, when saying it in Mandarin, the speaker cannot describe the sibling of his parent so simply. In order to correctly talk about his/her uncle, he is required to give specific information about the uncle such as whether the uncle is on the mother or the father's side, whether this uncle is older or younger than the parent, and whether this uncle occurred by marriage or by birth. Therefore, the way a language is structured can force you to think about aspects of your life you wouldn't think about as much had you spoken in a different language. To explicate the second difference, Chen demonstrates the verbal dissimilarities between languages. When speaking languages such as English or French, the speakers are forced to use different verbal tenses to talk about an event that occurred yesterday, today or tomorrow. On the other hand, in languages such as Mandarin or Dutch, speakers are restricted to the

use of fewer verbal forms when describing the same events - such as in the direct translation of “yesterday, it rained”, which in Mandarin would be said as, “yesterday, it rain” because of the absence of past tense. According to Chen, this distinction in the division of the time spectrum (past, present, and future) may influence the way the speaker perceives time, and thus the way she/ he acts according to time and risk. Thus when speaking a “futured language” (such as English), every time the future is discussed, the speaker is grammatically forced to cleave that event from the present, thereby treating the two events as “viscerally distinct”. This distinction could make the user disassociate the future from the present every time she/ he speaks. This could make the future feel much more distant than the present, thereby making it harder to save money than in languages that are “futureless” (such as Mandarin).

Thus to further test this and observe it on a broader scale, K.Chen accessed the linguistics literature that divided all the languages into two groups: Weak and Strong Future Time Reference (FTR) languages. Weak FTR refers to languages that have little to no verbs to communicate the future (such as Mandarin and Dutch) while strong FTR languages possess many tenses to conjugate verbs (such as English and French). When observing the different savings rate of countries, it became clear to Chen that the best countries at saving their annual GDP are weak FTR speaking countries. To test this finding further, Chen picked out specific countries that possess 2 national languages, one weak-FTR and one strong-FTR, which led him to Belgium and Nigeria. He then conducted a closest match significance test where he compared two families as identical as possible with respect to social and economic factors, with the exception of the language that they spoke. After statistical testing, he found that speakers of weak-FTR languages were 30% more likely to save money. Additionally, he found information on risk preference, since it is a tradeoff between present pleasures for future pain. He found that weak-FTR speakers were more likely to eat healthy, to wear condoms, and not to smoke.

The statistical tests implemented by K.Chen comprised multiple regressions, significance testing and survey design that will also be implemented in this paper and will be further elaborated in the methodology and results section.

2.3. Hyperbolic discounting

This topic of intertemporal choice is critical when working with tradeoffs between the present and the future, as they are decisions involving tradeoffs among costs and benefits occurring at different times. This sub-section will briefly explain the use of hyperbolic discounting as well as why it is relevant for this paper.

Frederick & Loewenstein (2002) explain why the future is discounted more than the present through John Rae's *"The sociological theory of Capital"* (1834) where it was explicated that the main cause for disparities in different countries levels of savings was caused by dissimilarities in "the effective desire of accumulation". The main factor that promotes this desire of "accumulation" is the propensity to exercise self-restraint; while the limiting factors are the uncertainty of human life as well as the excitement of present consumption against the discomfort of deferring such gratification. The Jevons father (1888) and son (1905) further elaborate on this point by mentioning "deferral of gratification will occur if it produces an increase in anticipatory utility that more than compensates for the decrease in immediate consumption utility". They add that gains are discounted more than losses, and that small amounts are discounted more than large ones. Therefore it is becoming increasingly apparent that, as humans, we have a preference for consuming gratification immediately while postponing losses.

This preference for the present and gains over the future and losses is called "Hyperbolic Discounting" and will be applied in this thesis. This is a time-inconsistent model of discounting as it demonstrates human inconsistency with regards to choices over time, as we make choices today that our future selves would wish not to have chosen, despite using the same reasoning. The following equation

represents this approach, where h is the time variable, while the (β, δ) formulation assumes a declining discount rate between this period and the next, but a constant discount rate thereafter.

$$D(k) = \begin{cases} 1 & \text{if } h = 0 \\ \beta\delta^k & \text{if } h > 0 \end{cases}$$

2.4. Cognitive reflection tests

Cognitive reflection tests were implemented into the survey with the aim of evaluating rational thinking, while distracting respondents from the time/risk questions, and measuring their linguistic mastery.

According to S. Frederick (2005) time and risk studies rarely make any allusion to the possible effects of cognitive ability to which he found a solution called “Cognitive reflection tests”(CRT). Cognitive ability refers to a person’s ability to think analytically, which has also been linked with IQ and mental sharpness. These tests measure one’s predisposition to override an initial instinctive response that is false, and to then engage in further deliberation to find the correct answer. The testing is implemented through trick questions where the subject must possess a high understanding of the language in order to see the solution. Thus, this test may also be used to determine the linguistic ability of a respondent. Additionally, people with high CRT scores are more patient than those with low CRT scores as they spend more time thinking about the problem. This difference in patience can be attributed to the ability to override your “gut feeling” and spend a little more time thinking rationally. When concerning financial preferences, high CRT people had a higher propensity to wait for receiving higher amounts than low CRT persons (e.g. WTP for overnight shipping of a book? Average: Low CRT: \$4.60 / High CRT:\$2.18). Moreover, low CRT respondent were evaluated to be more concerned with the future than their high counterparts.

This measure of linguistic comprehension and patience will be applied in the survey and will be used as an additional variable from which evaluation can be made.

3. Data & Methodology

3.1. Experimental Design

In order to gather data for this thesis, an online survey was applied on a sample size of approximately 80 bilingual respondents, most of whom were Erasmus University students. These respondents were either English/Dutch (1 strong & 1 weak FTR) or English/French bilinguals (2 strong FTR) due to the large presence of these groups in the region.

The survey asked questions relating to time and risk preferences in English and French (or Dutch), it then measured cognitive ability and then gathered health and demographic information. This is a within-subject design as the individual taking the survey responds once in English (control) and once in French/Dutch (treatment). The purpose here is to discern any potential differences when looking at the time preference between the French and the Dutch, as well as observing the difference between the way a bilingual's change of language can affect his/her preferences when answering once in English and once in French (or Dutch).

Because it is a within-subject design, when a respondent is asked a question about time or risk preference, (s)he may have an incentive to maintain a certain degree of consistency and therefore adapt the later answers to his earlier ones – namely order effects. Thus as to prevent this, 2 versions of each survey have been created where the only difference is the order in which they answer in English. In version 1, the respondent would first be asked question in English and then in French (or Dutch); while in version 2, the opposite. Therefore by doing so, the possibility of averaging the results enables us to remove the effects of the order.

Moreover the survey asks questions to give insight into the respondent's time and risk preferences, which was done through financial questions. As to ensure that these financial time/risk questions were answered with the highest degree of

honesty, an incentive system was deployed. For every tenth respondent for one of the financial questions, the answered amount would be rewarded to the respondent. This experiment was conducted exclusively online which led to a potential problem. If the respondents aren't "true" or "pure" bilinguals (speak two languages fluently), then they might speak a language while thinking in their mother tongue. This could influence the results negatively. Thus to ensure a minimum level of control of English, the origin of where the respondents learned English was asked and will be controlled for in the regression. Only respondents who claim to have either parent English speaking or have lived in an English speaking country for more than 5 years will be taken into consideration.

3.2. Methodology

Once the data has been gathered through surveys, the statistical software - namely SPSS - will be applied to analyse and evaluate the data. The first part will convey a rudimentary insight into the data that will be given through histograms and tables that will demonstrated means of both groups with regards to risk, time and health preferences. This will demonstrate general trends that will be further evaluated in the second part of the analysis. The principal objective of this section lies in the investigation of the treatment effect, which is asking the respondent a very similar question in their native language (Dutch/French) after having been asked in English, which should demonstrate differences in their preferences from one language to another. Another objective is to demonstrate general differences the two groups could have with respect to their health preference (amount of fruits they eat, amount of time they exercise, and whether or not they smoke) as well as their cognitive ability (see appendix for full survey).

The second section of the analysis will consist mainly in looking at the effect of several variables such as nationality, gender, proficiency on the monetary value the respondents have ascribed to the questions "For how much would you be willing to wait one month instead of receiving \$11/13 right now?". A significance level of 5%

will be applied. This will indicate whether or not the statements inferred from the previous section have effects that are significant or not.

3.3. Expectations

Based upon the description of the experimental design as well as the information provided by the literature on linguistic relativity and the works of K.Chen, certain extrapolations can be deduced about the results of the experiment:

Hypothesis 1: *Native speakers of a high FTR language (such as French) have a lower propensity to wait for gratification than those who speak a low FTR language (such as Dutch).*

This first hypothesis can generally be considered an extension of K.Chen's hypothesis as it relates to the differences in time preferences between two almost identical social groups in the exception of the languages they both speak. This postulate is about reaffirming the effect that was demonstrated in Chen's paper in the framework of this paper's collected sample as well as confirming general expectations from high and low FTR languages.

Hypothesis 2: *When switching from English to French, pure bilinguals tend to become more impatient and risk seeking. When switching from English to Dutch, pure bilinguals tend to become more patient and risk averse.*

This hypothesis aims to test the immediate effect a language can have on one's preferences as a result of the structure of the language. This is the main aspect where this paper differentiates itself from K.Chen's, as it is testing the effect on a bilingual sample. This will be evaluated via a simple regression as well as data analysis.

4. Results

Before demonstrating the results, the demographic of the sample will be disclosed as to provide an insight to any possible bias.

In a period of 3 weeks, 39 Dutch and 37 French bilinguals were asked to fill in the survey through an online portal. The French sample consisted primarily of males (68%) with a mean age of 20.95, who were mostly business students (62%). The Dutch sample were also mainly males (77%) with a mean age of 22.31 while also being chiefly business students (64%). Thus, it appears that the results will not be fully representative of the general French/Dutch bilingual population, however these two groups are very comparable due to the similarity in educational, age and sex.

When observing the linguistic abilities of each group, those considered to be perfect bilingual were considered to have answered the question “How did you learn English” with “Lived in an English speaking country” or “One of your parents is a native speaker”. Those who weren’t considered perfect bilinguals – those who still think in their native tongues when speaking English – were considered to have answered the question with “Learnt through mainstream media” or “Learnt as second language at school”. The perfect bilinguals are 48.7% for the Dutch while 72.9% for the French. This can be explained by the fact that most of the French respondents appeared to be from highly international backgrounds, more so than the Dutch, as twice as many of them claimed to have parents who were native English speakers. Additionally, another explanation for the results could be that the Dutch government has a policy of using subtitles over dubbing for all English television that they import (Nickelodeon, MTV, BBC) in order to increase the nation’s English-language ability.

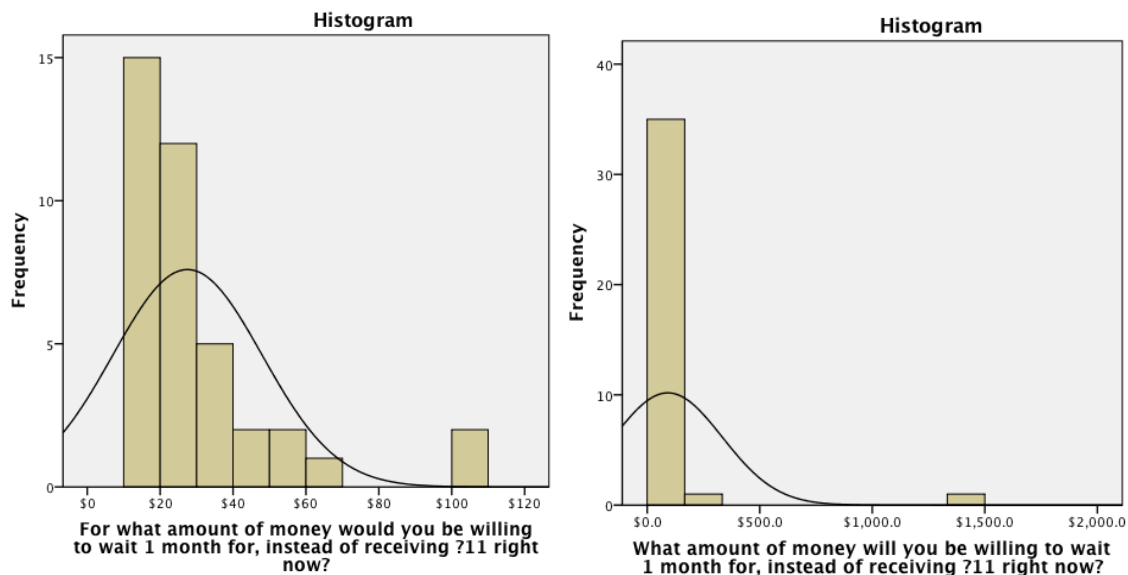
4.1. Raw experimental results

As to provide an unbiased and clear picture of the outcomes of the survey, this section will provide a simple breakdown of the results by demonstrating question by question what was collected. This section will not control the bi-lingual level claimed by each of the respondents.

4.1.1. Time preference

When asked about their preference between receiving a certain amount now (€11 and €13 respectively) or waiting 1 month for a specified amount, the Dutch respondents on average answered €27.5 and €44.2 respectively, while the French answered €91.5 and €101.9. This appears to suit the hypothesis, however, the difference seems to be too substantial. The reason for this is as a result of an outlier in the French respondents who skewed the results due to overly exaggerated responses, which may be observed in the graphs below.

Graph 1: Distribution of responses for Dutch / French



For this reason, the median will be indicated to give a more representative picture of the results. The median of the Dutch respondents is €20 (range: €11-100) and €25 (range: €13-430) while the French respondents median is €40 (range: €12-1500) and €50 (range: €13-1513) correspondingly.

When answering the time preference question with higher values (€111 & €113) as well as longer and multiple durations (1 month, 2 months and 1 year), the French respondents still maintain a higher overall average than their Dutch counterparts. These averages may be observed in the table below.

Table 1: Time preference means for French (red/left) and Dutch (green/right)

	1 month		2 months		1 year	
€111	262.7	152.9	494.9	245.4	1147.6	815.2
€113	265.2	254	499.6	463	1175.6	881.7

4.1.2. Risk preference

To measure their propensity for risk, respondents were given a choice between two seemingly different lotteries, which actually had identical expected values. The lottery options were given as follow:

1/ 70% chance of winning €400 or 30% chance of winning €930

2/ 70% chance of winning €600 or 30% chance of winning €1400

To prevent any bias, the surveys asked the first lottery in English and then the second one in Dutch/French to half of the respondents. And to the other half, the opposite, meaning that they were asked the first lottery in Dutch/French and the second one in English.

The result obtained for the Dutch respondents went as follow. When asked about their risk preferences in Dutch, the sample answered in a more risk-averse manner than a risk-seeking one with 61.5% opting for the safer bet (70% chance of winning) while 38.5% picked the riskier option (30% chance of winning). When observing how this sample answered in English, they became slightly more risk-seeking as 43.6% picked the lower probability bet against 56.4% of them picking its safer equivalent.

The results for the French sample went as follow: When asked about risk preferences in French, 51.4% of the sample opted for the risky bet while 48.6% chose the safer one, thus demonstrating a higher propensity towards risk with more risk-loving answers than risk-averse ones. When asked the same questions in English, the respondents appeared much more risk averse as 64.9% of them picked the safer bet of 70% chance of winning, while only 35.1% picked the riskier bet.

4.1.3. Cognitive Reflection Tests

To test the linguistic ability of the respondents as well as their ability to be patient in problem solving situations, cognitive reflection questions were applied in both English and Dutch/French.

The first question asked the respondents: “A ball and a bat cost €1.10 in total. The bat costs €1.00 more than the ball. How much does the ball cost?”. The initial answer at first sight is 10 cents, however with further deliberation, it becomes apparent that the answer is in fact 5 cents. Of the French respondents, 57% got the answer correctly, while 71.8% of the Dutch got the correct answer.

The second question asked: “If it takes 5 minutes for 5 machines to create 5 widgets, how long would it take 100 machines to make 100 widgets?”. This question isn’t tricky; it just requires a little bit of time and attention to solve. 81.1% of the French got this correctly, with 87.2% of the Dutch that getting it right as well.

The last question asked respondents: “In a lake, there is a lily pad. Every day, this lily pad doubles in size. If it takes 48 days for the lily pad to cover the entire lake, how long will it take for this lily pad to fill in half the lake?” The initial answer that comes to mind is half of 48, which is 24 days. However, the answer is actually 47 days. Of the Dutch respondents, only 61.5% got the correct answer against 65% for the French.

4.1.4. Health Preference

In the aim of observing the health attitudes of the sample, the respondents were asked questions about their smoking, eating and exercising habits.

Smoking habits

When questioned about whether or not they smoke, 82% of the French sample answered positively, which entail that they consider themselves more than just social smokers. When asking the same question to the Dutch, only 43.6% of them answered that they consider themselves regular smokers. This gives us information on the risk attitude of the respondents as smoking can be considered a tradeoff between present pleasures against future pains.

Healthy eating habits

To gain an insight on the healthy eating habits of the respondents, the survey interrogated them on the quantity of fruit and/or vegetables they each claimed to eat on a daily basis. The available options were none, 1 to 2, 3to 5, and more than 5. The results can be observed in the table below as it shows the percentage of the sample answering each option.

Table 2: Percentage of sample eating fruits/vegetables a day

	French	Dutch
0	5.2%	7.7%
1-2	43.5%	51.3%
3-5	35.1%	35.9%
More than 5	16.2%	5.1%

This tables shows that there is a slightly higher tendency for the French to eat healthier than the Dutch as less of them eat few fruits/vegetables while many more of them eat over 5 of them a day.

Exercising habits

When questioned on the amount of times they exercised and/or played sports on a weekly basis, the sample was given similar options to the previous question. This can be seen in the table below that shows the percentage of the sample answering in each of the available options.

Table 3: Percentage of sample exercising/playing sports on a weekly basis

	French	Dutch
0	8.1%	7.7%
1-2	59.5%	53.8%
3-4	27%	33.3%
More than 4	5.4%	5.2%

Observing the data within this table, it appears that the French and Dutch exercise equally as much, or at least, do not demonstrate a significant difference in how much they exercise a week.

4.2. Regression design

To test some of the assumptions that were established in earlier sections, this segment will conduct two linear regressions on questions 3 and 8 of the survey with a significance level of 5%. Question 3 asks in English how much one is willing to forgo €11 now to receive a certain sum in 1 month. Question 8 asks the same in either Dutch or French with the value of €13. Therefore, questions 3 and 8 will be the dependent variables in two separate regressions. The applied regressions will both have the same independent variables that are age, sex, occupation and nationality. To control for nationality, a new variable was created where French is equal to 0 and Dutch is equal to 1. Additionally, in order to control for some of the value given in question 3 and 8 that can be considered too high and distort the data, a new variable was created that caps the highest possible value to that of the 90th percentile. Thus the highest possible answer for both questions 3 and 8 is 100 as the respondents at the 90th percentile answered €100, which removes answers such as

€1500 that have a considerable effect on the analysis. Moreover, this section controls for pure-bilinguals as only the respondents that claimed to have answered that they learnt English through their parents or by living in an English speaking country were taken into account. Those who answered that they learnt through mainstream media or through school were discounted as they do not fit into this paper's definition of bilingualism (thinking in two separate languages equally).

4.2.1. Regression Q3 (€11 in English)

In the following table, it is observable that very few of the independent variable actually affects the value of the dependent variable. While the sex, age and occupation of one doesn't affect the value (s)he inputs into the answer of question 3, "nationality", on the other hand, does affect that value as it is significant at a 5% level.

Table 4: Stepwise regression of survey question 3

Variable	B	Std. Error	β	t	Sig
(Constant)	50.649	4.749		10.66	.000
Nationality	-22.146	6.762	-.362	-3.275	.002
Sex			.147	1.334	.187
Age			-.098	-.843	.402
Occupation			-.051	-4.58	.648

When looking at this regression, it shows that these variables explain only very little of the model, which is confirmed when we look at its goodness of fit (R^2) that is only of 0.131 (See appendix A). However, when considering that only "Nationality" is significant to the dependent variable, this could entail that this variable account for a large degree of the goodness of fit of this model. When looking closer at this model's correlation table, it is observable as well that the most significant effect comes from the "Nationality" variable. The relationship between the value of Q3 and "Nationality" is highly negative (-0.396) that entails that the higher the € value assigned by one, the higher the probability that that person is French.

4.2.2. Regression Q8 (€13 in Dutch/French)

Similarly to the previous section, this section tests the same independent variable on the dependent variable of Q8 of the survey that asks in Dutch/French for one's indifference between €13 now and a certain sum in 1-month time. It is discernible in the following table that the effects of sex, age and occupation are not significant while that of nationality is at the 5% significance level.

Table 5: Stepwise regression of survey question 8

Variable	B	Std. Error	β	t	Sig
(Constant)	52.027	4.983		10.440	.000
Nationality	-16.444	7.096	-.265	-2.317	.023
Sex			.143	1.250	.216
Age			.063	.522	.604
Occupation			-.052	-.449	.655

When looking closer at the regression, it shows that it explains only very little of the model as the value of the goodness of fit is 0.070 (See Appendix B), which is extremely low. Thus only 7% of the interaction can be explained through this model. Since "Nationality" is the only significant variable, most of the effect on the dependent variable can be attributed to it. When looking at the correlation between these the variable "nationality" and the dependent variable, it is observable that, here as well, there is an inverse effect of -.265.

5. Discussion & Conclusion

The outcomes of this thesis surveys were noteworthy although quite of few of these were insignificant. The insignificance of many of the effects can be attributed to a certain degree to the small and potentially skewed sample, which did not enable significant outcomes. Luckily, that isn't the intention of this thesis as this can be considered an extension or derivative of K.Chen's paper.

This chapter will interpret the meanings of the outcomes of the previous chapter as well as lead to the conclusion of the entire paper. In doing so, the limits of the survey and experimental design will be discussed in addition to possible recommendations for future research on the topic.

5.1. Discussion

The first part of the analysis simply demonstrated the means and averages of the survey questions, which related to interesting features such as time, risk, cognitive, and health preferences. This was done as to provide an unbiased representation of the sample's results as well as to either confirm or reject the general trend shown by K.Chen. The results showed that this effect mentioned by Chen could be confirmed to a relative extent as two highly similar samples of French and Dutch respondents were compared, which resulted in similar effects.

It was observed that much like Chen suggested, those speaking a language with high FTR (Future Time Referenced, which means possessed many verbal tenses for the future), such as French, had a much higher propensity to demand higher sums as to wait for retribution than their low FTR counterparts (Dutch). It revealed that the French must have a higher hyperbolic discount rate than that of the Dutch, although this was not calculated but rather estimated based on the result of the section.

Moreover, when considering the effect Chen mentioned about risk preferences, it was confirmed to a relatively high extent, as French respondents were 46% more likely to adopt a risk-seeking attitude when speaking French rather than English;

while the Dutch were 10% more likely to adopt risk-averse behaviour when speaking Dutch rather than English. This showed that the more a language has tenses that differentiate the future from the present, the higher the propensity for risk-seeking behaviour from the speaker. This effect is reinforced further by the data gathered on smoking as the French were found 88% more likely to smoke than the Dutch. This value is important as it demonstrates the way the French and Dutch consider present pleasure against future pains. However, when observing the data gathered for the healthy eating and exercising behaviour, it showed highly ambiguous effects. While the analysis of fruit/vegetable eating showed that the French ate 17% healthier than the Dutch; the exercising analysis showed that the Dutch were only 5% more likely to exercise than the French. Had this gone perfectly according to theory, it should have shown that the French eat much less healthy than the Dutch, and that the Dutch exercise much more than the French. Lastly, as for the cognitive reflection questions, the data gathered has effects that were too ambiguous to be considered, as the Dutch should have had more correct answers than the French, which was not always the case.

The second part of the analysis looked at two regressions where the dependent variables were Q3 (English) and Q8 (Dutch/French) of the survey concerning the willingness to wait a month for either €11 or €13. The independent variables concerned were age, sex, occupation and nationality. It became apparent that these models have very little explanatory power, however, the sole variable “nationality” contributed to almost all of the model’s explanatory power. Thus, the most important finding of this section was the confirmation that being/speaking French did actually increase the probability of asking for higher monetary value in exchange for patience as the effect of nationality was highly significant in the regressions. However, in the second regression, the effect of “nationality” was reduced possibly as a result of having half the sample answering in Dutch and the other half in French.

5.2. Conclusions

As a conclusion, it may be affirmed that the first hypothesis is not rejected. This comes as a direct consequence of the analysis in the first and second part, which demonstrated similar tendencies as that exhibited by K.Chen in his paper. While the first part of the analysis confirmed general tendencies, the second helped prove the significance of the effect. This means that overall, even when considering a bi-lingual sample, speakers of strong FTR languages (such as French) will perceive the future differently than those who speak weak FTR languages (such as Dutch). The more tenses a language has for the future, the more the speaker disassociates it with the present. This leads to risk-seeking attitudes, as the future feels more distant than it does to the low FTR speakers. It also leads to more risk-seeking behaviour that can be seen in the smoking habits. However, this paper was not able to confirm this effect on every level as heating and exercising habits contradicted the hypothesis.

The second hypothesis is rejected as a result of not having enough evidence to support the claim. The effect that bilinguals adapt their behaviour according to the language they speak in was proven possible by the first part of the analysis. French speakers showed a much higher propensity for risk-taking than when they spoke in English; conversely, the Dutch became more risk averse answering the survey in Dutch as opposed to answering it in English. When attempting to observe this effect in the regression, this effect could be confirmed in the English responses but not in Dutch/French ones. This occurred because the second regression could not properly differentiate the effect between the Dutch and the French since their responses were combined and opposite interaction diminished the amplitude of the effect. Therefore, the effect that a person's preference towards time and risk would change according to the language (s)he speaks in is rejected, but it's still worth looking into as a larger and more diverse sample might prove it correct.

5.3.Limitations

Many of the results proved to demonstrate the general trends expected, however, it

was biased due to its small size, small variance in age, and most of the sample being business students. This was good when comparing both groups to each other, but unfortunately, this holds little external validity. Therefore, to improve this paper I would recommend gathering a much larger and more varied sample as to be able to export the findings to the general population.

Additionally, as mentioned prior, some of the respondents answered in ways that skewed the data with overly high values. Some even answered the same monetary value in both English and Dutch/French questions, thus reducing the explanatory power of the data. This is potentially because not enough of the sample was financially remunerated for their contributions or that they simply did not care enough. To correct for this, I would modify the design of the experiment by gathering a financially remunerated panel study where respondents would be asked a series of question in the different languages they speak at different points in time. It would also enable us to observe the effect of their preferences over time, which would give us a more accurate depiction of the effects of languages. This would also prevent them from answering exactly the same for both languages.

Lastly, the hyperbolic discounting rate was only very briefly approximated in this paper. This comes as a result of the survey questions that did not possess enough explanatory power to distinguish between high discount rates that fit the usual exponential discounting framework from hyperbolic. This hyperbolic rate could be found only if we could compare the willingness to wait to consume things in a very short time horizon such as an hour or a day, in addition to having instantaneous and real incentives.

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Appendix

Regression 1: Q3-For what amount of money would you be willing to wait 1 month for instead of receiving \$11 right now?

Table A.1: Correlation Matrix

Correlations						
	For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?		What nationality are you?	Which sex are you?	How old are you?	Occupation?
Pearson Correlation	For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?	1.000	-.362	.176	-.197	-.060
	What nationality are you?	-.362	1.000	-.082	.299	.025
	Which sex are you?	.176	-.082	1.000	-.106	.035
	How old are you?	-.197	.299	-.106	1.000	.232
	Occupation?	-.060	.025	.035	.232	1.000
Sig. (1-tailed)	For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?	.	.001	.068	.047	.307
	What nationality are you?	.001	.	.245	.005	.416
	Which sex are you?	.068	.245	.	.187	.384
	How old are you?	.047	.005	.187	.	.024
	Occupation?	.307	.416	.384	.024	.
N	For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?	73	73	73	73	73
	What nationality are you?	73	73	73	73	73
	Which sex are you?	73	73	73	73	73
	How old are you?	73	73	73	73	73
	Occupation?	73	73	73	73	73

Table A.2: Model Summary (R^2)

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.362 ^a	.131	.119	\$28.8849	.764

a. Predictors: (Constant), What nationality are you?

b. Dependent Variable: For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?

Table A.3: Stepwise Regression

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	50.649	4.749		10.666	.000	41.180	60.117
	What nationality are you?	-22.146	6.762	-.362	-3.275	.002	-35.629	-8.663

a. Dependent Variable: For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?

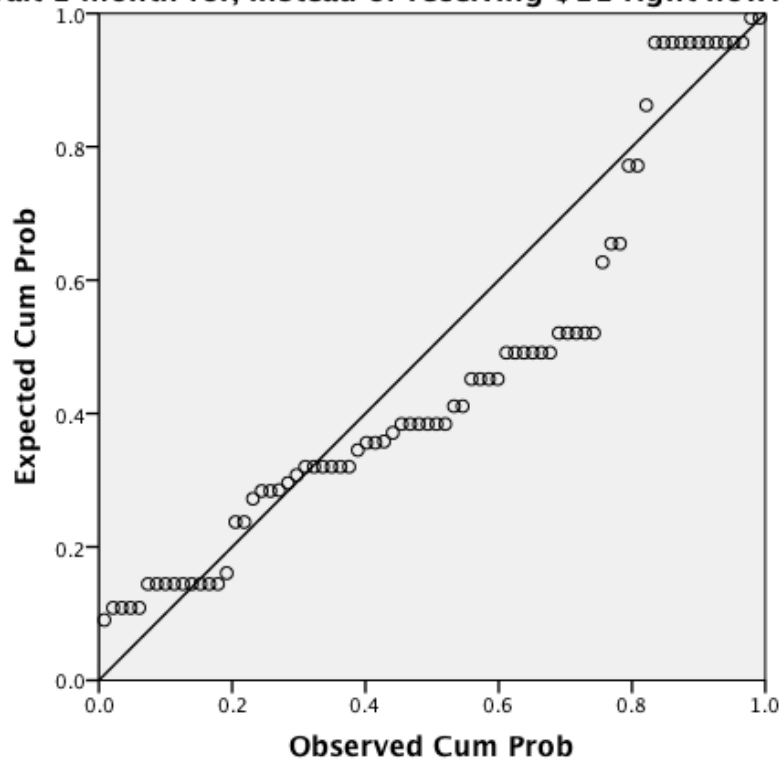
Excluded Variables ^a								
Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics			
					Tolerance	VIF	Minimum Tolerance	
1	Which sex are you?	.147 ^b	1.334	.187	.157	.993	1.007	.993
	How old are you?	-.098 ^b	-.843	.402	-.100	.911	1.098	.911
	Occupation?	-.051 ^b	-.458	.648	-.055	.999	1.001	.999

a. Dependent Variable: For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?

b. Predictors in the Model: (Constant), What nationality are you?

Graph A.4: P-P plot

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: For what amount of money would you be willing to wait 1 month for, instead of receiving \$11 right now?



Regression 2: Q8

-(Dutch) Voor welk bedrag zou je liever één maand wachten, inplaats van €13 nu te ontvangen?

-(French) Pour quelle somme d'argent serais-tu prêt a attendre 1 mois au lieu de recevoir €13 maintenant?

Table B.1: Correlation Matrix

Correlations						
	Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?		What nationality are you?	Which sex are you?	How old are you?	Occupation?
Pearson Correlation	Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?	1.000	-.265	.164	-.022	-.058
	What nationality are you?	-.265	1.000	-.082	.299	.025
	Which sex are you?	.164	-.082	1.000	-.106	.035
	How old are you?	-.022	.299	-.106	1.000	.232
	Occupation?	-.058	.025	.035	.232	1.000
Sig. (1-tailed)	Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?	.	.012	.083	.427	.312
	What nationality are you?	.012	.	.245	.005	.416
	Which sex are you?	.083	.245	.	.187	.384
	How old are you?	.427	.005	.187	.	.024
	Occupation?	.312	.416	.384	.024	.
N	Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?	73	73	73	73	73
	What nationality are you?	73	73	73	73	73
	Which sex are you?	73	73	73	73	73
	How old are you?	73	73	73	73	73
	Occupation?	73	73	73	73	73

Table B.2: Model Summary (R^2)

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.265 ^a	.070	.057	\$30.3129	.156

a. Predictors: (Constant), What nationality are you?

b. Dependent Variable: Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?

Table B.3: Stepwise Regression

Coefficients ^a							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	52.027	4.983		10.440	.000	42.090	61.964
What nationality are you?	-16.444	7.096	-.265	-2.317	.023	-30.593	-2.294

a. Dependent Variable: Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?

Excluded Variables ^a							
Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics	
						Tolerance	Minimum Tolerance
1	Which sex are you?	.143 ^b	1.250	.216	.148	.993	.993
	How old are you?	.063 ^b	.522	.604	.062	.911	.911
	Occupation?	-.052 ^b	-.449	.655	-.054	.999	.999

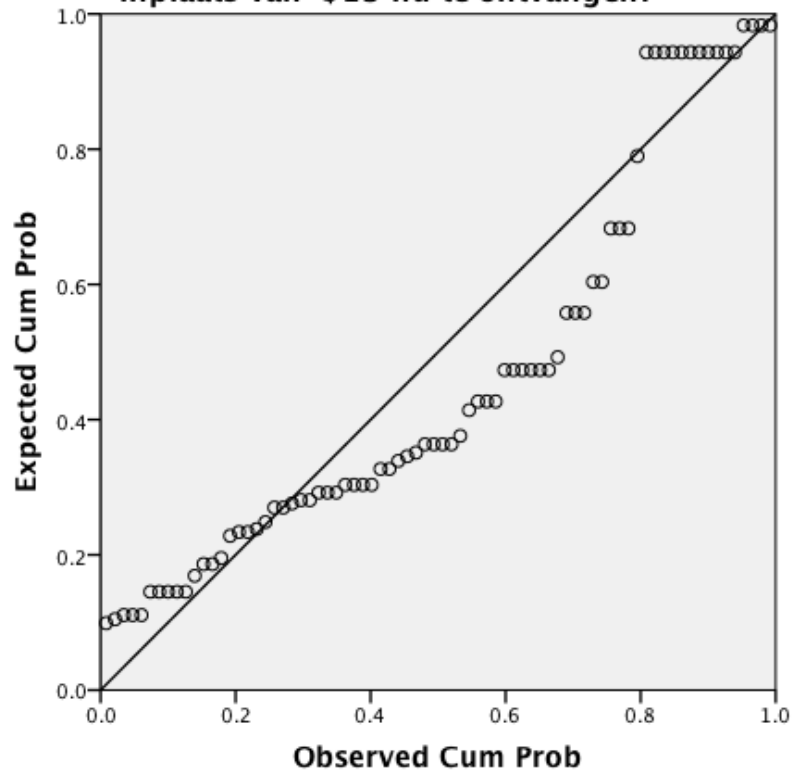
a. Dependent Variable: Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?

b. Predictors in the Model: (Constant), What nationality are you?

Graph B.4: P-P plot


Normal P-P Plot of Regression Standardized Residual

Dependent Variable: Voor welk bedrag zou je liever één maand wachten, inplaats van \$13 nu te ontvangen?



Survey English/French (Version 1)

This only account for the parts with the questions in 2 languages, the demographic and health questions are further.



In the following survey, you will be asked to answer a variety of question in English as well as in French. These questions vary from cognitive reflection tests to time/risk preference questions. If you have any questions about the study or any other inquiries, email me at jacob2312@hotmail.com

Note that 1 out of 15 respondents will be rewarded with the amount they input into this survey. (only for time preference questions)

A ball and a bat cost €1.10 in total. The bat costs €1.00 more than the ball. How much does the ball cost?

- ☐ 5 cents
- ☐ 10 cents
- ☐ 15 cents
- ☐ 20 cents

If it takes 5 minutes for 5 machines to create 5 widgets, how long would it take 100 machines to make 100 widgets?

- ☐ 10 mins
- ☐ 6 mins
- ☐ 5 mins
- ☐ 4 mins

What amount of money will you be willing to wait 1 month for, instead of receiving €11 right now?

For what amount of money will you be willing to wait (below mentioned amounts of time) instead of receiving €111 right now?

1 month	<input type="text"/>
2 months	<input type="text"/>
1 year	<input type="text"/>

Which lottery would you rather play?

- ☐ 70% chance of winning €400
- ☐ 30% chance of winning €930

Dans un lac, il y a un nénuphar. Chaque jour, ce nénuphar double de taille. Si cela prend 48 jours pour que le nénuphar couvre le lac entier, combien de temps prendrait-il pour que ce nénuphar recouvre la moitié du lac?

- ☐ 37 jours
- ☐ 24 jours
- ☐ 42 jours
- ☐ 47 jours

Une balle et une batte de baseball coûte au total €1.10. La balle coûte €1.00 de moins que la batte. Combien coûte la batte?

- ☐ €1.00
- ☐ €0.90
- ☐ €1.05
- ☐ €0.95

Pour quelle somme d'argent serais-tu prêt à attendre 1 mois au lieu de recevoir €13 maintenant?

Pour quelle somme serais-tu prêt à attendre ... au lieu de recevoir recevoir €113 maintenant?

1 mois	<input type="text"/>
2 mois	<input type="text"/>
1 an	<input type="text"/>

Quelle loterie préfères-tu?

- ☐ 30% de chance de gagner €1400
- ☐ 70% de chance de gagner €600

Survey English/Dutch (Version 1)



In the following survey, you will be asked to answer a variety of questions in English as well as Dutch. These questions vary from cognitive reflection tests to time/risk preference questions. If you have any questions about the study or any other inquiries, email me at jacob2312@hotmail.com

Note that 1 out of 15 respondents will be rewarded with the amount they input into the survey (only for time preference questions)

A ball and a bat cost €1.10 in total. The bat costs €1.00 more than the ball. How much does the ball cost?

- ☐ 5 cents
- ☐ 10 cents
- ☐ 15 cents
- ☐ 20 cents

If it takes 5 minutes for 5 machines to make 5 widgets, how long would it take 100 machines to make 100 widgets?

- ☐ 10 mins
- ☐ 6 mins
- ☐ 5 mins
- ☐ 4 mins

For what amount of money would you be willing to wait 1 month for, instead of receiving €11 right now?

For what amounts of money will you be willing to wait (below mentioned amounts of time) instead of receiving €111 right now?

1 month	<input type="text"/>
2 months	<input type="text"/>
1 year	<input type="text"/>

Which lottery would you rather play?

- ☐ 70% chance of winning €400
- ☐ 30% chance of winning €930

Een bal en een knuppel kosten samen €1.10. De bal kost €1.00 minder dan de knuppel. Hoeveel kost de knuppel?

- ☐ 90 cent
- ☐ 95 cent
- ☐ €1.00
- ☐ €1.05

In een meer liggen een groep leliebladen. Elke dag verdubbelt de groep zich. Als het 48 dagen duurt voordat het meer vol ligt, hoe lang zou het duren tot het meer halfvol is?

- ☐ 24 dagen
- ☐ 37 dagen
- ☐ 42 dagen
- ☐ 47 dagen

Voor welk bedrag zou je liever één maand wachten, inplaats van €13 nu te ontvangen?

Voor welk bedrag zou je liever (kies tijdperiode uit mogelijke keuzes) willen wachten, inplaats van €113 nu te ontvangen?

1 maand	<input type="text"/>
2 maand	<input type="text"/>
1 jaar	<input type="text"/>

Welke lotterij zou je liever spelen?

- ☐ 30% kans om €1400 te winnen
- ☐ 70% kans om €600 te winnen

Survey Health Questions

Do you smoke? (if you are an occasional smoker, check yes)

- ☐ Yes
- ☐ No

How often do you exercise on a weekly basis?

- ☐ Never
- ☐ 1-2
- ☐ 3-4
- ☐ More than 4

How many fruits/veggies do you eat a day?

- ☐ None
- ☐ 1-2
- ☐ 3-5
- ☐ More than 5

Survey Demographic Questions (for regressions)

How old are you?

Which sex are you?

- ☐ Male
- ☐ Female

Occupation?

- ☐ Business/Economics student
- ☐ Humanities student
- ☐ Medical student
- ☐ Law student
- ☐ Professional (precise which field below)
- ☐ Other

How did you learn English?

- ☐ Learnt at school
- ☐ Lived in an English speaking country
- ☐ One of your parents is a native speaker
- ☐ Learnt through mainstream media such as tv, songs, movies...
- ☐ Other (precise how below)