-MSc Thesis-

'Factors explaining the overestimation of food quantity for dinner with food wastage as result'

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Introduction

'*Factors explaining the overestimation of food quantity for dinner with food wastage as result'*

The particular problem that this research addresses is: the food wastage caused by overestimation of food quantity for dinner when an agent is cooking for multiple targets. In this research, an *'agent'* is someone that cooks food for his/her guests. The term *'guests'*, *'targets'* and *'other people joining the dinner'* are used interchangeably in this research and have the same meaning.

Problem statement

The general problem underlying this research is the wastage of food scraps; these are the leftovers of food after a dinner. The disposal of food rests is in most situations unnecessary, and can be avoided, because large parts of these leftovers that are disposed is still good to eat. The scale of the problem is significant; an average consumer disposes 51 kilos of comestible food per year; which has a monetary value of €175,-. This quantity of food is sufficient to prepare 80 warm meals for 1 person (Voedingscentrum, 2010). The problem is not leftovers in general; the problem is that these leftovers are unnecessarily wasted. These food scraps are still edible thus there is no reason to dispose of them. This research will investigate common made mistakes by consumers in the quantity estimation process for dinner. When these mistakes are identified, solutions or strategies can be developed and proposed to get rid of these inaccuracies.

Research questions

One main question and three sub-questions are designed to tackle this problem.

Main question:
-Which factors contribute to the existence of leftovers after dinner as a result of overestimation?

Sub questions:
- How does familiarity with the targets influence the quantity estimations for dinner?
- How does motivation of the agent influence the quantity estimations for dinner?
- How does the number of targets joining the dinner influence the quantity estimation for dinner?

The answers to these questions will help to provide a good insight in the factors that play a role when consumers are estimating food quantities for others. These factors came up after the literature study as possible factors that influence the quantity estimation of consumers. Besides, the intention is that insight in these factors can be used to reduce leftovers and food wastage. Consumers are influenced by multiple *cues*, this are indications that can help consumers making correct quantity estimation. Examples are average consumption quantity per person, situational factors as hunger and the

preferences of guests joining the dinner, since preferring a dish will most likely lead to a higher consumption. However, incorrect use or adjustment of these cues can lead to incorrect estimations and thus leftovers after dinner. Furthermore, these research questions deal with leftovers. Hereby, '*leftovers*' are the food scraps left after the dinner is over, this can be either food left in the pot or food left on the plate. Next to this, leftovers turn into *food wastage,* when these leftovers are disposed of unnecessarily.

Relevance

The problem of food waste exists already for a long time and no solutions is found or proposed yet; this is the reason why it is important to tackle this consumer behavioural problem. Research from Wenlock and collegues (1980) shows, already thirty years ago, the significant scale of the problem in Britain. This research is just a statistical overview of the problem and does not deal with the process that happens in the mind of consumers when cooking too much food and disposing of the leftovers. Although this research shows that the scale is significant, it did not attract a lot of attention from other consumer behaviour researchers by succeeding studies.

The problem of food wastage is already recognized in hospital settings, several researches addressed this problem (Almdal, Viggers, Beck, & Jensen, 2003; Barton, Beigg, Macdonald, & Allison, 2000; Edwards & Nash, 1999; Kelly, 1999; Wilson, Evans, & Frost, 2000). This research could identify the cause of the high level of food wastage and a solution by another serving method is already successfully introduced. Application from these serving methods is not likely to be the solution in household settings, but insight can be derived from these researches. General information about wastage and the wasting behaviour of consumers and households can be derived from research of household solid waste, e.g. (Hockett, Lober, & Pilgrim, 1995; Johnstone & Labonne, 2004).

Nowadays, there is more and more understanding of the rising problem of food wastage that needs to be solved. In 2010, the World Food Day was aimed at this problem (Wereldvoedseldag, 2010) and nowadays there is a campaign called *'food is meant to eat'* (Voedingscentrum, 2010). There is no research literature available about the mental processes acting in the mind of the consumer while making quantity estimates for dinner. This is the point that this research addresses; insights from the anchoring and adjustment theory (e.g. Block & Harper, 1991; Simmons, LeBoeuf, & Nelson, 2010; Tversky & Kahneman, 1974) can be used to see how consumers use an anchor value and adjust from this when making estimations for dinner.

This research will have an explorative character and is meant to explore several first insights in the phenomenon of food wastage. On the one hand strategies to prevent consumers from cooking too much food while on the other hand educate consumers to store their leftovers, should be used as a starting point to reduce food wastage.

The question is how to teach consumers to cook in a way that no or just a minimum of food is left over after finishing the dinner. A small decrease in food wastage per consumer will have great impact on the food availability, food production, waste processing and expenditures of households and so on.

The practical relevance for the consumer (organisations) is that this research will try to identify biases that cause food wastage and when strategies can be developed to reduce the food wastage. Consumers can save lots of money yearly by reducing their food waste; in fact, consumers are just cooking the extra food for the bin. A small reduction of food wastage per week for one household is a significant reduction on a yearly basis. After a lot of consecutive research, a framework of biases can be developed consisting of biases possibly occurring when making dinner. The next step after developing a framework is to link successful solutions to biases that cause food wastage.

Goal

The goal that this research would like to achieve is to get more insight in the mental processes that play a role in mind of the consumer when making quantity estimation for cooking. What this research would like to find out is if there are factors that play a role and cause food wastage due to overestimating the food quantity per dinner. When there is more insight in how people predict food quantities and how it could happen that there is a surplus of dinner food, strategies to overcome this can be developed.

This research likes to contribute to the research in the food disposal literature. As already mentioned, the literature is limited and need to be expanded due to the scale and the necessity of a solution. A more idealistic goal is that this research can support the equality of food distribution worldwide, when consumers are more conscious of their food wastage so hopefully more food will be available for famine countries. This research alone might not bring the world famine salvation, but it is a small step in the right direction.

Structure

The structure of this report is as follow: the first chapter presents the scale and the consequences of the food wastage problem and an overview model. The second chapter will give a brief overview of the food preparation process. The third chapter goes more in depth with concepts that play a role in estimation process for food preparation. The fourth chapter shows the methods used in this research. In the fifth chapter, the results will be elaborated. In the sixth chapter, the conclusion and discussion will be given and some ideas for future research will be proposed.

1. The problem of food wastage

1.1 Scale of the problem

The problem of food wastage has been acknowledged for already more than thirty years. In 1980, the findings from Wenlock et al. (1980) shows that food wastage is a significant problem. In the years after this publication, studies on this subject are limited, while the scale is significant and the problem is growing. For instance, 10-20% of all food purchases were disposed of in Dutch households in 2008, while a third of this was still edible (Meeusen & Hagelaar, 2008; Voedingscentrum, 2010). This means a total waste of 51 kilos worth €175,- edible food per person a year, this is a sufficient quantity of food to prepare 80 warm meals for 1 person (Voedingscentrum, 2010). The total monetary value of this disposed food that is / was edible is 600 million euros per year (MilieuCentraal, 2007). The part of food scraps that are disposed and non-edible, consists mainly out of peels from fruit and bones.

1.2 Consequences

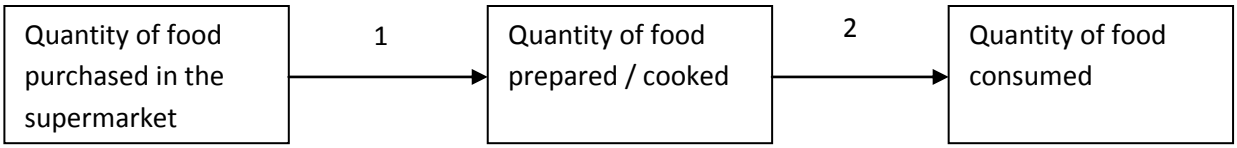
The consequences from the disposal of leftovers after dinner are numerous. First, a lot of CO2 is used to produce and transport the food products (MilieuCentraal, 2007). As known, the CO2 emissions have a negative influence on the environment; an important cause of the greenhouse effect. Therefore, the environment is additionally harmed to produce food, which will strangely be disposed of. Secondly, it is ironic to waste good food, while the global food distribution is unfair. In some third world countries, people are fighting for food, while in the Netherlands consumers just throw away leftover food. Third, when 10-15% of all the food purchased is disposed, the same amount of household money for food products is wasted, even though price is an important value in the conceptual model of the food choice process developed by (Furst, Connors, Bisogni, Sobal, & Falk, 1996). In that sense, it is bizarre to decide on household products with price as an important decision criteria and then dispose 10-15% of the product and thus of the price. In that way, it is more ethical to buy more expensive products and dispose less.

1.3 Discrepancies in the food preparation process that can cause food wastage

The 'process' of preparing and consuming dinner consists of the purchase of groceries, cooking/preparing the food and the actual consumption of the dinner. When organized in this way there arise two discrepancies between the three steps identified in this process. The first discrepancy is between purchasing and cooking / preparing; when people purchase more than they prepare, the surplus will be stored questionable whether these will be consumed before expiration. The second

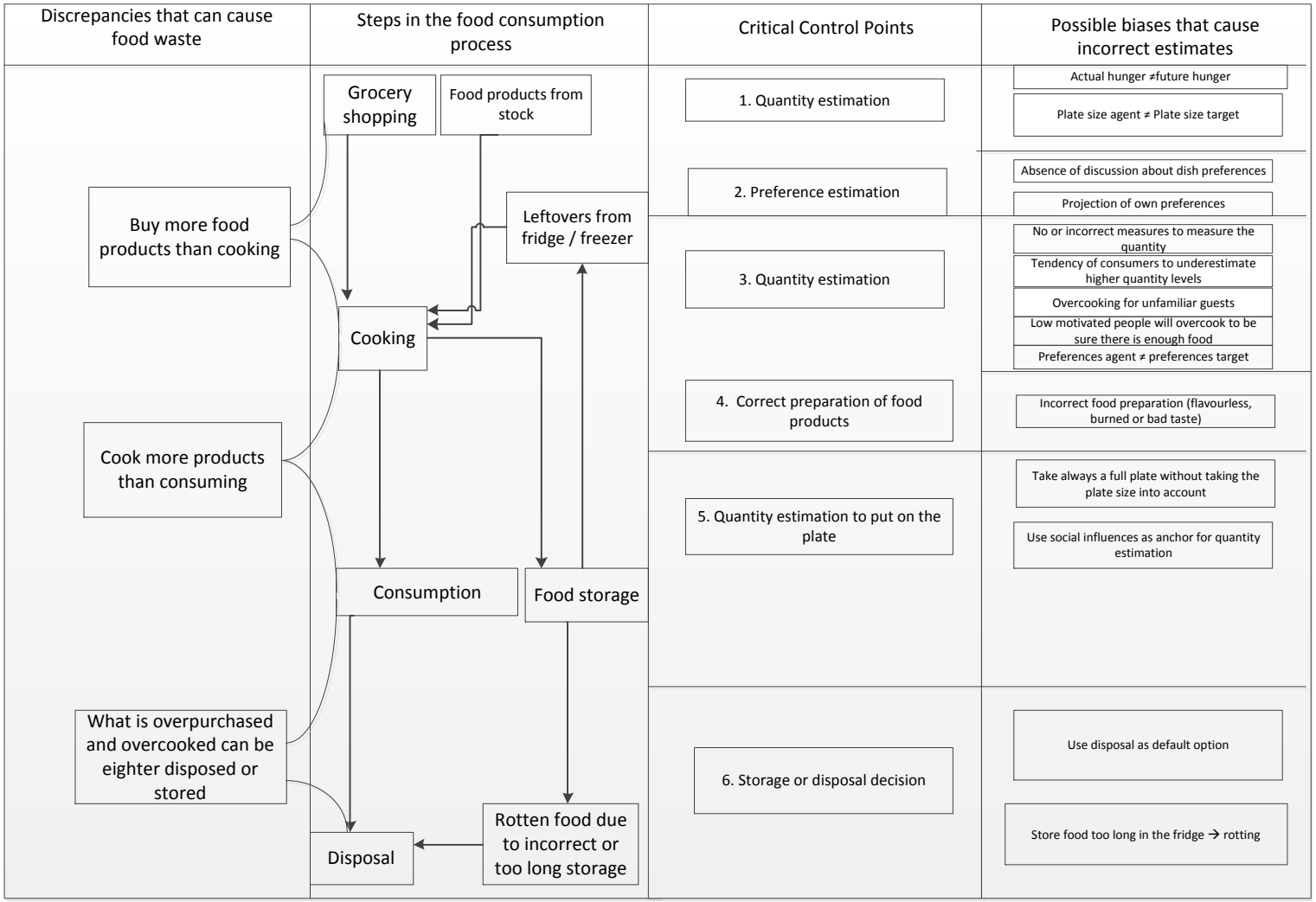
discrepancy is between cooking/preparing and eating; when the guests do not consume all the food that is prepared, this can be stored or disposed of. The discrepancies can be seen in the figure below. This research would like to address the second discrepancy when there is a surplus.

Figure 1: discrepancies in the 'food preparation process'



The food preparation process is mapped graphically in the model on the next page. In this model, the steps in the food preparation process are shown chronically. The most important are the two last columns where several Critical Control Points (CCP's) are identified and corresponding the biases (mistakes) that consumers can make to cause food wastage. In the next chapter there will be a short overview of this 'food consumption process' backed up with findings from the literature.

Model 1.1: Scheme of the food consumption process including Critical Control Points (CCP's) and biases



2. Food consumption process

2.1 Choice of dish

To start the food consumption process a dish is chosen to be consumed, which can be done collectively by the persons that will consume the dinner or just by the agent preparing the dinner. This dish can be decided on in the supermarket or at home. When an agent cooks for several targets, he tries to prepare a dish that ultimately satisfies all the targets. It is easier to fulfil this condition after a discussion in advance with the targets joining the dinner, so different possibilities can be weighed and the best option can be chosen.

Agents that are insecure about their choices like to have a discussion in advance to avoid negative evaluations (Chang, Chuang, Cheng, & Huang, 2011). In this joint decision making process, non-preferred dishes are avoided, which does not imply that always preferred dishes are chosen (Guidetti & Cavazza, 2008). It is interesting to look into the joint decision making literature since there might be a relation between preferences and consumed quantities. The decision to cook a non-preferred dish could be a reason that the targets are not able to empty their plate and food rests will be left on the plate. In fact, it is not that important to choose a dish preferred by everyone, but more important to make a correct prediction of the consumed food quantity.

People can overeat when consuming a preferred dish, which can be used as strategy to reduce leftovers, but this will switch the problem to overweigh people. Consuming a preferred dish will lead to a higher consumption and less leftovers. However, when consumers can choose their own dish like in a restaurant, this is no guarantee that there is no food wasted. The portions in restaurants are based on mediate or big eaters and for a small eater it is not possible to finish the plate. A factor that can have influence on the dish choice is the degree of CNFU (Consumers Need For Uniqueness (Irmak, Vallen, & Sen, 2010). The higher this degree, the more consumers like to be unique and vary dish choices very often. This decreases the chance to choose a dish that is not preferred and most likely left overs will decrease.

2.2 Grocery shopping

Food products are required to prepare a meal; some consumers have them in stock, but mostly, consumers go out for grocery shopping. Research from (Wansink, 2006) shows that in 90 per cent the same person responsible for the grocery shopping actually cooks the food. Thus, inconsistencies between the grocery shopper and the one that cooks the food will have a limited influence on misconceptions about the food preparation.

Another interesting concept worked out by Wansink is the nutritional gatekeeper (Wansink, 2006) who is the responsible for the shopping and 72% of the food intake of the household members. This is a significant percentage where this gatekeeper takes three out of four food decisions. It is difficult to

speak about joint decision making in this case when the one that buys the groceries almost makes all the food decisions. After the decision on the dish is made and the number of people joining the dinner is known a quantity estimate can be made and these groceries need to be purchased in the supermarket and this is not that easy.

First, adjustment in the quantity should be made for the stock available at home. The mistake often made is that people use their average inventory as an anchor for actual inventory (Chandon & Wansink, 2006) and when this does not match, mistakes in quantity estimation can occur.

Second, in the supermarket, retailers try to convince consumers purchasing more than they need by making use of multiple-unit pricing, purchase quantity limits and suggestive selling (Wansink, Kent, & Hoch, 1998). Purchasing larger quantities then needed can turn a nice sale offer into an expensive purchase or food wastage.

Third, the estimated purchase quantity needs adjustment for the situational factors that can differ over time, examples are hunger and preferences. This adjustment needs a prediction of hunger in the (near) future and this seems quite difficult, regarding the high number of mistakes (Gilbert, Gill, & Wilson, 2002). Adjustment is needed when people are hungrier or less hungry then they are normally, because this will influence their consumption.

A practical implication is purchasing undividable vegetables or packages with recipes for a certain number of people. Sometimes the required quantity is not available and a choice should be made between a (slightly) lower or higher quantity.

2.3 Food preparation

The step that succeeds the grocery shopping is the food preparation. Sometimes washing and/or cutting vegetables and meat precedes this. In this phase, another quantity estimate should be made; what is the quantity that actually will be cooked. In other words, should all the groceries be prepared for this dinner? For the preparation, cooking skills are required; otherwise burned or incorrect prepared food is also a cause of food wastage. Recent research found out that some poor people don't dare to cook food they don't know, because of the fear of incorrect preparation leading to food wastage (Engler-Stringer, 2011).

A difficult situation is the dinner preparation for young children who dislike various dishes. When parents try to pressure their children to finish their dish in order to prevent leftovers, will end up with the opposite (Galloway, Fiorito, Francis, & Birch, 2006). In this research, they also came up with a solution; to cook another dish for the children. The idea behind this is that the parents will choose a dish of which they are sure that the children will like it. The advantages of this are that the food choice for themselves is not limited and they will cook a dish the children will like, but it is uncertain whether this

will be a solution for the problem of the food wastage, because when children are not hungry, they will still not eat the food.

2.4 Food consumption

Consumption process

After food products are purchased in the supermarket and prepared in the kitchen, the actual consumption can start by first dividing the food in portions over the plates. In some households, the cook will put paced quantities on the dishes. Another possibility is to put the pot on the dinner table so everyone can serve himself or herself and decide personally on the quantity. This can have consequences for the leftovers and food wastage, because too much food on a plate for someone will probably be left over. When the food is put on a plate by the targets themselves, they might be modest and will not take too much food.

Consumers have the tendency to use incorrect anchors for choosing the quantity of food they consume like the amount of food other people joining the dinner take and even the body style of other people (McFerran, Dahl, Fitzsimons, & Morales, 2010). For instance, when the accompanying guests do not take that much food, this consumer will also not eat that much food. This effect is also found by (McFerran, et al., 2010) they found a correlation between quantity of food put on a plate and the actual consumption and the body type and amount of food other people present at the dinner. This is also part of social or personal norms that hold during dinner, as (Olsen & Grunert, 2010) found out. The adjustment of food intake when accompanied by others can also be called social modelling (Hermans, Herman, Larsen, & Engels, 2010). In this research they showed that men that are hungry before the experiment adjust their snack intake to the intake of the people around them. They will also eat more, and the other way around, when their dinner table companion eats more. The explanation for this is that males eat just as much as they can when they are hungry, but limited when their companion eats less. Another reason could be that people in a state of hunger are more sensitive for signals to eat more, so when others eat more they see this as an excuse to indulge more.

An effective strategy to reduce food wastage

In the food service in the hospitals, food wastage levels were successfully decreased after introducing solutions proposed by research. In the hospitals, the patients need a sufficient nutritional intake (Wilson, et al., 2000), but the food wastage levels are quite high. The nutritional intake was at first sight not at stake, people ordered more food than they needed and disposed of the surplus (Almdal, et al., 2003). The problem arises when food intake gets monotonous and for instance lacks sufficient vegetable intake.

Research conducted by (Wilson, et al., 2000) compared the traditional strategy of serving food on plates with a strategy where food is provided in bulk and clients can take the food they like. In both situations, people are asked in advance, what they would like to eat. The results show that the nutritional intake in the bulk food condition was significantly higher, but more importantly, the food wastage was

significantly lower in this condition. Several reasons why people waste more in the plated condition were identified: people were discouraged or overwhelmed by the amount of food on their plate, sometimes the food was served too cold or the presentation was not attractive (Kelly, 1999). With some effort this can be applied to a household situation, this would show that food wastage would be lower when serving for yourself from a big pot.

Another factor that was accountable for the high food wastage levels in the hospitals next to the plate waste is the lack of communication. When clients move from the one to the other department or when they are discharged, will sometime still receive their dish for that evening at their former corridor (Kelly, 1999). With some effort, we could apply this again to the household situation where the communication is also very important. You need to know how many people will join the dinner that evening to make a correct estimation. This is sometimes difficult when you invite people for a dinner and you are not sure how many people really join the dinner. Another example is cooking in a student house; the number of people joining the dinner is always different.

2.5 Disposal

Domestic solid waste

In the literature, no specific information is found about the disposal of domestic food waste. The findings shown below are based on the solid waste disposal literature. This will not exactly match the food disposal, but can be used to get certain insights. Waste in general, called Municipal Solid Waste (MSW) consists of paper, plastics, yard waste glass and other materials. In the US the MSW per capita is 0.75 ton per year, varying over the regions (Hockett, et al., 1995).

In their research, (Hockett, et al., 1995) found out the two most important determinants having a positive relation with the MSW amount. The first factor is the per capita retail sales, when this ratio increases, the amount of MSW will also go up. This relationship is comprehensible since the more products purchased in supermarkets, the more package material is used and also thrown away, which also holds for food products.

The second factor that has a positive relation with the MSW quantity per household are the disposal fees. When the disposal fee in a region is higher, the average MSW per household will be higher. A disposal fee is a predefined value of money, independent from the quantity of household waste that should be paid to the municipality as a compensation for the collection of household waste. Consumers see the disposal fee as a licence for disposal and make eagerly use of this. However, the line of thought is ironic: you dispose more because you paid for it.

Regarding the waste generation and disposal on a macroeconomic scale we see that the proportion of children, the composition and size of the household have a negative influence on the household MSW production. Population density and the degree of urbanisation seems to have a positive influence on the household MSW production (Johnstone & Labonne, 2004).

Factors influencing food wastage quantity

Despite the fact that confirming research is lacking, it is expected that socials norms have influence on the food wastage behaviour of consumers. This concept is quite strong, for instance for norms about healthy eating behaviour (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010). When people in your social environment put a lot of weight on health, most likely the others will also eat healthy. It is possible that when other people in the social environment of a consumer waste a minimum of food, this consumer would like to meet that norm and will not waste so much food as well. Some statistical findings by (Wenlock, et al., 1980) shows that the wastage quantity is higher in the Summer then in the Winter, but we are not able to find a cause to this. Next, adults waste more food than children and larger households waste less per person than smaller households. The reasons behind this are not known yet, but hopefully some more insight will be provided by this research.

A finding by (Edwards & Nash, 1999) show that the amount of food wastage is significant lower at breakfast then at lunch and dinner. While this research is dealing with the leftovers from the dinner, it might be possible to look for factors causing this effect. In this research they also found out that in almost all the cases people overestimate their hunger. They order more than they consume, which causes food waste. Another remarkable finding by this research is that women waste in almost all the cases more than men. This effect can be caused by the fact that men eat more and can overeat more than women. So, it might be expected that when women satisfied their hunger they almost immediately stop eating while men try to go on and empty their plate.

The next chapter will go more in depth into the quantity decisions that should be made during the dinner preparation process and how these estimations can end up higher than required and thus cause leftovers. Furthermore, the hypothesis will be proposed that will be tested in an experiment.

3. Quantity estimations for dinner

Making quantity estimations for dinner is not as easy as it looks like, which will be shown in different factors influencing the quantity estimation. This chapter will start by showing how preferences for certain dishes can influence the consumed quantity. After that, the influence of familiarity and motivation will be shown and is finalized by applying the principle of anchoring and adjustment on making quantity estimations for dinner.

3.1 Preferences

Preference in relation to quantity estimation

Since a relationship between preferences and consumption quantity of food products is expected, it is important to pay attention to the preference formation and prediction of preferences of others. The difficulty in predicting preferences for others lies in the finding that food preferences, at least for children, are not stable (Mata, Scheibehenne, & Todd, 2008). Next to this, when making preference predictions for familiar people, no correct adjusted for disconfirmations cues is made (Lerouge & Warlop, 2006).

Consumers overestimate their knowledge about others' preferences and do not pay attention to provided cues and look only for cues that endorse their ideas (Boyle, Hanlon, & Russo, 2011). This means that the assumption is made that when a dish is preferred once, it will be preferred always, but it can be doubted if this is always true. Having a discussion about preferences before heading to the supermarket is an effective strategy in joint decision making (Bohlmann & Qualls, 2001). It is the question how often people will have a discussion with each other about food preferences, since it cost some time and this decision should be made daily.

Projection

A bias that is often used by agents to predict the preferences of others is the usage of projection and injection (Bohlmann & Qualls, 2001; Irmak, et al., 2010). Projection is the reflection of one's own preferences on others, so one's own preferences increases perceived popularity amongst others. Injection means that regarding the preferences of others you will also like these options. The chance that using these biases you will you make the right prediction is very small, since food preferences will not be exactly the same.

The tendency to project preferences from ourselves on others is recently found by (Brenner & Bilgin, 2011), and they named this tendency *social projection*. This tendency is also seen as an anchoring and adjustment example by (West, 1996). The own preferences of the agent will deal as anchor in this situation and it is not enough adjusted towards the preferences from the targets. Another bias that could be used in predicting others' preferences is the stereotyping of favourite dishes. This means that agents have a favourite dish in mind for familiar targets. The consequence is that this dish is cooked

often and when this gets monotonous, targets can loose their preferences for this dish. From the sensory specific satiety perspective (e.g.(Havermans, Siep, & Jansen, 2010) two misconceptions could be identified in this stereotyping. First, people might have a large set of different favourite dishes; variety might be preferred over just a few favourite dishes. Second, the assumption that preferences are stable over time might not be right, since preferences of people could change over time.

3.2 Familiarity

Prediction of preferences for others is much easier for familiar targets than for unfamiliar targets. Agents have background information regarding food consumption of familiar targets. When experiences about preferences of unfamiliar others are lacking, it might be difficult to make correct estimations for this. Some difficulties should be overcome when cooking for unfamiliar others. First, it is expected that people like to show their hospitality to their guests and do not like to cook too less food and thus like to make sure that there is enough. Second, information about the expected quantity that guest would like to eat is not available. Familiarity will be manipulated in the experiment by showing or not showing the consumption patterns of others and in all situations their own consumption pattern is shown. This is realistic, since when unfamiliar guests will join for dinner, no information is known about their consumption patterns. For familiar guests, like the members of the households, information about consumption patterns is known and this is also shown in the experiment. To overcome this uncertainty, the easiest solution for the agent is to make sure that there is enough food, so cook more than the quantity that will be consumed. Based on these findings, the following hypothesis is proposed:

H1a: When agents are cooking for familiar targets, they will make lower estimations than when cooking for unfamiliar targets.

Accuracy

When agents make higher food quantity estimation when cooking for unfamiliar guests then what will actually be consumed, the unconsumed food is considered to be the leftovers. Hereby the assumption is made that the estimation is higher then the actual consumption. This is a logic assumption; it would be strange when consumers make lower estimations than the quantity of food they will consume for dinner. Consequence from 'positive leftovers' is that the analysis will be the same for estimations and accuracy. To show explicitly what the consequence for the leftovers will be, this effect is also taken into account and called accuracy. This means that a decrease in estimated value is expected; an increase in accuracy is expected.

H1b: When agents are cooking for familiar targets, they will make less accurate estimation than when cooking for unfamiliar targets.

Confidence

After consumers made their estimate, it is interesting to see how confident they are in the correctness of their estimate. In an extensive research (Block & Harper, 1991) is found that people tend to

overestimate their prediction accuracy, this tendency is called cognitive conceit. This shows that confidence has nothing to do with actual accuracy; consumers might be very confident about their estimation, but less accurate as they expected. By measuring the confidence levels after manipulating different factors, this shows us whether consumers experience this as lacking information and get less confident over their estimation. When making estimations for familiar guests, consumers have more data to base their estimations on; this leads to expectation of consumers being more confident when cooking for familiar targets:

H1c: When agents are cooking for familiar targets, their confidence level will be higher than when cooking for unfamiliar targets.

3.3 Motivation

It is interesting to see the influence of motivation on the quantity and accuracy of the estimations. This shows the leftover quantity for motivated and unmotivated consumers. Motivation can be reached both internally and externally. An example of external motivation could be to reward consumers. It is proven that quantity estimates are better when people are more motivated by financial incentives (Simmons, et al., 2010). It is unsure how strong this motivating is, since not all consumers would feel motivated by being rewarded. Pessimists might say that it is too difficult to make a correct estimation or that they will never win a prize. For this experiment it is not possible to reward respondents extensively, since there is only a limited amount of money available, which is used to attract students to participate in the experiment. Also, the link with the practice is lacking when consumers make quantity estimation for dinner, they will never receive a prize from the members of the household, because the estimation was very good.

Internal motivation can be reached by telling consumers to make the leftover rate as low as possible. In this way the costs will be reduced as well as the food wastage. This is a strong motivation and the pitfall is that consumers will lower their estimations than the actual amount of consumed food, but it is not likely that consumers will make estimations lower than the quantity actually consumed, since guests will end up hungry after dinner, which is obviously not the intention. This seems like a strong motivation, which can be used in the experiment to see how this influences the estimations, accuracy and confidence. It is expected that when consumers are more motivated, they put more effort in estimating correctly. When they would put more effort in this estimation, most likely it will be more accurate and thus the estimated quantity will be lower. Also, the consumer that puts more effort in his estimation can be more confident in that. Besides, a motivated consumer would like to make the best estimation and in this experiment, the best estimation is the most accurate estimation. Based on these expectations, the following hypothesis are derived:

H2a: When agents are more motivated, their quantity estimations for dinner will be lower than when consumers are less motivated.

H2b: When agents are more motivated, the accuracy of their quantity estimation for dinner will be higher.

H2c: When agents are more motivated, the confidence they have over their estimation will be higher than when consumers are less motivated.

3.4 Number of people joining dinner

It is interesting to see what happens with the quantity estimations when more people join the dinner. Will the quantity per person increase or decrease? This will give information about how consumers make their estimations and if they use a vast amount of food per person. In the experiment consumers will be provided with data about their personal consumption patterns and others (depending on the degree of familiarity). This will also show how consumers use provided data and adjust from that. This paragraph will go in depth about the anchoring and adjustment literature, which is exactly what is happening in the experiment. An unknown quantity needs estimation, some values are provided (consumption patterns) and the question is how the respondent uses these values (anchors) and how they adjust from this. It is interesting to see if and how consumers use this strategy, since this is not researched yet and where no link between anchoring and adjustment and quantity estimations for dinner is proven. Three times in the food consumption process anchoring and adjustment can be used to make estimations. First, a quantity decision needs to be made on how many groceries need to be purchased for the dinner. Second, a decision needs to be made if all the purchased groceries will be cooked or maybe that groceries from stock can be added. Third, either the guest or the agent needs to decide how much food to put on their plate.

Anchoring

Anchoring and adjustment is a common used bias to help making an estimate of an unknown quantity (Tversky & Kahneman, 1974). The anchoring and adjustment bias works as follows: When people need to make and estimate they will use a certain predefined value, the anchor, to decide the direction to adjust from it. Then, this estimate is evaluated and eventually adjusted until a sufficient estimate is found (Simmons, LeBoeuf, & Nelson, 2010). Mistakes are easily made when there is incorrect adjusting from the anchor.

A pitfall using the bias of anchoring and adjustment is to put too much value on an anchor. This can occur when people are provided with an irrelevant anchor; this is an anchor that is much higher or lower than the target value. From research we know that with lack of motivation people will not adjust enough from this anchor value (Simmons, et al., 2010). Consumers will then end up with an estimate that is not accurate. An example of an irrelevant anchor is the amount of food products on the package. Research found out that the more chips there is presented on an image on the package, the more people will consume, because they think this package contains more chips (Madzharov & Block, 2010).

In another research, a link is found between motivation and the direction of the estimate and the consequences for the adjustment (Simmons, et al., 2010). In this research, findings are that when motivation is higher and the direction of adjustment is known, people will adjust further away from the anchor value, which causes a bigger anchor-estimate gap. The other way around, when the direction of the estimate away from the anchor is not known, motivated people will adjust less away from the

anchor then unmotivated people. The direction of the adjustment away from the anchor is known when an irrelevant anchor is provided, so the consumer is sure that this anchor is too low or too high. When an anchor is provided that is too close to the value that should be predicted, consumers might get insecure about the direction they should adjust away from of the anchor. In this research, motivation was established by a financial incentive, the respondents with the best prediction would be rewarded by money.

The consumer can make the predefinition of a value, this is a self-made anchor or someone else can provide it, a provided anchor. An example of a self-made anchor is the average consumed food quantity for familiar targets. When getting more and more experienced and cooking more often for the same people, consumers establish an anchor value for the food quantity per person. An example of a provided anchor is the portion size provided by the producer of the food product. Consumers use more often the anchoring and adjustment bias when they establish the anchors themselves (Epley & Gilovich, 2001). The reason is that consumers are more aware when they make the anchor themselves. When working with provided anchors, consumers might see this anchor easier as irrelevant. In this experiment, the respondents will receive a relevant anchor value, because anchoring, as strategy to estimate food quantities, is something else than anchoring in general.

Adjustment

There is also research done to the adjustment from the anchors. The most important finding is that consumers will make a prediction in the lower half of the confidence interval when they are provided with a low anchor (LeBoeuf & Shafir, 2006). The other way around, when consumers are provided with a high anchor, they will make an estimation in the upper half of the confidence interval. When this is applied to the food preparation process and the food wastage, this works as follows: If consumers use the amount of purchased groceries as an anchor, it is possible that they buy exactly the right amount of food, but it is also possible that they buy more or less then the quantity of food they will consume. So, if people buy exactly the right amount of food it is possible that they will cook this amount with no leftovers. It is also possible that consumers do not trust their own expectation and would like to adjust from this anchor. Every adjustment will cause a shortage or surplus of food. At the other hand, when applying the results from the research from (LeBoeuf & Shafir, 2006) we might expect that when consumers purchase less food than what they consume, the adjustment will me made upward. Adding leftovers or products from stock can do this, but still this might not be sufficient. The other way around, when people buy a lot of groceries and while cooking they might think of the fact that they bought too much and adjust downwards. But, in most cases this will be too much food.

Number of people joining the dinner

Research from (Wansink, 2006) shows that consumers have the tendency to underestimate larger quantities of food. For instance when provided with one portion of 100 gram and one portion of 200 gram and ask them to make a quantity estimate. In this sense the exact value of the estimation is not

important, most important is the ratio between the two estimates. What is found in this research is that most consumers expect the bigger portion to be less then twice the smaller portion, their estimation is for instance 100 and 180 grams. The practical implication with this tendency in the kitchen is that when cooking for more people and underestimating the quantity, they will compensate this by adding more food. Consequence might be that when consumers need to prepare for instance 400 grams of food and they underestimate they quantity, they might end up with 500 grams of food and thus most likely leftovers of food. From this information, the following hypothesis regarding estimated quantity and accuracy can be derived:

H3a: When more targets join the dinner, the estimation will be higher (per person) than when less people join the dinner

H3b: When more targets join the dinner, the accuracy will be lower than when less people join the dinner

Independent from the fact if more targets are to a higher or lower degree familiar with the target, when more people join the dinner, the uncertainty will rise. Every single person has a certain deviation in his consumption patterns, which is for one person X, for two persons this is 2X and for 5 persons this will be 5X. This shows that the uncertain range will increase when more targets join the dinner. The expectation is that this will work on in the mind of the agent and make him less confident regarding his quantity estimation. This expectation is expressed in the following hypothesis:

H3c: When more targets join the dinner, the confidence will be lower than when less people join the dinner.

4. Methods

This chapter will show the methodology of this research. The first paragraph will explain the setup of the experiment, which is used to test the hypothesis. The second paragraph will show the conceptual model with all the influences from the different independent factors on the dependent factors. The third paragraph shows how the independent variables are manipulated. The fourth paragraph explains the measurement of the dependent factors, these factors will measure the influence from the independent factors.

4.1 Setup experiment

The hypothesis proposed in chapter 3 will be tested in an experiment. The reason for testing these hypothesis in an experiment is because this is a quantitative research method and a lot of respondents can be included. In an experiment, it is possible to ask many questions to many respondents. Within a short time, lots of information regarding many factors can be gathered from many people. This is useful for this research, since only limited information is available regarding the phenomenon of food wastage and it is not clear where to put the focus. In the experiment respondents have to make quantity estimations for dinner. First, respondents will read out a short story, this is to help the respondents by making an estimate. Next to the quantity estimations, in the experiment, respondents are asked for socio- and demographic data like gender, age and study direction. Also questions regarding their cooking skills, eating behaviour and their experience with leftovers are asked. To measure the influence of the manipulations, a question is inserted how confident they are about their estimation and if this estimation is in the right direction. Since motivation is manipulated, it should be ensured that this is understand by the respondents and thus a manipulation check regarding motivation is insert. The entire experiment can be found in Appendix A. There will be four different versions whereby the independent variables will be manipulated and the story will be different. The variables will be manipulated within and between subjects resulting in a 2x2x2 mixed design. This is the reason why there is chosen to manipulate motivation and familiarity between subjects and # of targets within subjects. This means that respondents have to make a quantity estimation for 2 and for 5 persons. Besides, respondents have to imagine cooking for either low or high familiar targets and respondents will be manipulated by having either high or low motivation. To prevent respondents from answering social desirable, questions that directly ask how much food consumers dispose will be left out and the answers will stay anonymous. This research will be carried out under students of the Wageningen University. This sample is not representative for the Dutch citizen, so caution should be exercised when generalizing conclusions.

Design

In this experiment, an 2(# of targets joining the dinner: 2 vs 4) x2 (familiarity with the targets: low vs high) x2(motivation to cook the right quantity: low vs high) mixed design will be used to manipulate three independent factors over four different versions. The first factor (#of people joining the dinner) will be manipulated within subjects and the second two factors (familiarity and motivation) will be manipulated between subjects.

Table 4.1: setup experiment and manipulation variables

Version	Situation	Independent	Independent	Independent
		# of targets joining the dinner	Familiarity with the targets	Motivation to cook the right quantity
A	1	2	Low	Low
	2	5	Low	Low
B	1	2	Low	High
	2	5	Low	High
C	1	2	High	High
	2	5	High	High
D	1	2	High	Low
	2	5	High	Low

Table 4.1 shows the four different versions that arise when manipulating the independent variables. The independent factor # of targets joining the dinner is manipulated within subjects, which means that all the respondents have to make a quantity estimate for two and for five persons. The factor familiarity with the targets is manipulated between subjects, which means that in version A and B respondents have to imagine cooking for low (un)familiar targets and in version C and D, respondents have to imagine cooking for (high) familiar targets. Regarding the factor motivation, this independent factor is manipulated between subjects, which mean that respondents in version A and D are not motivated to make the right estimation and respondents in version B and C are highly motivated to make the right quantity decision.

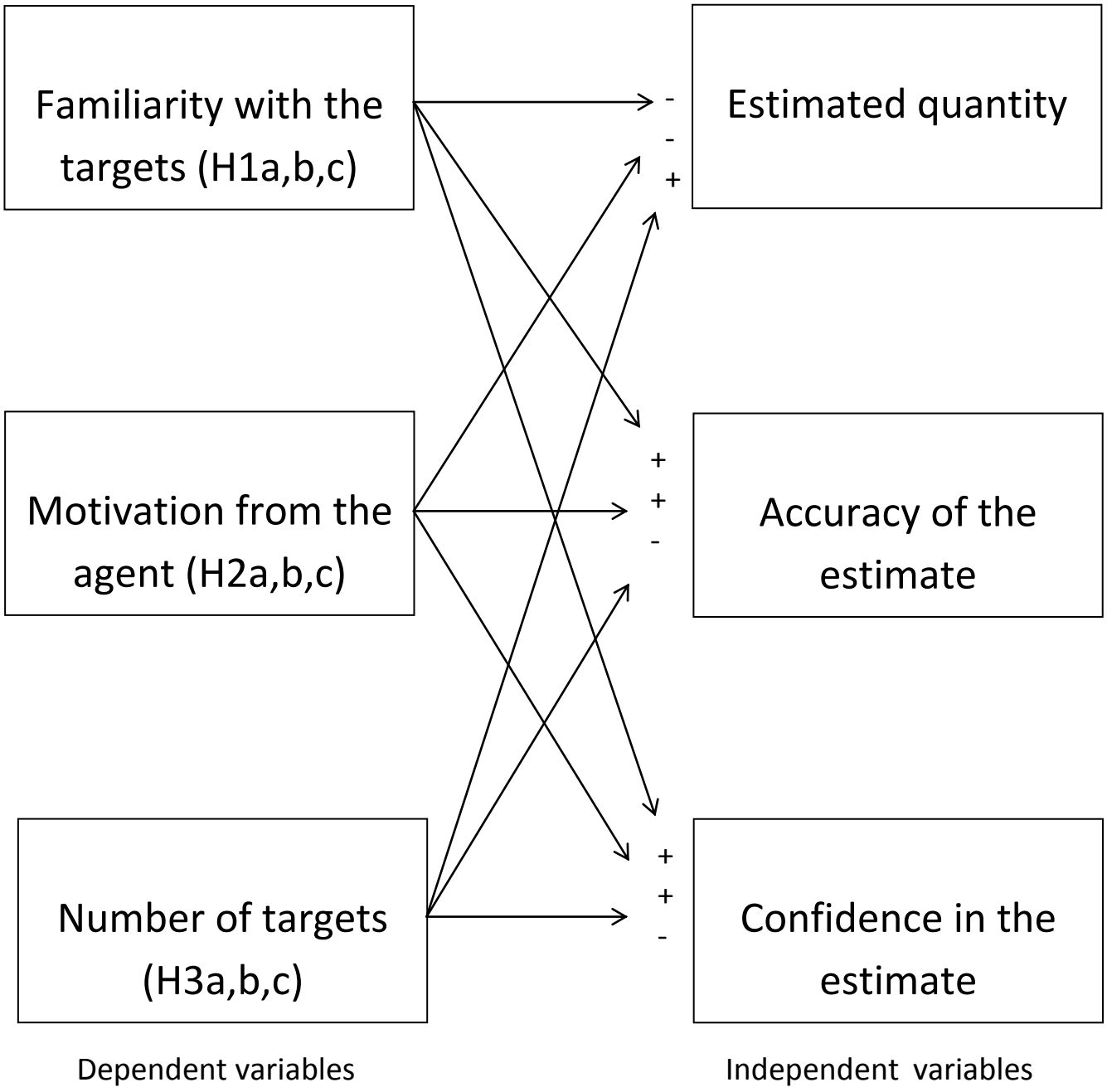
To be able to make a good analysis and draw conclusions based on this experiment a sufficient amount of respondents per condition is required, to give enough power to the tests. The sufficient amount of

people per condition is 20-30 persons, thus for this experiment 80-120 respondents are sufficient to test the hypothesis. The experiment was successful and 142 respondents filled in the questionnaire. To gather the required number of respondents, this experiment will run for 2 or 3 days at the Forum and / or the Leeuwenborch building depending how many respondents will fill in the survey within a day. The written version of the experiment can be found in Appendix A.

4.2 Relation between independent and dependent variables

To test if the hypothesis are indeed true and thus that the factors have influence, certain dependent variables should be measured to show this influence. In the table below all the different independent and dependent variables with their expected relation.

Model 4.1 Relation between independent and dependent variables



In model 4.1 the independent variables are listed on the left side and the dependent variables are listed on the right side. The independent variables are familiarity, motivation and number of targets, these factors will be manipulated in the experiment. The next paragraph will show how these variables are manipulated. To measure the influence from these independent factors, three dependent factors are included in this model and in the hypothesis.

Regarding the factor familiarity with the targets, the following hypothesis are proposed in chapter 3:
H1a: When agents are cooking for familiar targets, they will make lower estimations than when cooking for unfamiliar targets.

H1b: When agents are cooking for familiar targets, they will make less accurate estimation than when cooking for unfamiliar targets.

H1c: When agents are cooking for familiar targets, confidence levels will be higher than when cooking for unfamiliar targets.

The factor familiarity with the targets is manipulated between subjects, which means that respondents have to make a quantity estimate for either low or high familiar targets. The influence is measured on the basis of estimated quantity, accuracy and confidence. These hypothesis are included in this conceptual model (Model 4.1) and shows the expectation that familiarity will have a negative influence on the estimated quantity(H1a). This means that when agents are cooking for familiar people, the estimated quantities will be higher than when cooking for unfamiliar targets. The estimated quantities per person will be included in the analysis, to get rid of some un-useful interaction effect with the number of targets, since this is another independent factor. Corresponding with the hypothesis of a lower estimated quantity, a higher accuracy is expected(H1b). This is corresponding, since the estimated quantity is higher than the actual consumption (average of the provided consumption patterns) and thus closer to this value (a lower estimated quantity) means a more accurate estimation. The last hypothesis regarding familiarity is that familiarity will have a positive influence on the confidence(H1c). This means that when agents are making an estimation for familiar targets, their confidence in their estimation is higher. In the experiment, confidence is measured after the respondent made the estimate, with the question 'how sure are you about the correctness of your estimate'.

Regarding the second independent variable, motivation, the following hypothesis are proposed in chapter 3:

H2a: When agents are more motivated, their quantity estimations for dinner will be lower than when consumers are less motivated.

H2b: When agents are more motivated, the accuracy of their quantity estimation for dinner will be higher.

H2c: When agents are more motivated, the confidence they have over their estimation will be higher than when consumers are less motivated.

The factor motivation is manipulated between subjects, which means that respondents are either motivated to make a correct estimation or not motivated. The influence from this manipulation regarding motivation are measured on basis of estimated quantity, accuracy from the estimate and the confidence level respondents have in their estimation. The hypothesis are also included in the conceptual model 4.1 and shows a negative influence from motivation on the estimated quantity (H2a). When consumers are more motivated, the expectation is that the estimated quantity per person will be lower than when consumers are less motivated. Because the estimated quantity will be lower, the accuracy of the estimate will be higher (H2b). Hypothesis 2c is shown in Model 4.1 as a positive influence from motivation to confidence, since the expectation is that when consumers are more motivated, their confidence level will be higher than when consumers are not motivated.

The following hypothesis are proposed in chapter 3 regarding the factor number of targets:

H3a: When more people join the dinner, the estimation will be higher (per person) than when less people join the dinner

H3b: When more people join the dinner, the accuracy will be lower than when less people join the dinner

H3c: When more people join the dinner, the confidence will be lower than when less people join the dinner.

The number of targets is manipulated within subjects, which means that respondents have to make a quantity estimate for 2 and for 5 persons. The influence from this manipulation is measured on basis of the estimated quantity, the accuracy from this estimate and the confidence level respondents have in their estimation. The hypothesis are also included in conceptual model 4.1, with the expectation that the number of people will have a positive influence on the estimated quantity(H3a). This means that when more people join the dinner, the estimated quantity per person will be higher. When the estimation will be higher, the accuracy will be lower (H3b). The lowest arrow shows the expectation that when more people join the dinner, the confidence level that respondents have over their estimate will be lower(H3c). Since an estimation should be made for more people, the uncertainty range around the consumed quantity will also increase resulting in a lower confidence level.

Interactions between independent variables

It is possible that some factors in Model 4.1 will have interactions with each other. One interesting interaction is that when respondents are getting more motivated because they make a quantity estimate for unfamiliar targets. In this way, the motivation as manipulated in the experiment will be even strengthened. It is interesting to see in the analysis if this is true.

4.3 Manipulation independent variables

The factor # of people joining the dinner is manipulated within subjects, this means that all the respondents have to make a quantity estimate for two and for five persons. These numbers are chosen to make it vivid for respondents, it is expected that students are familiar with cooking for two and for five persons. It is not realistic to ask respondents to make a good quantity estimate when imagine cooking for, for instance, ten people. Besides, this research investigates food wastage in household settings and cooking for two and five persons is common in these settings. Besides, it is not possible for respondents, to just easily double the quantity estimate for two persons. In the experiment is asked to make a quantity for either two or five persons and not to make a quantity estimate per person, because then it will not be possible to measure the influence from the # of targets joining the dinner. This manipulation is obvious when respondents read out the experiment and a manipulation check is not required.

The factor familiarity with the target is manipulated between subjects, thus respondents have to make a quantity decision for low or high familiar respondents. The difference between low and high familiar targets is established by showing (familiar) or not showing (unfamiliar) the consumption patterns of other targets joining the dinner. In both the manipulations, respondents get their own (imaginary) consumption pattern. This is given to help the respondents by making a quantity estimate. For low familiar targets, the respondents do not receive their consumption pattern. For the familiar targets, the respondents will see the consumption pattern(s) from the other people joining the dinner including their selves. This is a realistic manipulations, since, in practice, when cooking for familiar targets, this are people for who the respondents is cooking more often, the respondent will know the (average) consumption pattern from these people.

The factor motivation is manipulated between subjects, which means that dependent from the version respondents are in, they will be motivated or not by the story in the experiment. In the low motivation condition, respondents get the information that the last time they prepared food for these target(s) that there was not enough food. Next to this, they are also told that they have a big freezer so it is not a problem to have leftovers after the dinner. In the high motivation condition, respondents are told that they will go the next day on vacation so that they do not like to have food wastage. In earlier research where the influence of motivation in relation to the accuracy of the estimates is measured, motivation is created by giving money to the respondents. For this variable it is important to run a manipulation check, since it is not sure if this manipulation will be understood by respondents as intended by this experiment.

Manipulation check motivation

In this experiment motivation is manipulated and the effect of this manipulation on the dependent variables is measured. To make sure that a difference in the dependent variables is caused by the manipulation of this independent factor, motivation, a manipulation check is included. This is to check if

the respondents understand the manipulation as it is intended by this experiment. When respondents in the low motivation condition felt strongly motivated, caution should be exercised when drawing conclusion regarding this factor. This check is needed for motivation, since it is not sure if respondents will be more motivated by the story in the experiment. The manipulation check will consist of several statements and respondents have to give a valuation on a 7-point Likert scale. The correctness of the manipulation can be measured by comparing the answers on these statements for respondents in the low motivation and in the high motivation condition.

4.4 Measurement of dependent variables

To test our hypothesis, three dependent variables are measured to check the influence of the independent variables. These variables are the estimated quantity, the accuracy of the estimation and the confidence from the respondent in his estimation.

The estimated quantity are the quantity estimations respondents make in this experiment, for two and for five persons. When measuring the influence from motivation and familiarity, the estimation will be converted to quantities per person to make fair equations. It is interesting to investigate how this estimate is increasing or decreasing under influence of the different independent factors familiarity, motivation and number of people joining the dinner.

The accuracy of the estimate is the difference between the target value (consumed quantity) and the estimated value. The accuracy is higher when this gap is smaller and the accuracy is lower when this gap is bigger. In this experiment, there is no actual target value since it is not known how much food will actually be consumed. To give this a value, the assumption is made that the average from the provided consumption patterns, which is 100 gram in all situations, equals the consumed quantity. In this experiment all the values for accuracy (estimate-target value) will be positive, since it is not possible to make an estimation lower than the expected consumption quantity. For the analysis this means that the measured influence from the independent factors will be the same for estimate and accuracy. The reason to make difference between estimate and accuracy is that a direct link can be drawn between accuracy and leftovers. Because when the accuracy is lower, there will be more leftovers.

The last dependent factor is the level of confidence, this measures how convinced respondents are about their just produced estimate. There is no link between confidence and accuracy, respondents might have the idea to made a very accurate estimation, but this has nothing to do with the actual accuracy. The confidence is measured in the experiment direct after the quantity estimation by asking on a 7-point Likert scale how confident the respondent is that his estimation is right.

5. Results

In this chapter, the results from the experiment will be discussed, the hypothesis will be tested and some general conclusions will be drawn. First, this chapter will start with a description from the sample of respondents. After that, the data will be analyzed to give a global overview about how consumers make up their estimates. At the end, the results will be used to test the hypothesis and draw some general conclusions.

5.1 Sample

In this experiment, 142 students from Wageningen University completed the questionnaire as described in the chapter 4. The majority of respondents are women, 103 (73%) versus 39 males (27%). Most likely, this surplus of women is caused by two reasons, first is the higher willingness of women to participate in an experiment and second, within the WUR, women overrepresented by about 60 percent of the students (Resource, 2011). A negligible number of missing values show that apparently the questions were clear. Only students participated in this experiment. The age range is rather extensive ranging from 18 to 36 years old, with an average of 21.02 years. The study is mainly in correspondence with the relationships within the university, shown a high number of 47 Nutrition and Health students (33%) and 15 Biology students (11%). An overrepresentation of 18 Landscape and Architecture students (13%) is found when analyzing this sample, the reason for this is that the experiment took place on the floor where these specific students have their classes.

Table 5.1 Manipulation of the targets

Version	**Familiarity with target**	**Motivation**	**Number of respondents**
A	Low	Low (*'big freezer'*)	36 respondents
B	Low	High (*'leaving on holiday'*)	36 respondents
C	High	High (*'leaving on holiday'*)	35 respondents
D	High	Low (*'big freezer'*)	35 respondents
The factor 'number of people joining the dinner' is manipulated within-subjects, as cooking for 2 or 5 people.			

As table 5.1 shows, the respondents are equally divided over the different manipulations. Respondents rate themselves an average score of 5.48 for their experience with cooking. It can thus be assumed that this sample of respondents has good cooking skills. This question is asked by a scale where 1 stands for many experience and 7 stands for little experience, this is recoded in SPSS, with 1 standing for little experience and 7 for many experience. Furthermore, respondents rate themselves an average of 5.25 when they are asked to their experience with cooking for others. The respondents in this sample can be qualified as average eaters, regarding their average estimation of 4.65 on a 7-point scale, ranging from small to big eater. More often, male respondents (71.7%) see themselves as big eaters (a score of 5 or higher) than females (53.4%), indicated by (Eta= .388), which shows a quite strong relation.

5.2 Manipulation check motivation scale

Motivation is next to familiarity the second manipulated variable. To affirm a correct interpretation from the manipulation by the respondents, a scale is included in this experiment to see what level of motivation respondents experience when completing the experiment. These results will be compared with the motivation levels as intended by the manipulations in the experiment. Respondents are motived by telling them that 'leftovers are undesirable, since you will leave on holiday the next day' (high motivation). In the low motivation condition, respondents are told that 'leftovers are not a problem, since you have a big freezer'.

Motivation is measured by a scale consisting of 5 elements that is included in this experiment. When analyzing the scale, the conclusion can be drawn that the reliability is not so high (α=.607). This means that the coherence between all the 5 elements that form the scale is limited. This limited coherence cannot be upgraded by leaving out one or more elements. The reason for the low reliability is that apparently not all the 5 elements measure motivation in the same way. A univariate anova is performed to see the influence of motivation, familiarity and the interaction between both on the average value of the motivation scale.

Table 5.2 Motivation scale (univariate anova)

Factor	**F**	**Df**	**P**
Motivation	.915	1	.341
Familiarity	1.459	1	.229
Motivation * Familiarity	.650	1	.422

Tabel 5.2 shows that none of the factors has significant influence on the average value of the motivation scale. This result does not imply that the manipulation is not successful; still the differences between the manipulations can be measured. The differences can be measured between the manipulations, but it is difficult to say that respondents in the one or the other condition are more motivated. For the ease of the reader, this factor will still be called motivation. To go a little bit more in depth and see why both factors as well the interaction between both have no influence on the average of the motivation scale, ANOVA tables are made for all the items individually. In all these tables just one significant influence is measured, this is the influence of the factor familiarity on the (recoded) item: 'it does not matter how accurate I made the quantity estimates' ($F(1)=6.016$, $p=.015$*). The reason for this is not known, since all the items from the manipulation scale measure more or less the same and only one item show significant influence because of the manipulation.

5.3 Estimation process of consumers

In this paragraph the estimation process of consumers will be discussed. The first part of this paragraph will deal with the strategies that consumers use themselves and in the second part can be seen which from the provided estimation cues are actually used.

5.3.1 Estimation strategies

Incorrect estimations of food quantity for dinner are a major cause of leftovers. With the help of different hypothesis is tried to test common made mistakes in the quantity estimation process. Before these mistakes can be identified, some insight in the quantity estimation process of consumers is required. In an open question in the experiment, respondents are asked to write down their personal quantity estimation process. This qualitative information is quantified in 7 categories, which can be found in table 5.3 on the next page.

Table 5.3 Strategies used for quantity estimation

Strategy	**Number of persons**
Usage of average *'The last time I ate 100 grams, so 100*2 and 100*5'*	60 (42%)
Usage of safety margin *'Average pp plus something extra'*	35 (25%)
Usage of highest values *'I just took the scenario where everybody will eat their maximum quantity (125 gram), in that way I am sure that there will be enough food and most likely some leftovers'*	15 (11%)
Usage of own rules of thumb *'Standard rule at home: 100 gram pp'*	11 (8%)
Take gender into account *'In the first situation i imagined me and my friend and in the second situation I imagined 2 males and 2 females'*	11 (8%)
Downward adjustment *'Average is 100 gram per person, so 5 woman means 500 gram, but in social context they will eat less, so 450 gram'*	9 (6%)
Take packaging size into account *'I just took 500 gram, since that is also the content of a package pasta'*	4 (3%)

An important note for table 5.3 is that there is the possibility that one respondent uses multiple strategies to come up with an estimate. Table 5.3 shows us that most of the consumers use the average as help for their estimation and put a safety margin on top to be sure that there is enough food. Some other strategies are not widespread used, like the usage of own rules of thumb, or taking gender or packaging size into account. Also upward or downward adjustment from an anchor value (average) is not commonly used.

To put these figures in perspective, crosstabs are created between the three most used strategies and the two manipulation factors familiarity and motivation and chi-square tests are included to see the strength of an eventual relation.

Table 5.4 Crosstabulation estimation strategies and manipulations

Strategy	**Crosstab familiarity**	**Crosstab motivation**
Usage of average *(Yes = 60 respondents, 42%)* *(No = 82 respondents, 58%)*	LOW: Yes: N=29 (40%) No: N=43 (60%) --- HIGH: Yes: N=31 (44%) No: N=39 (56%) --- *$\chi^2(1) = .234$ $p = .629$*	LOW: Yes: N=31 (44%) No: N=40 (56%) --- HIGH: Yes: N=29 (41%) No: N=42 (59%) --- *$\chi^2(1) = .115$ $p = .734$*
Usage of safety margin *(Yes =35 respondents, 25%)* *(No= 107 respondent, 75%)*	OW: Yes: N=18 (25%) No: N=54 (75%) --- HIGH: Yes: N=17 (24%) No: N=53 (76%) --- *$\chi^2(1) = .010$ $p = .921$*	LOW: Yes: N=24 (34%) No: N=47 (66%) --- HIGH: Yes: N=11 (15%) No: N=60 (85%) --- *$\chi^2(1) = 6.408$ $p = .011$ **
Usage of highest values *(Yes= 15 respondents, 11%)* *(No= 127 respondents, 89%)*	LOW: Yes: N=9 (13%) No: N=63 (87%) --- HIGH: Yes: N=6 (9%) No: N=64 (91%) --- *$\chi^2(1) = .580$ $p = .446$*	LOW: Yes: N=10 (14%) No: N=61 (86%) --- HIGH: Yes: N=5 (7%) No: N=66 (93%) --- *$\chi^2(1) = 1.864$ $p = .137$*

*means that the p-value is significant, which means <.05

Table 5.4 shows that low motivated consumers use a safety margin significantly more often. Thus, when respondents are instructed that they have a big freezer they use more often a safety margin then when they are instructed to leave on holiday the next day. This is interesting, because it is an indication that the quantity estimation process of consumers is not static and can be influenced by several factors at the same time. This can be used as a starting point for a solution, the knowledge that with the right arguments, or under the right circumstances, estimations are made differently.

To show the exact influence of the factor motivation on the usage of a safety margin, a logistical regression is performed. This logic regression measures the strength from both the factors motivation and familiarity and the interaction between both on the usage of a safety margin. In this analysis, usage of a safety margin is a dichotomous outcome variable, this is a yes/no variable and inserted in the analysis as a categorical variable. The influence from the different manipulations is measured and the coding strategy is 'simple'.

Table 5.5 Logistical regression 'usage of safety margin'

Factor	B	Wald	df	Sig	Exp(B)
Constant	-2.367	15.369	1	.000*	.094
Motivation	1.962	7.957	1	.005*	7.111
Familiarity	1.114	.725	1	.125	3.048
Familiarity * Motivation	-1.664	.885	1	.060*	.189

*means that the p-value significant, which means <.05

Table 5.5 shows a strong positive relation between the motivation manipulation and the usage of a safety margin, which is statistically significant. This means that when respondents are more motivated, they will less often use a safety margin and the other way around, when consumers are less motivated, they will use more often a safety margin in their estimation. In practice, it is not desirable making use of extraordinary safety margins, since it will cause leftovers. Thus, motivating respondents can be part of the solution to reduce leftovers. In this experiment, respondents get motivated by telling them that they will leave the next day for holiday. This is not a situation that will happen daily in practice, since consumers will just go a few times a year on holiday. In the discussion will be more elaborated how to motivate consumers.

5.3.2 Estimation cues

Respondents are asked to value the different estimation cues that are provided on a 7-point scale. With the help of a repeated measure Anova is the relationship between the estimation cues (inserted as covariate) and both estimations (for 2 and 5 persons) investigated. This analysis will give insight in which cues have influence on the estimations and if there is positive or negative influence. The F value in the table below shows that between subject effects from these cues on the estimated quantity.

Table 5.6 Influence of estimation cues on actual estimates (repeated measures ANOVA)

Cue	**Average value (on a 1-7 scale)**	**Parameter estimate (2 persons)**	**P**	**Parameter estimate (5 persons)**		**F**	**df**	**P**
Provided numbers	5.26	B= -7.152	.032*	B= -.757	.924	.634	1	.427
Average of provided numbers	5.06	B= -3.564	.115	B= -4.376	.418	1.371	1	.244
Safety margin	4.36	B= 6.223	.001*	B= 14.759	.001*	14.133	1	.000*
Own quantity standards	4.08	B= -2.614	.257	B= -.286	.959	.175	1	.676
Highest values of provided numbers	3.56	B= 5.354	.016*	B= 15.720	.003*	10.173	1	.002*
Most frequent value of provided numbers	3.24	B= -2.039	.336	B= -6.264	.218	1.669	1	.195
Lowest value of provided numbers	2.29	B= -5.869	.053	B= -10.663	.140	3.336	1	.070*

*means that the p-value is significant, which means <.05

Table 5.6 shows that the estimation is significantly influenced by then following cues: safety margin, highest values and lowest values. This seems contradictory, but a logical explanation can be found for this. It can be imagined that consumers use the following strategy: check what are the highest and the lowest values in the consumption pattern(s) of their guest(s) and then take an estimate somewhere in between and put a safety margin on top of it. In table 5.6 also the parameter estimates for the different cues are mentioned. Here we see that apart from the cues 'highest values' and 'safety margin', all the factors have a negative influence on the height of the estimate. Thus, the factors 'highest value' and 'safety margin' have a positive influence on the estimate, which is quite logic. This means that either conscious or unconscious consumers are influenced by more cues in their estimation process.

5.4 Familiarity with the target

This paragraph will show the influence of the familiarity of the agent with the targets that join the dinner on the estimated quantity, the accuracy of the estimate and the confidence the consumer will have in his estimation.

5.4.1 Estimated quantity and accuracy

The expectation is that familiarity has a negative influence on the estimated quantity and a positive influence on the accuracy. This means that when agents are familiar with their targets, their estimation will be lower and the accuracy will be higher. This is put together in Hypothesis 1a and 1b: H1a: When agents are cooking for familiar targets, they will make lower estimations than when cooking for unfamiliar targets.

H1b: When agents are cooking for familiar targets, they will make less accurate estimation than when cooking for unfamiliar targets.

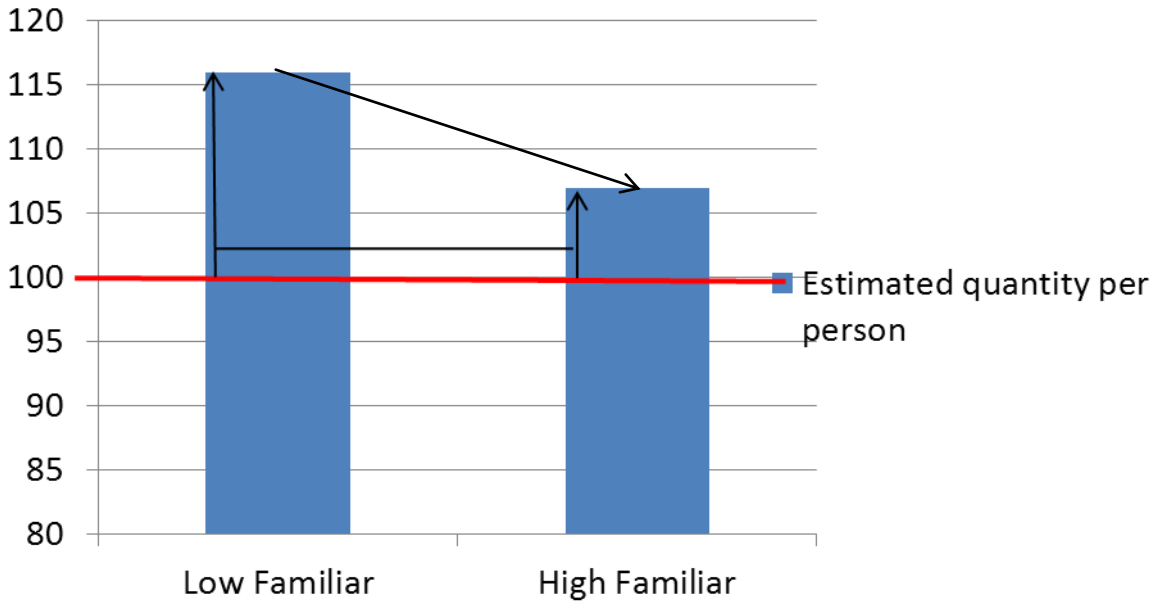


Figure 5.1 Influence of familiarity on the estimated quantity and accuracy

Figure 5.1 shows the average quantity estimations (in grams) per person when agents make an estimation for low familiar targets and when agents make an estimation for high familiar targets. The red line in the graph shows the average consumption quantity, which in this analysis stands for the actual consumption. This graph shows that when agents are more familiar with their targets the

estimated quantity will be lower. It also shows that all the estimations are above the average, above the actual consumption. Next to this, this graph also shows that the accuracy will be higher when agents are more familiar with their targets. Thus when cooking for more familiar targets, less food will be leftover and possibly wasted. To see if these effects are strong enough to be entitled as significant, an Anova table is performed to measure these effects.

Table 5.7 Between-subjects effects on quantity estimates

Factor	**F**	**Df1**	**Df2**	**P**
Familiarity	7.119	1	138	.009 *
Motivation * Familiarity	.961	1	138	.329

*means that the p-value is significant, which means <.05

Table 5.7 shows that the factor familiarity has a significant influence on the estimated quantity. The estimation will be significant lower when agents are cooking for familiar targets then when they are cooking for unfamiliar targets. Hypothesis 1a; 'When agents are cooking for familiar targets, they will make lower estimations than when cooking for unfamiliar targets', can be accepted. Since the accuracy is a positive value; the estimation is higher than the actual consumption, this analysis also holds for the accuracy. So; table 5.9 also shows that the factor familiarity has a significant influence on the accuracy of the estimate. The estimate will be more accurate when agents are cooking for familiar targets then when agents are cooking for unfamiliar targets. With this information, H1b: 'When agents are cooking for familiar targets, they will make less accurate estimation than when cooking for unfamiliar targets', can be accepted.

This is a nice result, that a significant influence from familiarity on the estimated quantity and accuracy. However, to use these outcomes in a strategy to reduce leftovers might be more difficult. The factor familiarity with the target is in itself a static factor, this means that a consumers is either familiar or unfamiliar with the targets, it is not possible to influence this. What can be done with this information is to educate consumers to better memorize the consumption quantities from other people that are not joining the dinner that frequent. In this way, the familiarity with the unfamiliar targets gets a little more familiar, which results in lower estimations and thus less leftovers and food wastage.

5.4.2 Confidence

It is interesting to see what is the influence from the factor familiarity on the confidence respondents experience in their estimate. The expectation is that when consumers are more familiar with their targets, they will have more knowledge about the consumption patterns from these targets. Thus the consumers can be more confident in their estimation. This is expressed in H1c: 'When agents are cooking for familiar targets, confidence levels will be higher than when cooking for unfamiliar targets.'

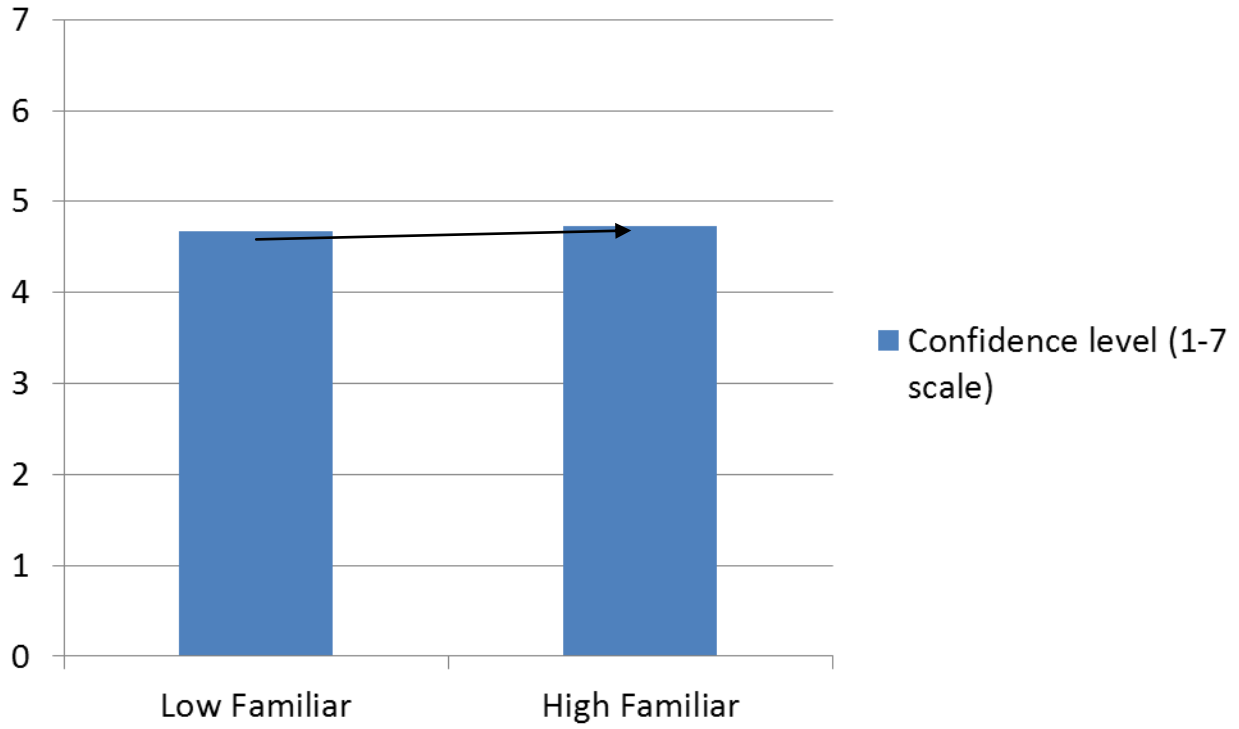


Figure 5.2Influence of familiarity on confidence level

Figure 5.2 shows the quantity levels as measured in the experiment just after making the quantity estimations. The average confidence level is calculated for low and high familiar targets and a separation between confidence level for two and for five persons is left out, since this is another separate independent variable which will be handled in the next paragraph. This graph shows that when consumers are more familiar with their targets, only a small increase in confidence level is established. The entire table with all the confidence levels for the different versions and situations can be found in Appendix C.

Table 5.8 Between subjects effects confidence levels

Factor	F	Df1	Df2	P
Familiarity	.060	1	138	.808

Familiarity * Motivation	.087	1	138	.768

Table 5.8 shows that, as can be seen in the graph, indeed no influence is found from the factor familiarity on the confidence, nor an influence in found from the interaction with motivation. This data is not supporting H1c: 'When agents are cooking for familiar targets, confidence levels will be higher than when cooking for unfamiliar targets', and this hypothesis can be rejected. It is surprising that consumers do not have more confidence over their estimations when they have more data to base their estimation on. It is possible that this uncertainty in both situations is caused by the differences within the consumption patterns. When familiar with the guests, there might still be an uncertain deviation of for instance -10% and +10% around the average consumption quantity, so still enough reason to lack confidence. This could not the be whole reason why the difference in confidence between the low familiar and the familiar targets is very small. The reason for this could be that confidence is an characteristic of a consumer and differs from consumer to consumer. It might be difficult to change. But it is not possible to base this assumption on just one single result.

5.5 Motivation of the agent

This paragraph will show the influence from the motivation of the agent on the estimated quantity, the accuracy of the estimate and the confidence level respondents have in their estimation. One remark should be put to the term 'motivation of the agent', this is not the best term to describe the influence from this manipulation. The manipulation check shows that respondents did not feel more motivated in the manipulations that were intended to motivate them. But nevertheless, the respondents read out the story and the factor 'leaving on holiday'(high motivation) or 'having a big freezer' (low motivation) had influence on their estimations. Thus the influence from this manipulation will be shown in this paragraph and for the ease of the reader still be called motivation, while this is not the real correct term for it.

5.5.1 Estimated quantity and accuracy

It is interesting to see what is the influence from motivation on the estimated quantity and the accuracy. A positive effect is expected by a lower estimated quantity and a higher accuracy, resulting in fewer leftovers. This expectation is expressed in two hypothesis; H2a: 'When agents are more motivated, their quantity estimations for dinner will be lower than when consumers are less motivated' and H2b: 'When agents are more motivated, the accuracy of their quantity estimation for dinner will be higher.'

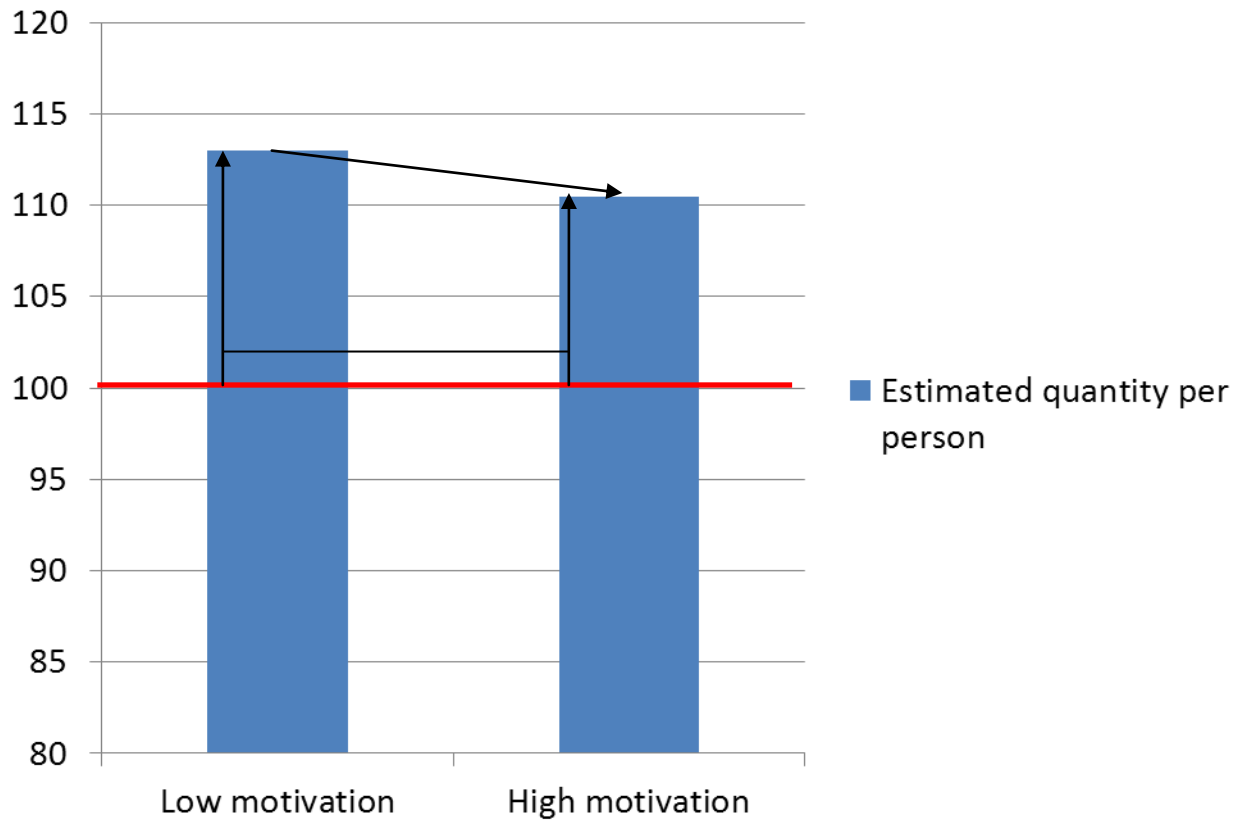


Figure 5.3 Influence of motivation on estimated quantity and accuracy

Figure 5.3 shows a big difference in estimated quantity and accuracy between low and high motivated respondents. When respondents are given in the high motivation condition the instruction that they will leave on holiday, the estimation will be lower than respondents making an estimate in the low motivation condition. In this condition, the respondents are instructed that they have a big freezer, thus it is not a problem to have leftovers. Additionally, this graph also shows that when consumers are more motivated, the estimation will be more accurate. To be sure that these results are significant, the between subject effects will be measured.

Table 5.9 Between subjects effects estimated quantity and accuracy

Factor	F	Df1	Df2	P
Motivation	19.769	1	138	.000 *
Motivation * Familiarity	.961	1	138	.329

*means that the p-value is significant, which means <.05

Table 5.9 shows that motivation has a significant influence on the estimated quantity and thus also on the accuracy of this estimate. This means that when consumers are more motivated their estimations will be lower than when consumers are less motivated. This outcome also proves the expectation that the accuracy will be higher when consumers are more motivated. Both H2a and H2b can be accepted. Conclusion is that motivation is a possible factor that can be used to reduce leftovers. But, it is not possible to use this factor in exact the same way as in this experiment, since it is not possible to motivate consumers daily by telling them that they will leave on holiday the next day, thus that leftovers should be avoided. Nevertheless, it is a good finding that consumers are not stubborn in making high estimations and that there are methods to motivate consumers making lower estimations. The next step in using this strategy to reduce food wastage is to find ways to motivate consumers making lower estimations.

5.5.2 Confidence

The link between motivation and confidence is not an obvious one. But the idea behind this link is that when consumers are more motivated and put more effort in their quantity estimation, they might be more confident regarding their estimation. This is expected in H2c: 'When agents are more motivated, the confidence they have over their estimation will be higher than when consumers are less motivated.'

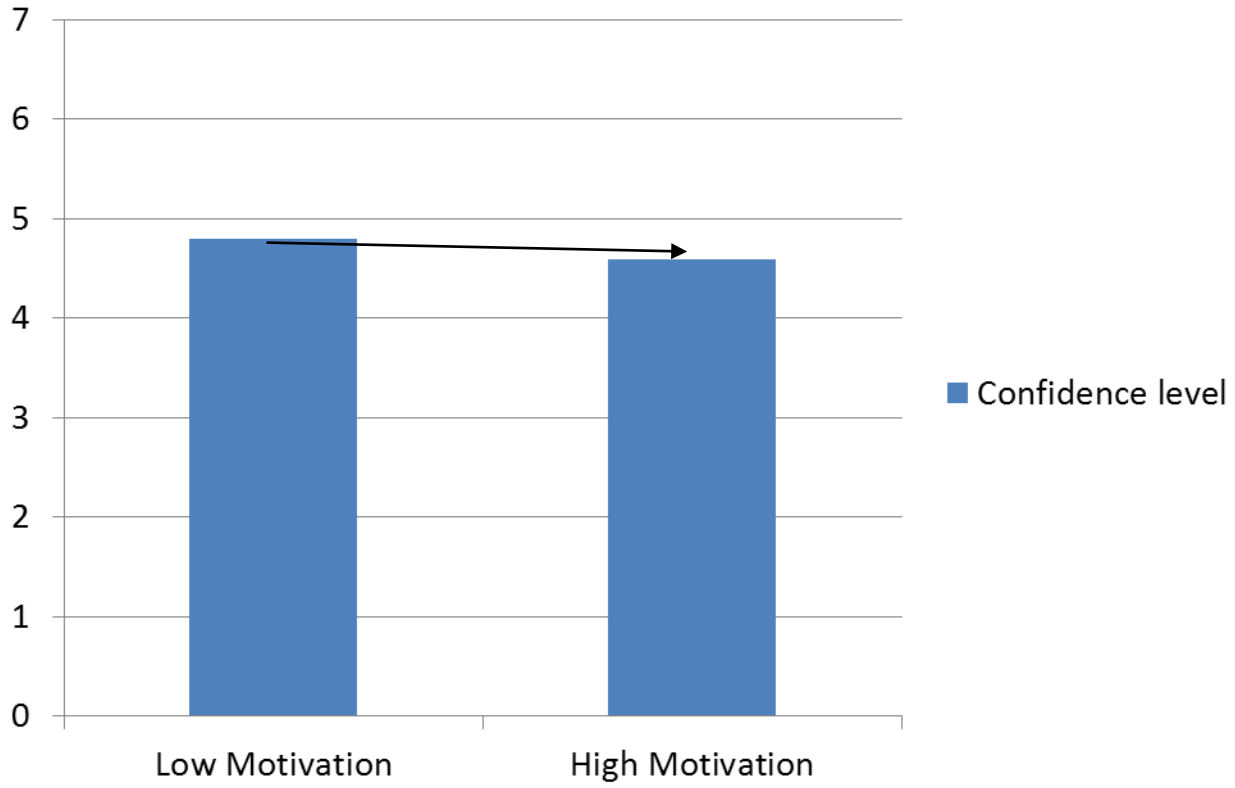


Figure 5.4 Influence of motivation on confidence level

Figure 5.4 shows that opposing H2c that when consumers are more motivated, their confidence level will decrease, thus H2c can be rejected. Although the different is very small, this graph shows that it is not true that when consumers are more motivated that their confidence will be higher.

Table 5.10 Between subjects effects confidence level

Factor	**F**	**Df1**	**Df2**	**P**
Motivation	.836	1	138	.362
Familiarity * Motivation	.087	1	138	.768

Table 5.10 proofs what following the graph was expected, that motivation, nor the interaction of motivation and familiarity has a significant influence on the confidence levels respondents experience when completing the experiment. This is also an indication that confidence is an characteristic of consumers and not subject to outside influences.

5.6 Number of targets joining the dinner

In this paragraph, the influence from the number of targets joining the dinner will be measured on the estimated quantity, the accuracy of the estimate and the confidence level of the respondent after producing a quantity estimate. In this analysis, the focus is mainly on the number of targets joining the dinner, but the interactions with the between subjects manipulated factors familiarity and motivation will also be taken into account.

5.6.1 Estimated quantity and accuracy

The expectation is that when more targets join the dinner, there will also be more leftovers. Several reasons are backing up this expectation First, when more people join the dinner, most likely this are unfamiliar people, because it is not very common to cook every day for large groups of people. When cooking for unfamiliar guests, as concluded in the paragraph regarding familiarity, consumers will prepare more food per person. The proposed explanation for this is that consumers want to be hospitable and to be sure that there is enough food; a safety margin will be added to the food quantity to ensure this. But since there is no clue to assume that unfamiliar targets will have a bigger consumption pattern, this will cause more leftovers. Second, when more people join the dinner, the uncertainty range is larger, imagine that all the targets will consume their maximum quantity, there is excessively less food. Third is that consumers might have difficulties to estimate bigger quantities and will overestimate the food quantity which results in larger food quantities then required. This is expressed in the following 2 hypothesis: H3a: 'When more people join the dinner, the estimation will be higher (per person) than when less people join the dinner', and H3b: 'When more people join the dinner, the accuracy will be lower than when less people join the dinner.'

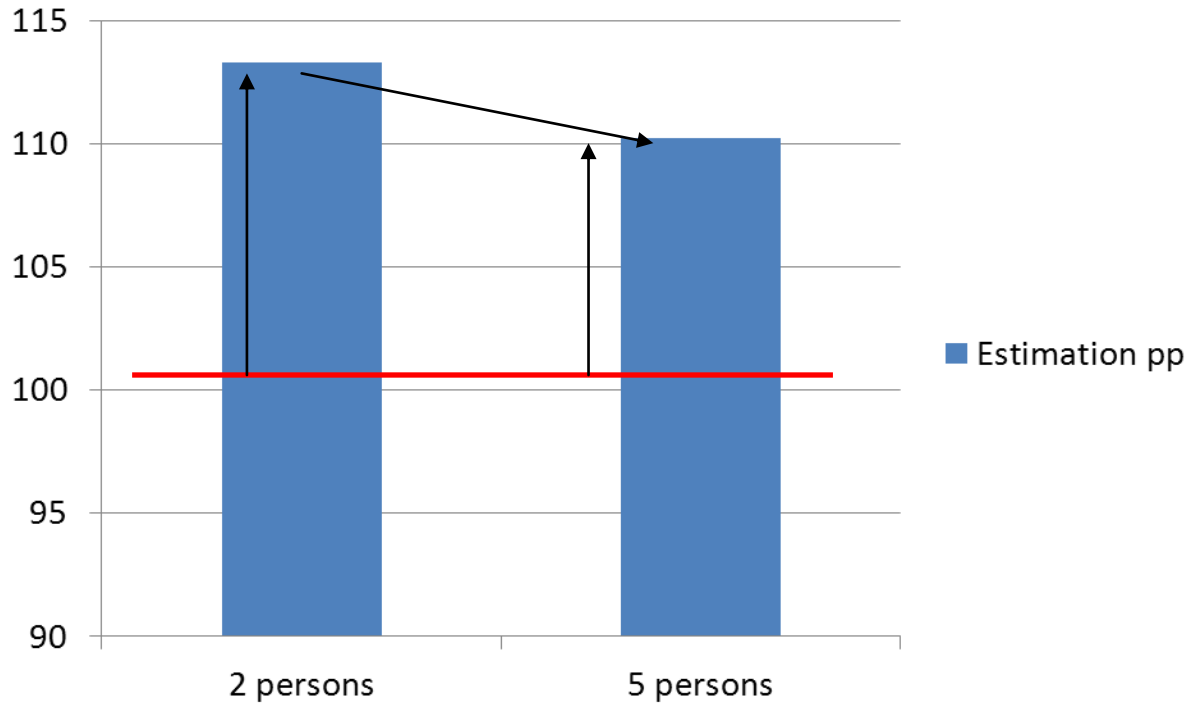


Figure 5.5 Influence number of targets on estimated quantity and accuracy

Figure 5.5 shows that, opposing the hypothesis 3a and 3b, the estimations per person are lower for more targets. Also the estimation is more accurate for more targets. The differences between both the estimations / accuracies are not that big, so it is interesting to see if these results are significant.

Table 5.11 Within subject effects estimated quantity and accuracy

Factor	F	Df1	Df2	P
Number of targets joining the dinner	3.107	1	138	.000*
Number of targets joining the dinner *Motivation	.733	1	138	.393
Number of targets joining the dinner *Familiarity	2.543	1	138	.113
Number of targets joining the dinner *Motivation * Familiarity	1.000	1	138	.319

*means that the p-value is significant, which means <.05

Table 5.11 shows what is expected on basis of figure 5.5 and that is that the estimations as well the accuracy levels differ significantly when the number of people joining the dinner differs. This means that, indeed, when more people join the dinner, the estimated quantity per person decreases and the accuracy increases. In the perspective of food wastage, this is a positive finding, meaning that fewer leftovers will be created when more targets join the dinner. It is difficult to find a logical explanation for this, since the uncertainty range is larger when five people join the dinner then when two people join the dinner, so a higher estimation was expected. This effect, with fewer leftovers for larger groups, is even strengthened by the assumption that leftovers can deal as second serving for hungry people in a larger group. It is not possible to promote eating in larger groups to reduce leftovers. The numbers of targets that join the dinner is rather static and consist mostly of the members of the households. A possible explanation for this result could be that consumers are making an estimation for a group of two, respectively five persons. In this way no attention is paid to the quantity per person. Estimating larger quantities might be difficult and underestimated. When the consumption patterns in both groups are the same, on the first sight, fewer leftovers will be created in larger groups. But, it is also interesting to see what happens regarding the group size and the social interactions. This is not measured in this research, but it might be possible that the consumption in a larger group is smaller because of social influences. Concluding remark is that this is useful information, but it is difficult to use the number of targets as a factor to reduce food wastage.

5.6.2 Confidence

The logical link between number of targets joining the dinner and the confidence level that respondents have in their estimation is that when more targets join the dinner, confidence levels will go down. This simply because more people give a bigger uncertainty range and thus will give the consumer a less confident feeling. It is interesting to see if this expectation is supported by the outcomes of this experiment. The hypothesis regarding this effect is H3c: ‘When more people join the dinner, the confidence will be lower than when less people join the dinner.’

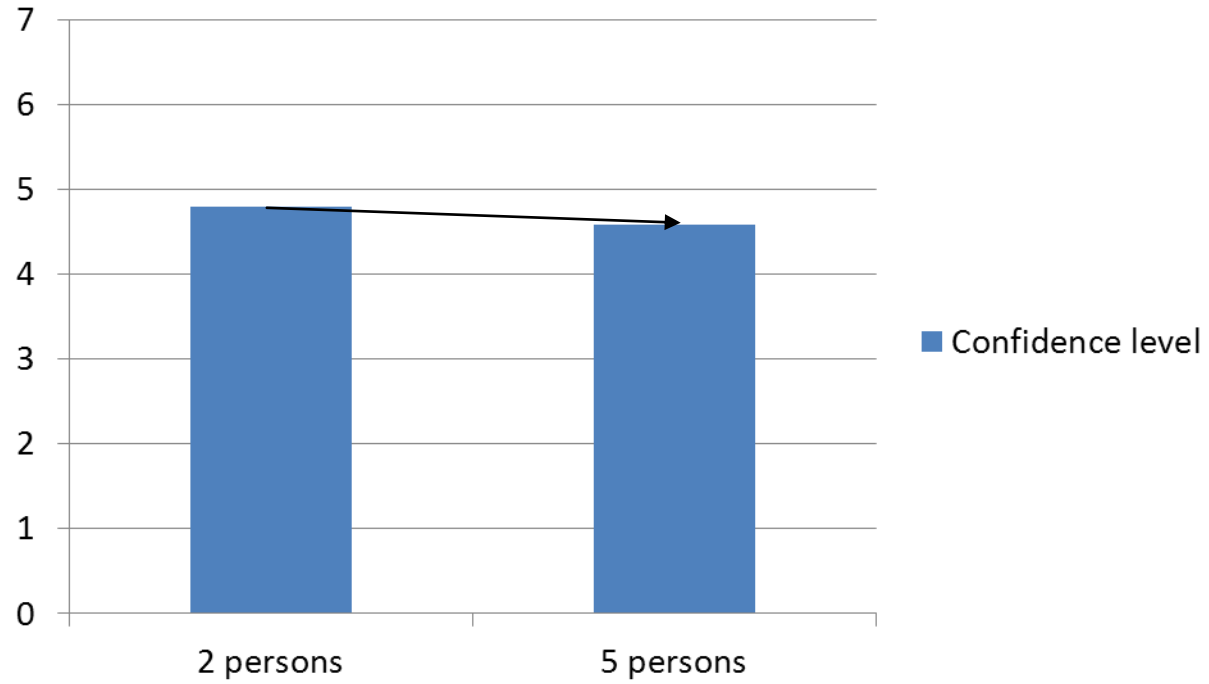


Figure 5.6 Influence of # of targets on confidence level

Figure 5.6 shows that when more targets join the dinner, the confidence level will go down. This is in line with the hypothesis but from the graph it is not sure if these differences are significant and conclusions can be drawn on basis of this. Therefore, these within subjects effects will be further analysed.

Table 5.12 Within subject effects confidence level

Factor	**F**	**Df1**	**Df2**	**P**
Number of people joining the dinner	6.735	1	138	.010*
Number of people joining the dinner* Familiarity	.002	1	138	.962
Number of people joining the dinner* Motivation	4.449	1	138	.037*
Number of people joining the dinner * Familiarity * Motivation	1.251	1	138	.265

*means that the p-value is significant, which means <.05

Table 5.12 shows that there is a significant influence from the number of people joining the dinner on the confidence level consumers experience when making a quantity estimate. The reason for this could be that when more people join the dinner, the uncertain range will increase and make people less confident. It is not known how consumers will deal with this uncertainty, since the earlier paragraph found out that consumers do not make higher estimations per person when more people join the dinner. It is also possible that in their confidence levels, consumers just reflect the bigger uncertainty, but that they do not feel obliged to solve this uncertain situation. Another finding is that there is a significant interaction from number of people joining the dinner * motivation on the confidence level. Most likely is that consumers will be more motivated when more people join the dinner and this will have influence on their confidence levels. Independent from the fact if consumers are familiar with their targets or not in this experiment there is for one single person a deviation around the average from -25% (-25 gram) or +25% (+25 gram) around the average of 100 gram. This means an uncertain range of 50 gram for 1 person, for two persons this is a range of 100 gram (between the lowest possible consumption and the highest possible consumption) and for 5 persons this is even 250 gram. This easy calculation shows us why it is more difficult to make accurate estimations for more guests. Since in this experiment all the estimations are higher than the average, more guests mean a bigger range of uncertainty and thus a higher estimation and most likely more leftovers. This way of estimating above the average can be called guest-directed estimation, since the guest is the starting point. Out of hospitality consumers would make themselves sure that there is enough food by cooking more than actually needed. Hospitality is a good characteristic of consumers, but when more hospitable means more leftovers it turns into a pitfall. Another strategy that can be imagined is the 'average-strategy', where the cook will just cook the average quantity (in the experiment 100 gram) per person multiplied by the number of guests. This is an effective strategy to get rid of extraordinary safety margins out of hospitality. In this way, when all the guests eat their average quantity, there is exactly enough for all, and when someone likes more food, he or she should be lucky that another guest is eating less than the average quantity. When this is not the case, this guest will just eat a little bit less than he would actually like to. When this happens more often, his average quantity can be adjusted upwards when he is eating with familiar others.

5.6 Leftovers or food wastage

The existence of leftovers after dinner is not per definition a problem, this will arise when leftovers turn into food wastage, meaning the needless disposal of food rests. Since this is an important part of the food wastage, several questions or statements in the experiment were pointing at this.

5.6.1 Average number of servings

The average number of servings of this sample of 142 undergraduate Wageningen University students is 1.51 servings. An extra serving can be used as a strategy to reduce leftovers, when extraordinary overeating is avoided. Extraordinary overeating is ethically not right since this will move the problem from food wastage to overweight consumers. We might expect that males more often take a second serving, since males give notice that they are big eaters compared to females (*Eta= .388).*

An important statement to identify the scale of the problem is the statement 'I have often leftovers after finishing dinner'. Respondents ranked their answer with an average value of 4.13 on a 7-point scale where 1 stands for 'totally disagree' and 7 stands for 'totally agree'. This means that consumers don't have often leftovers after finishing dinner, but still regularly. A logical explanation for this can be found by creating some crosstabs to see the correlation between 'having leftovers' and 'the usage of a safety margin' and 'enough food is a form of hospitality'.

Table 5.13 Correlations between leftovers and the factors 'safety margin' and hospitality

Factor	'I have often leftovers after dinner'	'On top of my estimation I put a safety margin to be sure that I have enough food'	'Taking care of enough food is a way of hopsitality'
'I have often leftovers after dinner'	-	Pearson Correlation = .330 P = .000 *	Pearson Correlation = .347 P= .000*
'On top of my estimation I put a safety margin to be sure that I have enough food'	Pearson Correlation = .330 P = .000	-	Pearson Correlation = .182 P= .030*
'Taking care of enough food is a way of hopsitality'	Pearson Correlation = .347 P= .000*	Pearson Correlation = .182 P= .030*	-

*means that the p-value is significant, which means <.05

Table 5.13 shows a strong correlation between the factor 'I have leftovers after dinner' and both the factors 'on top of my estimation I put a safety margin' and 'taking care of enough food is a way of hospitality'. A less strong correlation is found between the factors 'safety margin' and 'hospitality'. There seems to be a relation between the answers on the three different questions in the experiment. It is not possible to judge on basis of this information what is the cause and what is the consequence. A causal chain as shown below is possible.

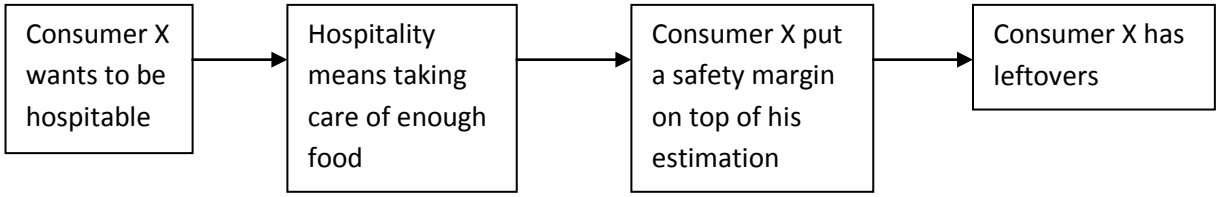


Figure 5.7 Causal chain 'hospitable, safety margin, leftovers'

In figure 5.7 the results are expressed in a causal chain based on the results in table 5.12. This starts when a consumer wants to be hospitable and finds that caring for enough food as being hospitable. To reach this, the consumer will put a safety margin on top of his estimation and the result is leftovers. Regarding the problem of food wastage, these links are not a problem per se; this starts when the leftovers turn into food wastage. It is hard to come up with different ends for this mean, since hospitality has often to do with unfamiliar guests, so information about consumption patterns is lacking and thus a safety margin is required to make sure that there is enough food. The solution can be found in the correct storage and actual consumption of leftovers, to avoid food wastage. In the discussion and recommendation, this solution will be further elaborated.

5.6.2 Leftovers on the plate

Another question was to imagine having leftovers on the plate, how to deal with this. Respondents are given the exercise to imagine having leftovers on the plate when their hunger is appeased. The question is if they will dispose these or just continue eating and empty their plate. Respondents scored on average 3.24 on the statement 'when I already ate enough food, but there are still leftovers on my plate, I leave these rests'. The other way around, respondents scored on average 4.84 on the statement 'when I appeased my hunger, but there are still leftovers, I will empty my plate'. This was ranked on a 7 point scale with 1 as totally disagree and 7 totally agree. What we see here is that consumers see eating more than they actually need as a solution to reduce leftovers. It is interesting to put this into perspective to analyze the relation with the question if the respondents see food wastage as a problem of the household money (average =5.61) or as an environmental problem (average=5.45). When investigating the reason why consumers emptied their plate, a correlation is taken between 'emptying the plate' and 'environmental problem or problem for the household'.

When running correlation analysis, this shows that consumers that see the food wastage as an environmental problem are more likely to empty their plate then consumers that see this as a wastage of household money. Pearson's correlation between 'empty my plate when I ate enough' and 'environmental problem' is .129 (p=.128). Pearson's correlation between 'empty my plate when I ate enough' and 'problem for the household money' is .035 (p=.635). Since these correlations are not significant, no conclusions can be based on these results.

5.8.3 Leftovers after dinner

Respondents are also asked to imagine having leftovers when the dinner is finished, what to do with these. More than half of the respondents (n=73) answered that they will store the leftovers in the fridge or freezer. Another 35% (n=51) said it will be dependent from the quantity. These people note that the amount of leftovers should be significant to store these, otherwise they will dispose it. For most of the people a significant quantity is (at least) one portion. All leftovers together should form one portion or more, then this will be stored, otherwise it gets disposed. Only 5% (n=8) of the respondents say that they will dispose the leftovers independent from the quantity they have leftover. A few respondents (n=10) say that they will do something else with the leftovers, which means giving to the dog or giving to other housemates. To put these figures into perspective, it is investigated how much food was left for respondents that say that the storage/disposal decision is dependent from the quantity and will dispose by less than 1 portion. In the first situation, cooking for two people, from the respondents that say that the storage/disposal decision is dependent from the quantity, only 3.5% of the respondents has leftovers more than one portion. In the second situation, this was 10%. This means that in practice, still a lot of food gets disposed because it is not a significant quantity. This outcome seems also an argument in favor of a strategy whereby consumers are learned or pushed to take better care of their leftovers. Because first, it is very difficult to push consumers to cook smaller quantities, since they might be afraid cooking to less food. Second, it is a strange measure to push consumers to overcook more to make it worth it to store the leftovers.

6. Conclusion and discussion

At first, the goal of this research was to investigate why consumers make a higher than required food quantity estimation for dinners, resulting in leftovers and most likely in food wastage.
The most important reasons for this is that consumers are not motivated enough to make the right quantity decision and consumers are not aware enough of the consumption patterns of other people joining the dinner. Besides, when fewer people join the dinner, the quantity estimation per person is higher, while there is no indication that their consumption will be higher.
These are the most important outcomes of this research and can be used in food wastage reducing strategies. When consumers are more motivated, their estimations will be lower and while still sufficient to satisfy all the people that join the dinner. Paying more attention to the consumption patterns of other targets joining the dinner can help an agent to make his/her estimations more accurate. Equalizing food portions for different numbers of people joining the dinner can help in reducing leftovers in small groups of people.

The manipulation check afterwards showed that respondents were indeed manipulated as intended. The aim was to motivate consumers to make a better estimate by telling them they will leave on holiday the next day. What happened is that respondents actually made a better estimate but did not feel motivated to do so. Nevertheless, this is a strong way to let respondents make lower and more accurate estimations. Unfortunately, it is not possible to use this strategy in practice to motivate consumers, but there are several other strategies to manage that, with the same possible effect. One strategy is to motivate consumers financially and another strategy is more idealistic to motivate consumers. When accumulating all the leftovers from the last month, a significant quantity of food will become apparent for most households, which is equivalent to a lot of wasted money. This concludes that there was unnecessary purchase of food products. The expectation is that this will better motivate students specifically than people from different age categories. Students have a limited budget to spend and their food budget is comparatively a larger part of their income than other social group, which means that it is a decision worth considering carefully. An idealistic way to motivate consumers can be to point out the ethical problems when dealing with food wastage. For instance, worldwide there are famine countries where people suffer and are prepared to give anything for food that Dutch consumers waste daily.

The results show that when consumers are more familiar with their targets, the estimations will be lower and the accuracy will be higher. This is what is desirable to solve the food wastage problem. Familiarity seems like a static factor, but can still be used to reduce food wastage. Consumers can get more familiar with their targets by better memorizing their guests' consumption patterns. This way it is not required anymore to cook dinner with extraordinary large safety margins to make sure that there is enough food.

The conclusion is that when fewer targets join the dinner, the quantity estimation per person increases. This means that when equal consumption patterns are assumed, the leftover rate per person is higher when fewer targets join the dinner. Since the reason for this is unknown, it is difficult to use this factor in a strategy to reduce food wastage. A possible strategy using this information could be by making equal portions with the same quantity of food per person independent from the number of people that join the dinner. When this food quantity equals or is just slightly higher than the actual consumption per person, a minimum amount of food will be leftover.

When taking Model 1.1 in mind, this research focused on the Critical Control Points 3 (Quantity estimation) and 6 (Storage or disposal decision). Consumers have loads of different, sometimes contradicting strategies to make food quantity estimations for dinner. The similarity between all the strategies is that the estimation is (slightly) higher than the actual required quantity. Another interesting finding is that consumers make significantly higher estimations when cooking for unfamiliar guests. The reason for this is insecurity caused by the lack of knowledge regarding the consumption pattern of unfamiliar guests. In this experiment, the average was always 100 grams of food formed by 2 values of 100, one of 125 and one of 75.

Estimating food quantities is not a static, but dynamic process under influence of multiple factors simultaneously. This research found out that estimations would be higher when consumers would have a big freezer, because storage of leftovers is not an issue. Estimations will be lower when the consumers would leave on holiday the next day. These are two examples of factors that are tested in this research, but most likely, there are much more factors that have a positive influence on the consumers' food quantity estimation process.

Concerning the storage or disposal decision, the problem is not that consumers use disposal as default option. The problem is a large group of consumer disposes their leftovers when this is less than one portion, which is usually the case. More formal; the frequency of food wastage is a bigger problem than the quantity. In addition, not all the stored leftovers will be consumed and will eventually be disposed of.

Another possible way to reduce food wastage is to educate consumers in how to deal with leftovers properly, by storing it in the right way, possibly use these leftovers in another dish. During the analysis, it appeared that consumers see overeating as a solution to reduce leftovers. This solution would be ethically wrong and might shift the problem from food wastage to overweight consumers. It is very important to find arguments to withhold consumers from cooking extraordinary quantities of food.

Another solution that does not find arguments in this research is to make consumers aware that sometimes taking a smaller portion than you would like to is better than wasting almost every day, for instance, 10% of the prepared food. The consumer must be convinced that considering 'hospitality' or 'consumer-focus' while making quantity estimates with large safety margins will just result in a lot of food wastage.

When implying these recommendations, some limitations should be taken into account. First of all, this research is performed amongst students and this group of people is not a representative sample for the Dutch society. Concerning experience in cooking, this might be limited, because the experience just limits in most of the situations, to just a few years of cooking. What makes it even more difficult is that students will often cook for very different targets. This differs regarding the number of people joining, preferences and consumption patterns. Another limitation is that this is a passive conducted experiment, and the ability to imagine all the situations and quantities might be difficult for the respondents. Possibly, these results will differ when there are more differences in consumption patterns conjoining big and small eaters.

Recommendations

The next step that can succeed this research is a study with a more realistic experiment. This can be done by making the sample of respondents more representative for the average Dutch citizen and include consumers from different age categories. The experiment can be made more realistic by making more differences within the consumption patterns. In this research, all the consumption patterns are the same, but just in a different order. It will also be very interesting to see what will happen when a mixed company of small and big eaters joins the dinner.

A finding in this research is that consumers in general have less than one portion leftover and do not see this worthy to store. A follow-up research can investigate what to do with this finding, educating how to use these leftovers in different dishes or how to minimize these leftovers. Using leftovers in a different dish seems like an appropriate solution, because the leftover quantity is not sufficient for one portion. The other possibility is to investigate if it is possible to further minimize the food quantity for dinner and eliminate safety margins, since these most of the time end up in the bin.

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Appendix A

Experiment

-General Introduction-

Dit onderzoek gaat over hoe consumenten hoeveelheden inschatten als ze gaan koken. Je wordt gevraagd om verschillende open en gesloten vragen te beantwoorden. Je krijgt voor dit onderzoek een willekeurig nummer toegewezen, en de door jou verstrekte gegevens worden uitsluitend onder dit nummer opgeslagen om de anonimiteit te garanderen. Gegevens worden bewaard op de server van de universiteit. Je kan je op elk moment tijdens het onderzoek terugtrekken van deelname zonder verdere gevolgen. Deelname duurt ongeveer 10 minuten. Het onderzoek is uitsluitend voor academische doeleinden, en er zijn geen commerciële bedrijven bij betrokken. Als er vragen zijn over dit onderzoek kunt u deze stellen aan de onderzoeksleiding in de zaal, of contact opnemen met Erica van Herpen (MCB groep).

[*This experiment is dealing with the quantity estimations of consumers when preparing dinner. You are asked to answer several open and closed questions. For this research, you will receive a random number and your data will be saved by this number to guarantee anonymity. Data will be saved on the server of the university. You can quit this research at every moment without further consequences. Participation will take about 10 minutes. This research is meant for academic goals, and there are no commercial companies involved. When there are questions, you can ask them to the research leader in the room or Erica van Herpen (MCB group)].*

-Version A-

1. Vanavond ga je pasta koken voor een vriend die komt eten en voor jezelf. Je kookt dus voor totaal 2 personen. De laatste keer dat je voor deze vriend hebt gekookt was er te weinig eten. Het is niet erg om restjes over te houden, je hebt een grote vriezer waar restjes bewaard kunnen worden. Geef aan hoeveel gram pasta je klaar gaat maken voor jou vriend en jezelf. Basseer je bij het maken van een hoeveelheid schatting gebruik van onderstaand consumptiepatroon van jezelf.

   [*Tonight you will cook pasta for a friend that will come for dinner and for yourself.* ***So you are cooking for total 2 persons. The last time you made pasta for this friend there was not enough food. It is not a problem to have leftovers; you have a big freezer where you can store the leftovers.*** *Please indicate how many grams of pasta you will prepare for your friend and yourself. Base this estimation on the consumption pattern you see below from the past 4 times you ate pasta.]*

Tijdsmoment [*Timestamp]*	A	B	C	D
Eigen consumptie Per persoon [*Own consumption Per person]*	100 gram	100 gram	75 gram	125 gram

Ik ga …. gram pasta klaarmaken.

[*I will prepare…grams of pasta]*

Wat denk je over de hoeveelheid die je zojuist hebt geschat in relatie tot de hoeveelheid pasta die gegeten gaat worden?

[*What is your opinion about the quantity that you just estimated in relation to the quantity of pasta that actually will be eaten]*

1 2 3 4 5 6 7

Te laag Precies goed Te hoog

[*Too low Exactly right Too high]*

Hoe zeker ben je dat je een goede inschatting hebt gemaakt

[*How confident are you that you made the right estimation]*

1	2	3	4	5	6	7
Heel zeker						Heel onzeker
[*Very sure*						*Very insecure]*

2. Vanavond ga je pasta koken voor drie vrienden die komen eten en voor jezelf. Je kookt dus voor 4 personen. De laatste keer dat je voor deze vrienden hebt gekookt was er te weinig eten. Het is niet erg om restjes over te houden, je hebt een grote vriezer waar restjes bewaard kunnen worden. Geef aan hoeveel gram pasta je klaar gaat maken voor jou vriend en jezelf. Baseer je bij het maken van een hoeveelheid schatting gebruik van onderstaand consumptiepatroon van jezelf van de afgelopen keren dat je pasta hebt gegeten.

   [*Tonight you will cook pasta for three friends that will come for dinner and for yourself.* ***So you are cooking for total 4 persons. The last time you made pasta for this friend there was not enough food. It is not a problem to have leftovers; you have a big freezer where you can store the leftovers.*** *Please indicate how many grams of pasta you will prepare for your friend and yourself. Base this estimation on the consumption pattern you see below from the past 4 times you ate pasta.]*

Tijdsmoment [*Timestamp]*	A	B	C	D
Eigen consumptie Per persoon [*Own consumption Per person]*	100 gram	125 gram	100 gram	75 gram

Ik ga …. gram pasta klaarmaken.

[*I will prepare…grams of pasta]*

Wat denk je over de hoeveelheid die je zojuist hebt geschat in relatie tot de hoeveelheid pasta die gegeten gaat worden?

[*What is your opinion about the quantity that you just estimated in relation to the quantity of pasta that actually will be eaten]*

1	2	3	4	5	6	7
Te laag			Precies goed			Te hoog
[*Too low*			*Exactly right*			*Too high]*

Hoe zeker ben je dat je een goede inschatting hebt gemaakt

[*How confident are you that you made the right estimation]*

1	2	3	4	5	6	7
Heel zeker						Heel onzeker
[*Very sure*						*Very insecure]*

-Version B-

1. Vanavond ga je pasta koken voor een vriend die komt eten en voor jezelf. Je kookt dus voor totaal 2 personen. Je kookt voor deze vriend omdat jullie morgen samen op vakantie gaan. Voor een langere tijd is er niemand thuis, dus liever houd je geen restjes over want er is niemand thuis om deze restjes op te eten. Geef aan hoeveel gram pasta je klaar gaat maken voor jou vriend en jezelf. Om je te helpen bij het maken van een hoeveelheid schatting kun je gebruik van onderstaand consumptiepatroon van jezelf van de afgelopen 4 keren dat je pasta hebt gegeten.

Tijdsmoment	A	B	C	D
Eigen consumptie Per persoon	125 gram	100 gram	75 gram	100 gram

Ik ga ..... gram pasta klaarmaken.

	Te weinig		Precies goed			Te veel	
Wat denk je van de hoeveelheid die je zojuist hebt ingeschat in relatie tot de hoeveelheid pasta die werkelijk gegeten gaat worden?	☐	☐	☐	☐	☐	☐	☐
	Heel onzeker					Heel zeker	
Hoe zeker ben je dat je een goede inschatting hebt gemaakt ?	☐	☐	☐	☐	☐	☐	☐

2. Vanavond ga je pasta koken voor vier vrienden die komen eten en voor jezelf. Je kookt dus voor totaal 5 personen. Je kookt voor deze vrienden omdat jullie morgen samen op vakantie gaan. Voor een langere tijd is er niemand thuis, dus liever houd je geen restjes over want er is niemand thuis om deze restjes op te eten. Geef aan hoeveel gram pasta je klaar gaat maken voor jouw vrienden en jezelf. Om je te helpen bij het maken van een hoeveelheid schatting kun je gebruik van onderstaand consumptiepatroon van jezelf van de afgelopen 4 keren dat je pasta hebt gegeten.

Tijdsmoment	A	B	C	D
Eigen consumptie Per persoon	125 gram	100 gram	75 gram	100 gram

Ik ga ..... gram pasta klaarmaken.

	Te weinig			Precies goed			Te veel
Wat denk je van de hoeveelheid die je zojuist hebt ingeschat in relatie tot de hoeveelheid pasta die werkelijk gegeten gaat worden?	☐	☐	☐	☐	☐	☐	☐
	Heel onzeker						Heel zeker
Hoe zeker ben je dat je een goede inschatting hebt gemaakt ?	☐	☐	☐	☐	☐	☐	☐

Version C

1. Vanavond ga je pasta koken voor een vriend die komt eten en voor jezelf. Je kookt dus voor totaal 2 personen. Je kookt voor deze vrienden omdat jullie morgen samen op vakantie gaan. Voor een langere tijd is er niemand thuis, dus liever houd je geen restjes over want er is niemand thuis om deze restjes op te eten. Geef aan hoeveel gram pasta je klaar gaat maken voor jou vriend en jezelf. Om je te helpen bij het maken van een hoeveelheid schatting kun je gebruik van onderstaand consumptiepatroon van jezelf van de afgelopen 4 keren dat je pasta hebt gegeten.

Tijdsmoment	A	B	C	D
Eigen consumptie Per persoon	125 gram	100 gram	100 gram	75 gram
Consumptie vriend Per persoon	100 gram	75 gram	125 gram	100 gram

Ik ga ..... gram pasta klaarmaken.

	Te weinig			Precies goed			Te veel
Wat denk je van de hoeveelheid die je zojuist hebt ingeschat in relatie tot de hoeveelheid pasta die werkelijk gegeten gaat worden?	☐	☐	☐	☐	☐	☐	☐
	Heel onzeker						Heel zeker
Hoe zeker ben je dat je een goede inschatting hebt gemaakt ?	☐	☐	☐	☐	☐	☐	☐

2. Vanavond ga je pasta koken voor vier vrienden die komen eten en voor jezelf. Je kookt dus voor totaal 5 personen. Je kookt voor deze vrienden omdat jullie morgen samen op vakantie gaan. Voor een langere tijd is er niemand thuis, dus liever houd je geen restjes over want er is niemand thuis om deze restjes op te eten. Geef aan hoeveel gram pasta je klaar gaat maken voor jouw vrienden en jezelf. Om je te helpen bij het maken van een hoeveelheid schatting kun je gebruik van onderstaand consumptiepatroon van jezelf en jouw vrienden van de afgelopen 4 keren dat jullie pasta hebben gegeten.

Tijdsmoment	A	B	C	D
Eigen consumptie Per persoon	125 gram	100 gram	100 gram	75 gram
Consumptie vriend 1 Per persoon	100 gram	75 gram	125 gram	100 gram
Consumptie vriend 2 Per persoon	75 gram	100 gram	125 gram	100 gram
Consumptie vriend 3 Per persoon	100 gram	100 gram	75 gram	125 gram
Consumptie vriend 4 Per persoon	100 gram	125 gram	100 gram	75 gram

Ik ga ..... gram pasta klaarmaken.

	Te weinig			Precies goed			Te veel
Wat denk je van de hoeveelheid die je zojuist hebt ingeschat in relatie tot de hoeveelheid pasta die werkelijk gegeten gaat worden?	☐	☐	☐	☐	☐	☐	☐
	Heel onzeker						Heel zeker
Hoe zeker ben je dat je een goede inschatting hebt gemaakt ?	☐	☐	☐	☐	☐	☐	☐

Version D

1. Vanavond ga je pasta koken voor een vriend die komt eten en voor jezelf. Je kookt dus voor totaal 2 personen. Het is niet erg om restjes over te houden, deze kan je de volgende dag nog eten of je kan ze bewaren in de vriezer om deze later nog een keer te eten. Geef aan hoeveel gram pasta je klaar gaat maken voor jou vriend en jezelf. Om je te helpen bij het maken van een hoeveelheid schatting kun je gebruik van onderstaand consumptiepatroon van jezelf en jouw vriend van de afgelopen 4 keren dat je pasta hebt gegeten.

Tijdsmoment	A	B	C	D
Eigen consumptie Per persoon	100 gram	75 gram	125 gram	100 gram
Consumptie vriend Per persoon	125 gram	100 gram	100 gram	75 gram

Ik ga ..... gram pasta klaarmaken.

	Te weinig			Precies goed			Te veel
Wat denk je van de hoeveelheid die je zojuist hebt ingeschat in relatie tot de hoeveelheid pasta die werkelijk gegeten gaat worden?	☐	☐	☐	☐	☐	☐	☐
	Heel onzeker						Heel zeker
Hoe zeker ben je dat je een goede inschatting hebt gemaakt ?	☐	☐	☐	☐	☐	☐	☐

2. Vanavond ga je pasta koken voor vier vrienden die komen eten en voor jezelf. Je kookt dus voor totaal 5 personen. Het is niet erg om restjes over te houden, deze kan je de volgende dag nog eten of je kan ze bewaren in de vriezer om deze later nog een keer te eten. Geef aan hoeveel gram pasta je klaar gaat maken voor jouw vrienden en jezelf. Om je te helpen bij het maken van een hoeveelheid schatting kun je gebruik van onderstaand consumptiepatroon van jezelf en jouw vrienden van de afgelopen 4 keren dat jullie pasta hebben gegeten.

Tijdsmoment	A	B	C	D
Eigen consumptie Per persoon	100 gram	75 gram	125 gram	100 gram
Consumptie vriend 1 Per persoon	100 gram	75 gram	125 gram	100 gram
Consumptie vriend 2 Per persoon	100 gram	125 gram	100 gram	75 gram
Consumptie vriend 3 Per persoon	125 gram	100 gram	100 gram	75 gram
Consumptie vriend 4 Per persoon	75 gram	100 gram	125 gram	100 gram

Ik ga ..... gram pasta klaarmaken.

	Te weinig			Precies goed			Te veel
Wat denk je van de hoeveelheid die je zojuist hebt ingeschat in relatie tot de hoeveelheid pasta die werkelijk gegeten gaat worden?	☐	☐	☐	☐	☐	☐	☐
	Heel onzeker						Heel zeker
Hoe zeker ben je dat je een goede inschatting hebt gemaakt ?	☐	☐	☐	☐	☐	☐	☐

-General Questions-

Tijdens het invullen van de vragenlijst had je toen het idee dat je voor mannen of vrouwen zou gaan koken
[*While filling in the questionaire did you had in mind that you will cook for men or woman]*

☐ Mannen [*Men]*
☐ Vrouwen [*Woman]*
☐ Dat weet ik niet [*I don't know]*

Wat is je leeftijd? …..jaar
[*What is your age …..years]*

Geslacht: man / vrouw
[Sex male/female]

Als je restjes hebt na het eten, wat doe je met deze restjes?]
[*When you have leftovers after dinner, what will you do with these leftovers?]*
☐ Deze bewaar ik in de koelkast / vriezer [*I will store these in the fridge/freezer]*
☐ Deze gooi ik weg [*I will throw these away]*
☐ Dat hangt af van de hoeveelheid, als er meer dan __ porties over zijn, dan bewaar ik het
[*That depends from the quantity, when there are more than __portions left, i will store them]*

Als je kookt voor anderen, hoe bepaal je dan de hoeveelheid eten die je gaat bereiden
[*When you are cooking for others, how will you estimate the quantity that you will prepare*

☐ Ik weet hoeveel ik eet en vermenigvuldig dat met het aantal personen dat mee-eet. [*I know how much food i eat and multiply this with the number op people joining the dinner]*
☐ Ik weet precies wat de anderen per persoon eten en tel dit bij elkaar op [*I know exactly how much food the others will eat per person and sum these up]*
☐ Ik weet wat de gemiddelde Nederlander eet en vermenigvuldig dit met het aantal personen. [*I know what the average Dutchman eat and multiply this with the number of people]*
☐ Ik volg de hoeveelheden op die op het pak staan of die in het recept staan. [*I follow up the quantities that are mentioned on the package or the recipe]*
☐ Die inschatting maak ik op gevoel [*I make this estimation on the feelings]*
☐ Anders, namelijk ……. [*Something else, namely….]*

Hoeveel ervaring heb je met koken?

[*How much experience do you have with cooking?}*

1	2	3	4	5	6	7
Veel						Weinig
[*Many*						*Little]*

Hoeveel ervaring heb je met koken voor anderen?]

[*How much experience do you have with cooking for others?]*

1	2	3	4	5	6	7
Veel						Weinig
[*Many*						*Litlle]*

Wanneer het gaat om voedselconsumptie kan ik mijzelf indelen in de categorie

[*Regarding food consumption i can classify myself as]*

1	2	3	4	5	6	7
Kleine eter						Grote eter
[*Small eater*						*Big eater]*

Hoe vaak eet je restjes van eten dat je bewaard hebt?

[*How often do you eat leftovers that you have stored]*

1	2	3	4	5	6	7
Nooit						Heel vaak
[*Never*						*Very often]*

Als je voor een groep mensen gaat koken en je moet besluiten wat voor gerecht je wilt eten, ga je dan uit van je eigen voorkeuren of hou je meer rekening met de voorkeur van anderen?

[*When you are cooking for a group of people and you have to decide which dish to eat, do you reason from your own preferences or are you more taking into account the preferences of others?]*

1	2	3	4	5	6	7
Eigen voorkeur						Voorkeur van anderen
[*Own preferences*						*Preferences of others]*

Appendix B

Quantity estimates and accuracy for all the different versions (manipulations).

Version	**Familiarity**	**Motivation**	**Estimate 1 (2 pers)**	**Accuracy Estimate 1**	**Estimate 2 (5 pers)**	**Accuracy Estimate 2**
A	Low	Low	259.17 gram *=129.59 gram pp*	+59.17 gram *=29.59 gram pp*	602.78 gram *=120.56 gram pp*	+102.78 gram *=20.56 gram pp*
B	Low	High	216.81 gram *=108.41 gram pp*	+16.81 gram *=8.41 gram pp*	529.17 gram *=105.83 gram pp*	+29.17 gram *=5.83 gram pp*
C	High	High	203.57 gram *= 101.79 gram pp*	+3.57 gram *=1.79 gram pp*	506.43 gram *=101.29 gram pp*	+6.43 gram *=1.29 gram pp*
D	High	Low	226.00 gram *=113.00 gram pp*	+26.00 gram *=13.00 gram pp*	565.00 gram *=113.00 gram pp*	+65.00 gram *=13.00 gram pp*
Total	-	-	226.55 gram *=113.28 gram pp*	+26.55 gram *=13.28 gram pp*	551.06 gram *=110.21 gram pp*	+51.06 gram *=10.12 gram pp*

Appendix C

Average confidence levels

Version	Familiarity	Motivation	Confidence over estimate 1 (2 persons)	Confidence over estimate 2 (5 persons
A	Low	Low	4.81	4.67
B	Low	High	4.75	4.44
C	High	High	4.83	4.34
D	High	Low	4.83	4.89
Total	-	-	4.80	4.58