

How Packaging Characteristics Change the Perception of Product Net Weight

by

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ABSTRACT

The research is aiming at finding how packaging characteristics affect the perceived product net weight. Packaging is the interface that connect customers and products, and perceived weight is one of the defining factors at the point of purchasing. Perceived weight also influences consumption rate of the product, which may bring opportunity to food manufacturers to make their product more appealing to the target customers, it might also help to increase sales revenue, reduce food waste and combat climate change.

Three hypotheses were tested, (1) whether people perceive rigid packaging to contain more product than non-rigid packaging; (2) whether people perceive multi-pack packaging to contain more product than single-pack packaging; and (3) whether people with lower overall muscle strength tend to estimate products heavier.

Five types of tomato sauce packaging and five types of milk packaging were selected in the study, 39 people participated in the study, in addition, data from 3 participants were dropped due to data loss and equipment failure.

The result showed that the net weight of multi-pack packaging milk is perceived to be heavier than single-pack packaging milk, however, there is no perceived weight difference in the case of tomato sauce. The result also showed that the net weight of rigid packaging tomato sauce is perceived to be heavier than non-rigid packaging tomato sauce, while there is no perceived weight difference in the case of milk. And people with less muscle strength didn't perceived product weight to be heavier than people with more muscle strength.

Mixed effect was also investigated and consisted result was shown, as milk and tomato sauce with non-rigid multi-packs (NM) were perceived to have similar net weight with rigid single-packs (RS), while non-rigid single-packs(NS) were perceived to contain less product than non-rigid multi-packs (NM) and rigid single-packs (NM=RS>NS).

The study provides a general direction for researchers and food manufactures to investigate deeper into the question that how packaging characteristics influence people's weight perception. The application of the studies could potentially be lucrative for food manufacturers, retailers in the meantime reduce food waste.

CHAPTER 1: INTRODUCTION

Modern marketing strategy for grocery products is a well calculated science. In the past, all the grocery products were marketed to women from age 18 to 49. With the cultural and technology changes, product marketing is aiming to more and more specific population by age, diet option, annual income, and other factors. (Kesler, 1986). When people choose products at the supermarket, the first interface they experience is the package. Customers decide what to buy, and how to checkout.

Packaging is not only a space to print brand and product information. Research shows that on average, people spend 12 seconds when choosing the item in each category. 42% of shoppers spend less than 5 seconds when choosing the item and 42.1% of people did not recall the price after they placed the product in their shopping cart (Dickson & Sawyer, 1990). What is the key factor influencing customers' item selection in a short period of time?

Companies believe the key is the package; they use packaging to build the image of the brand and attract people to buy the product (Kesler, 1986). Marketers design their package to stand out from the competition. Coca-Cola changed the shape of the bottle design to potentially increase the market growth by 25 to 660 percent (Prince, 1994), Hanes designed an egg-shaped package for their pantyhose. This convenient design stands out from the competition and attracts consumers (Bloch, 1995).

Researches show that packaging characteristics can influence customer response, such as the shape of the package (Folkes & Matta, 2004; Garber, Hyatt, & Boya, 2009; Raghubir & Greenleaf, 2006; Yang & Raghubir, 2005), weight distribution of the package (Deng & Kahn,

2009), the graphic display on the package (Garber, Hyatt, & Boya, 2008; Hurley, Galvarino, Thackston, Ouzts, & Pham, 2013).

The other significant impact from packaging is the consumption of the product. When people choose a product in the supermarket, they perceive the amount of product inside the package. This perception of product quantity influences their perceived consumption, which lead to a change in their real consumption rate of their purchase (Raghubir & Krishna, 1999). For example, people pour less toilet cleaner out of the bottle when they were given bottle contain 500 milliliter of toilet cleaner compare with people receive bottle contain 1000 milliliter of toilet cleaner (Folkes, Martin, & Gupta, 1993). Wansink (1996) made a more specific study of consumption and packaging. They found out people tend to use more when the package of the product they use is larger, and they also concluded people consume more when the unit price is low when they indirectly and directly manipulated the unit price of the products the participants were using. Moreover, they believe part of the reason people consume more with larger packaging is because participants perceived the cost of usage is cheaper.

People estimate the weight in the mind and decide how much product they plan to buy, which makes perceived weight an important factor in the packaging design. There are a lot of factors that may influence the perceived weight. These phenomena have been studied by the scientific community since the early 1890s, such as the size-weight illusion (SWI) that people perceived weight differently when the researcher changed the size while controlling shape and the mass (Charpentier, 1891). A most recent study shows that as human brains learn from daily statistical input, people assume smaller objects are denser (Peters, Balzer, & Shams, 2015). Material-weight illusion (MWI) also has been studied by a lot of researchers. It was first introduced by Seashore (1899), and his research shows that people assume weight differently

when comparing material. Under the same weight, wood material is being assumed heavier than metal material (Wolfe, 1898). Harshfield and DeHardt (1970) supported Wolfe's idea and did experiments on more materials. When controlling the weight and size, polystyrene surface block was perceived heavier than wood surface block, and metal finish block had been assumed to have the lightest weight (Buckingham, Cant, & Goodale, 2009; Buckingham, Ranger, & Goodale, 2011). Research also show that the MWI is guaranteed to happen in the light weight object (58.5g) and less likely to happen on the heavy weight object (357 g) (Ellis & Lederman, 1999).

Self-checkout technology has been introduced to the public in recent years. Bi-optic and handheld scanners are the two type of scanning technology that is popular in most of the supermarkets in United States. Self-checkout became part of modern shopping experience. Despite the flaws of the system, retailers are pushing self-checkout technology all over the world, and they estimate they will install more than 300,000 unit of self-checkout station by 2019 worldwide (NCR, 2014).

When we consider the shopping procedure, we can clearly see the close relationship between package and checkout technology. It is possible both factors can affect the decision of the customers. However, most of the researchers are only focusing on the theory of how to implement the technology successfully (Bitner, Ostrom, & Meuter, 2002), customer preference and experience with the self-service system (Meyer & Schwager, 2007; Opara-Nadi, 2005), potential benefit of the self-serve checkout system (Smith, 2005). So far, only some of the research studies people's decisions on checkout method and the packaging characters.

In our study, we have considered the factors that may influence people's perception of weight. We categorized the grocery products we selected into two types of packaging, (1) rigid

and non-rigid packaging (2) single-pack and multi-pack packaging. Despite the packaging of the products, it is believed that the perceived weight could be determined by the customers' physical condition. We considered the correlation between people's muscle strength and their perceived weight of packages.

Goals for our study were to validate (1) if people perceive rigid packaging to contain more product than non-rigid packaging; (2) if people perceive multi-pack packaging to contain more product than single-pack packaging; and (3) if people with lower overall muscle strength tend to estimate products heavier.

CHAPTER 2: METHODS

2.1 Participants

We recruited 39 volunteers to participate in the study. There were 24 males and 15 females with an average age of 21.282 years old ($SD= 3.734$). The mean height of the participants was 1.773 meter ($SD= 0.128$). The data from four participants was excluded due to data loss during transfer and equipment failure.

2.2 Equipment

A five-level steel shelf was used in the experiment. It was 1.8288 meters high and 1.2192 meters wide, with a 0.4318 meters difference between each level (Figure 1).

Five 1.89 liter (1/2 gal) packages of milk and five 0.68 kg (24 oz) packages of tomato sauce were selected. We covered up all the labels on the packages with white paper and relabeled them using the word “Milk” or “Tomato Sauce” to avoid people select items due to graphic design (Garber, Hyatt, & Boya, 2008; Hurley, Galvarino, Thackston, Ouzts, & Pham, 2013). Each item had a different type of packaging: rigid/non-rigid and single-pack/multi-pack. The details of each package are listed in (Figure 2) (Table 1).

A standard-size shopping cart was used in the experiment for the participants to place the selected items in. (Figure 3)

A hand dynamometer was used to estimate the overall muscle strength of the participants. Hand dynamometers have been proven as effective tools to estimate the overall muscle strength among young adults (Wind, Takken, Helders, Engelbert, 2010) (Figure 4).

2.3 Procedures

We contacted the participants to schedule the experiment. To prepare for the experiment, we randomly placed items in different shelf locations for each participant. Once the participants arrived, we measured their grip force with a hand dynamometer on both hands. Then we introduced the products the participants could pick from and asked them to pick one milk package and one tomato sauce package from the shelf and place them in the shopping cart.

As soon as the participants placed the items in the shopping cart, we asked them to estimate the net weight and overall weight of the selected items, the reason for item selection, and what self-checkout technology they would like to use. Then we asked the participants to take all the items off the shelf and guess the net weight and overall weight of each item.

After all the weight estimation, the participants were asked to fill in a questionnaire. We then debriefed the participants about the study and ended the experiment.

2.4 Data Analysis

The statistical software JMP Pro 13 were used to analysis the data. When analyzing the difference between categories, perceived weight of each product from each participant were collected, the researchers put these data into different categories: Rigid/Non-rigid, Single-

pack/Multi-pack, Rigid Single-pack/Non-rigid Single-pack/Non-rigid Multi-pack, then the researchers calculate the mean of each categories and compare the perceived weight with the actual weight of the product and record the difference between two sets of data. Then calculate the mean of each categories, compare the difference between categories, and use t-test or paired t-test to valid the data. The researchers use linear regression function to find the correlation between grip force and perceived weight.

CHAPTER 3: RESULT

3.1 Rigid vs. Non-rigid

When comparing the mean perceived net weight of rigid and non-rigid tomato sauce packaging, we observed a mean difference of -0.0281 kg. The difference was not statistically significant. (Figure 5)

The difference between the mean perceived net weight of rigid and non-rigid milk packaging was 0.2231 kg. The difference was statistically significant ($p=0.0375$). (Figure 6)

3.2 Single-pack vs. Multi-pack

When comparing the mean perceived net weight of single-pack and multi-pack tomato sauce packaging, we observed a mean difference of -0.1132 kg. The difference was statistically significant ($p=0.0256$). (Figure 7)

The difference between the mean perceived net weight of single-pack and multi-pack milk packaging was -0.1223 kg. The difference was not statistically significant. (Figure 8)

3.3 Grip Force Effect

When trying to run the linear regression on the perceived overall product weight and grip force, two significant interceptions were shown but the slopes of the regression were not statistically significant. (Figure 10)

3.4 Mixed Effect of Packaging Characteristic

When analyzing the data, we found some unexpected result concerning rigid/non-rigid or single/multi packaging characteristics, which led us to consider the mixed effect of these factors. We conducted paired t-test between all three types of the packing characteristics involved in the study: rigid – single-pack (RS), non-rigid – single-pack (NS), non-rigid – multi-pack (NM). We found that there were significant differences between these types of packaging, concerning both tomato sauce and milk. From the result of the paired t-test, we concluded that non-rigid multi-pack packaging was perceived to a have the same net weight as rigid single-pack packaging, and both of them were perceived to have a lower net weight than non-rigid single-pack packaging. (NM=RS>NS) (Figure 10, 11)

CHAPTER 4: DISCUSSION

In our study, we examined the following hypotheses: (1) people perceive rigid packaging to contain more product than non-rigid packaging; (2) people perceive multi-pack packaging to contain more product than single-pack packaging; and (3) people with lower overall muscle strength tend to estimate products heavier. The first and the second hypothesis have been partially supported and the third hypothesis were being rejected, all the hypotheses are discussed below.

4.1 Hypothesis 1: People Perceive Rigid Packaging to Contain More Product than Non-Rigid Packaging Product.

Our results confirmed this hypothesis in the case of milk packaging. When comparing the perceived net weight difference between rigid and non-rigid packaging in our selected product, we observed that people perceived rigid milk containers to enclose more milk than non-rigid milk containers. This means rigid packaging milk may attract people who prefer to get a better value out of their purchase.

However, the hypothesis was rejected in the case of tomato sauce. People perceived rigid packaging does not contain more than non-rigid packaging. We associate this perception to the light weight of tomato sauce packaging (0.68 kg). This finding did not confirm to that of Ellis and Lederman (1999) who found that material weight illusion is guaranteed to happen on light weight objects and not likely to happen on heavy weight objects.

4.2 Hypothesis 2: People Perceive Multi-Pack Packaging to Contain More Product than Single-Pack Packaging.

Our results supported this hypothesis in the case of tomato sauce packaging. When comparing the perceived net weight difference between single-pack and multi-pack packaging in our selected product, we observed that people perceived multi-pack packaged tomato sauce contain more than single-pack packaged tomato sauce. People with who prefer to purchase less tomato sauce may find single-pack package more desirable.

However, the hypothesis was not supported in the case of milk. People perceived net weight difference between multi-pack packaging and single-pack packaging.

4.3 Hypothesis 3: People with Less Muscle Strength Tend to Estimate Products to Be Heavier.

To validate this hypothesis, we plotted the perceived average overall weight and average grip force. People with less muscle strength did not tend to estimate products to be heavier, showing people's perception of the weight of products was not associated with their muscle strength.

4.4 Combination of Hypothesis 1 And Hypothesis 2:

When looking more deeply into the possible mixed effect of packaging characteristics, in the case of both tomato sauce and milk, non-rigid multi-pack packaging was perceived to contain similar net weight to rigid single-pack packaging. Both packaging characteristics were perceived to contain more than non-rigid single-pack packaging (NM=RS>NS).

Different packaging materials could be the cause of this result, since the net weight of our products was controlled. When people perceived the overall weight of the product to be higher, they also perceived the net weight of the product to be higher ($p < 0.05$) (Figure 12).

4.5 Other Findings:

Additional results were found from the experiment. We observed that certain shelf locations and products were more popular than others. This could be associated with the short time span for product selection and the lack of brand and price information. Therefore people only picked the product based on packaging characteristic and convenience of the shelf location.

In addition, we found that some items were repeatedly chosen during the experiment. They were item 2 (glass jar) in tomato sauce and 7 (plastic jug) in milk. It can be argued that they are the most common packaging design for tomato sauce and milk in North America. We believe that the popularity was the result of shopping habits. This is in line with findings from previous studies about people's tendency to repeatedly purchase the same product (Bettman & Zins, 1977; Deighton, Henderson, & Neslin, 1994; Motes & Woodside, 2001; Taylor, 2001).

CHAPTER 5: CONCLUSION

At this point we need to address the importance of our results. We can summarize it into three points: (1) Make the product more attractive to target audience, (2) Increase sales revenue, and (3) Decrease food waste and combat climate change.

5.1 Make the Product More Attractive to Target Audiences

Our research was concentrating on how packaging characteristics change people's perception of the product net weight.

Consumption rate of the product can be influenced by packaging characteristics (Raghubir & Krishna, 1999; Folkes, Martin, & Gupta, 1993; Wansink, 1996).

People have different lifestyles, which lead to differences in their perceptions of the products. Some people try to have a healthy lifestyle, they may prefer certain products that are perceived lighter (Deng & Kahn, 2009). Some people prefer to purchase products that are perceived heavier.

By implementing our results, we can change people's weight perception by manipulating packaging characteristics to make the product more desirable to intended customers.

5.2 Increase Sales Revenue

Due to the fluctuation of the market price for raw material and the emergence of competitors, manufacturers need to look into more options to increase profit, such as downsizing the product weight and packaging, increase sales revenue and increase purchasing frequency.

5.2.1 Downsizing product

One way to increase the profit is to perform product downsizing, ie. to reduce the size of the product (Adams, Di Benedetto, & Chandran, 1991). Downsizing can be performed on product weight or packaging, our result provides a general direction for the manufacturers to perform downsizing by manipulating packaging characteristics without potentially impact the sales revenue.

5.2.2 Make people believe product has superior value

Another way to boost profit is to make people believe product has superior value, it is known that certain types of people prefer to purchase high price–performance ratio products, under the same price, customers would choose the product they perceived heavier as they believe that such products have greater value (Raghubir & Krishna, 1999). If manufacturers follow the general direction of our result and keep their packaging to be perceived heavier when maintaining the price, it could potentially make their products standing out from their competitors.

5.2.3 Increase purchasing frequency

Increase purchasing frequency would also increase profit, study showed that when people perceive that they purchase large quantity of product, they tend to consume more (Raghubir & Krishna, 1999; Folkes, Martin, & Gupta, 1993; Wansink, 1996). The consumption rate could be raised by increasing the perceived weight of the product, which would increase the purchasing frequency that leads to increased sale revenue.

5.3 Decrease Food Waste and Combat Climate Change

In United States and Europe, 15% to 30% of the food is being wasted after purchasing (Kantor and Lipton, 1997; Engström and Carlsson-Kanyama, 2004; Ventour, 2008; Quested and Johnson, 2009). Food manufacturing is a high energy-consuming process. Water, labor force, machine and energy are all needed for the growing, processing, maintaining, and distributing of food. 15% to 30% of the food purchased gets wasted, which means that 15% to 30% of the energy mentioned above gets wasted, and the decomposed food will be emitting methane and carbon dioxide into the atmosphere. Food waste could be one of the largest greenhouse gas emission resources we overlooked. In Williams, Wikström, Otterbring, Löfgren & Gustafsson (2012) study they found that food packaging makes up 20% to 25% of the reason that household food was wasted and in their conclusion, the number one reason of food waste resulted from packaging is “Difficult to Empty”. If we increase the perceived product net weight which would in turn increase the food consumption and decrease the actual net weight of the product, we can potentially solve the “Difficult to Empty” issue, increase food usage efficiency, decrease food waste and greenhouse emission.

CHAPTER 6: FUTURE WORK

6.1 Discover More Packaging Materials

Although we looked into people's perception of packaging characteristics, we only focused on two features, whether the material is rigid or non-rigid and if the package is single-pack or multi-pack.

We looked into four broad categories mentioned above in a large variety of packaging styles. For packaging materials, we can investigate a narrower category of materials such as plastic, metal, glass, cardboard etc. We can also explore different types of single-pack or multi-pack packaging, such as packaging transparency.

6.2 Find the Optimal Shelf Location to Increase Product Flow to Achieve More Economic Benefit

Another aspect we can look into is the shelf location, although there are some researches that have already looked into finding the optimal shelf location for each product to increase sales (Curhan, 1972; Borin , Farris & Freeland, 1994; Murray, Talukdar & Gosavi, 2010), none of them included packaging characteristics nor customer feature into their calculation.

In the perspective of retailers, it would be ideal for them to find the optimal shelf location for each product, it would increase inventory turnover rate. As an alternative perspective, once the retailers find out the optimal shelf location for certain types of product, they can make the manufacturers to bid on slotting fee among competitors in the same category.

More topics can be explored following our experiment, and our research provided a start for the much-needed future experiment in packaging design. Those future designs could not only be lucrative to the cooperation, but could also potentially decrease food waste and level of greenhouse gas emission.

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<https://doi.org/10.1016/j.jretai.2004.11.003>

Appendix: A

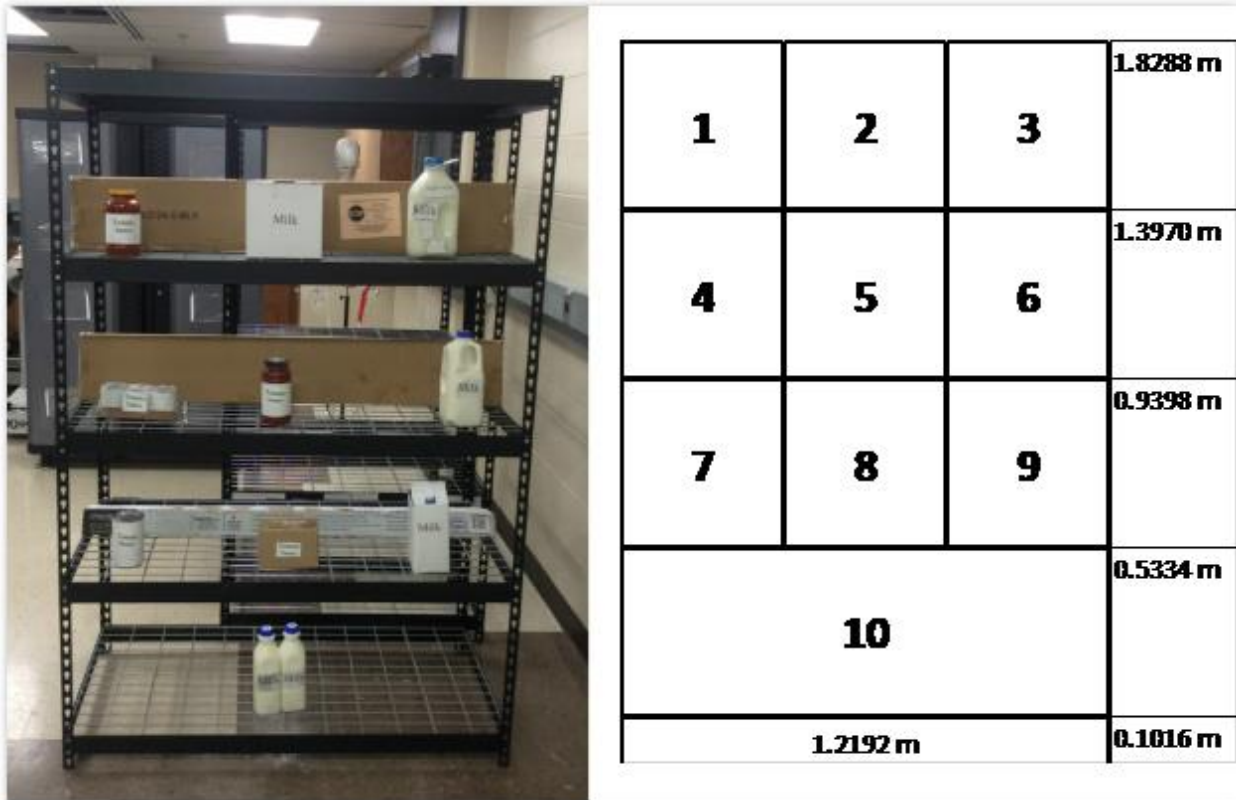











Figure 1. Picture and Diagram of the Shelf

| Item No. | Picture | Packaging Characteristics | Net Weight | Overall Weight | Length | Width | Height |
|----------|---|---------------------------|------------|----------------|---------|--------|---------|
| Item 1 |  | Non-rigid, Single-pack | 0.680 kg | 0.75 kg | 0.08 m | 0.08 m | 0.165 m |
| Item 2 |  | Rigid, Single-pack | 0.680 kg | 1.05 kg | 0.09 m | 0.09 m | 0.165 m |
| Item 3 |  | Rigid, Single-pack | 0.680 kg | 0.75 kg | 0.085 m | 0.085m | 0.135 m |

| | | | | | | | |
|-----------|---|--------------------------|-------------|---------|--------|--------|-----------|
| Item 4 |  | Non-rigid, Multi-pack | 0.680 kg | 0.85 kg | 0.21m | 0.07 m | 0.08 m |
| Item 5 |  | Non-rigid, Multi-pack | 0.680 kg | 0.9 kg | 0.16 m | 0.11 m | 0.11 m |
| Item 6 |  | Non-rigid, Multi-pack | 1.952 kg | 2.25 kg | 0.19 m | 0.12 m | 0.19 m |

| | | | | | | | |
|-----------|---|---------------------------|-------------|---------|------------|------------|------------|
| Item 7 |  | Non-rigid, Single-pack | 1.952 kg | 2 kg | 0.105 m | 0.105 m | 0.25 m |
| Item 8 |  | Non-rigid, Multi-pack | 1.952 kg | 2.05 kg | 0.075 m | 0.15 m | 0.25 m |
| Item 9 |  | Rigid, Single- pack | 1.952 kg | 2.85 kg | 0.12 m | 0.095 m | 0.255 m |


| | | | | | | | |
|------------|---|---------------------------|-------------|---------|------------|------------|-----------|
| Item 10 |  | Non-rigid, Single-pack | 1.952 kg | 2.05 kg | 0.095 m | 0.095 m | 0.24 m |
|------------|---|---------------------------|-------------|---------|------------|------------|-----------|

Figure 2. Detail of the Items



Figure 3: Picture of shopping cart



Figure 4: Picture of hand dynamometer

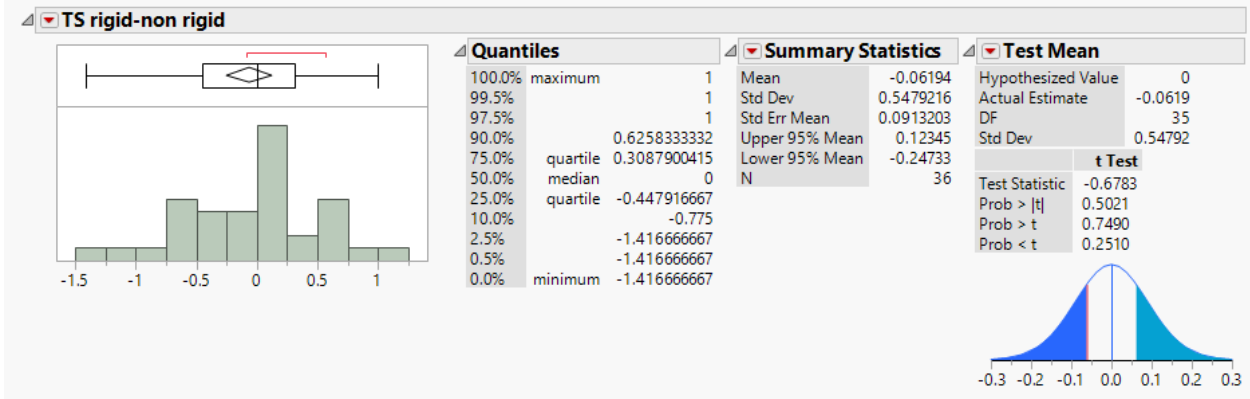


Figure 5: Result of weight difference in rigid and non-rigid package tomato sauce

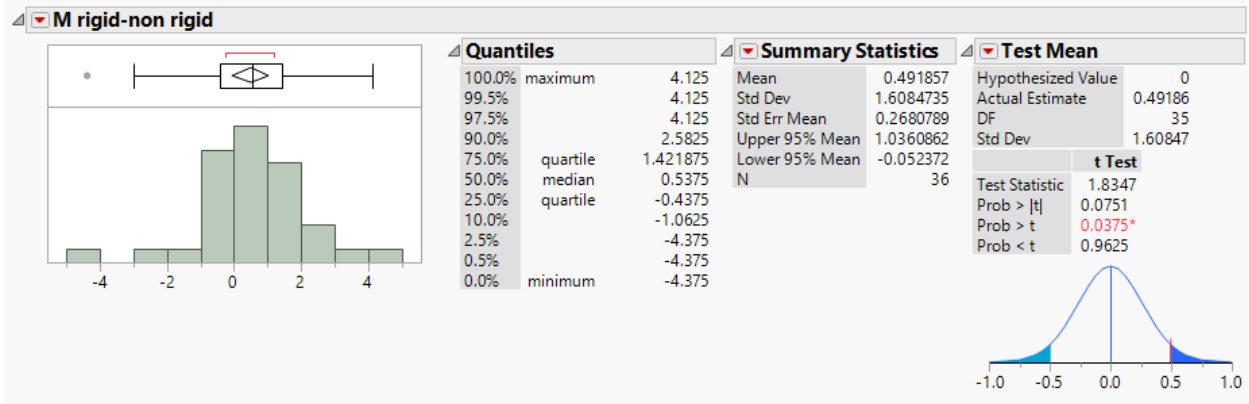


Figure 6: Result of weight difference in rigid and non-rigid package milk

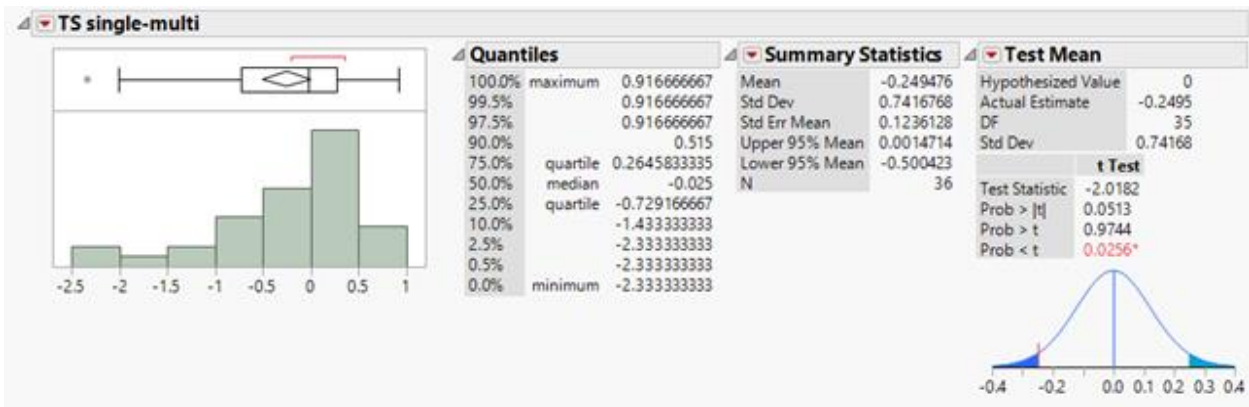


Figure 7: Result of weight difference in single-pack and multi-pack tomato sauce

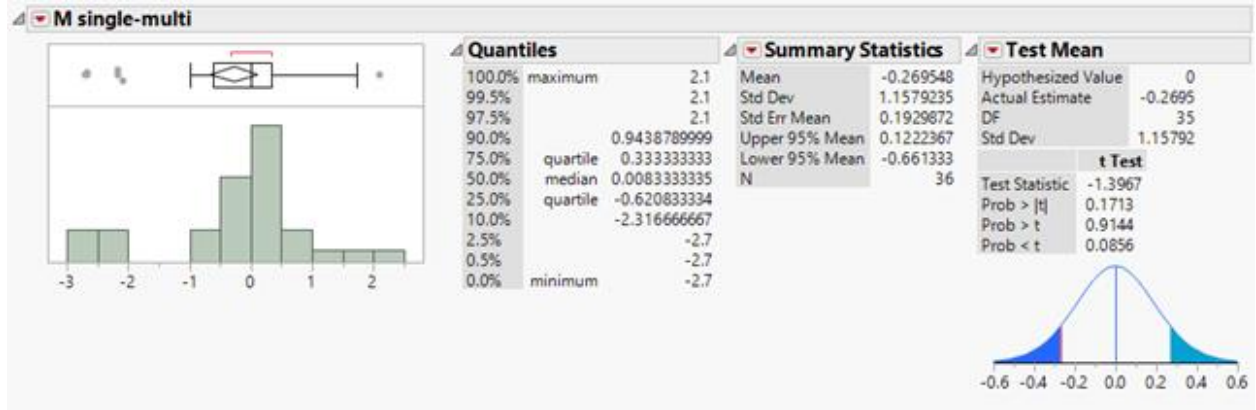


Figure 8: Result of weight difference in single-pack and multi-pack milk

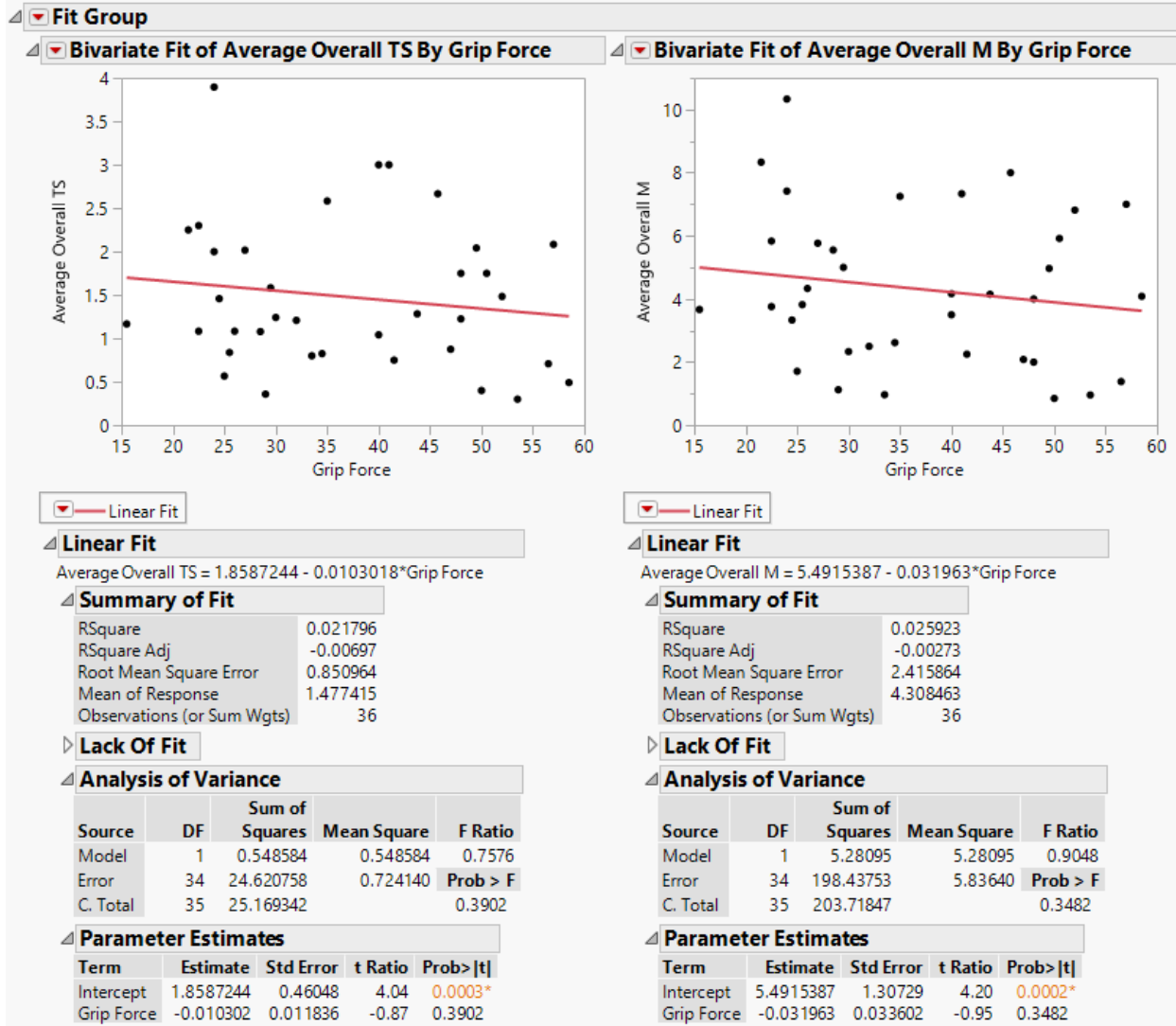


Figure 9: The correlation between grip strength and perceived overall weight

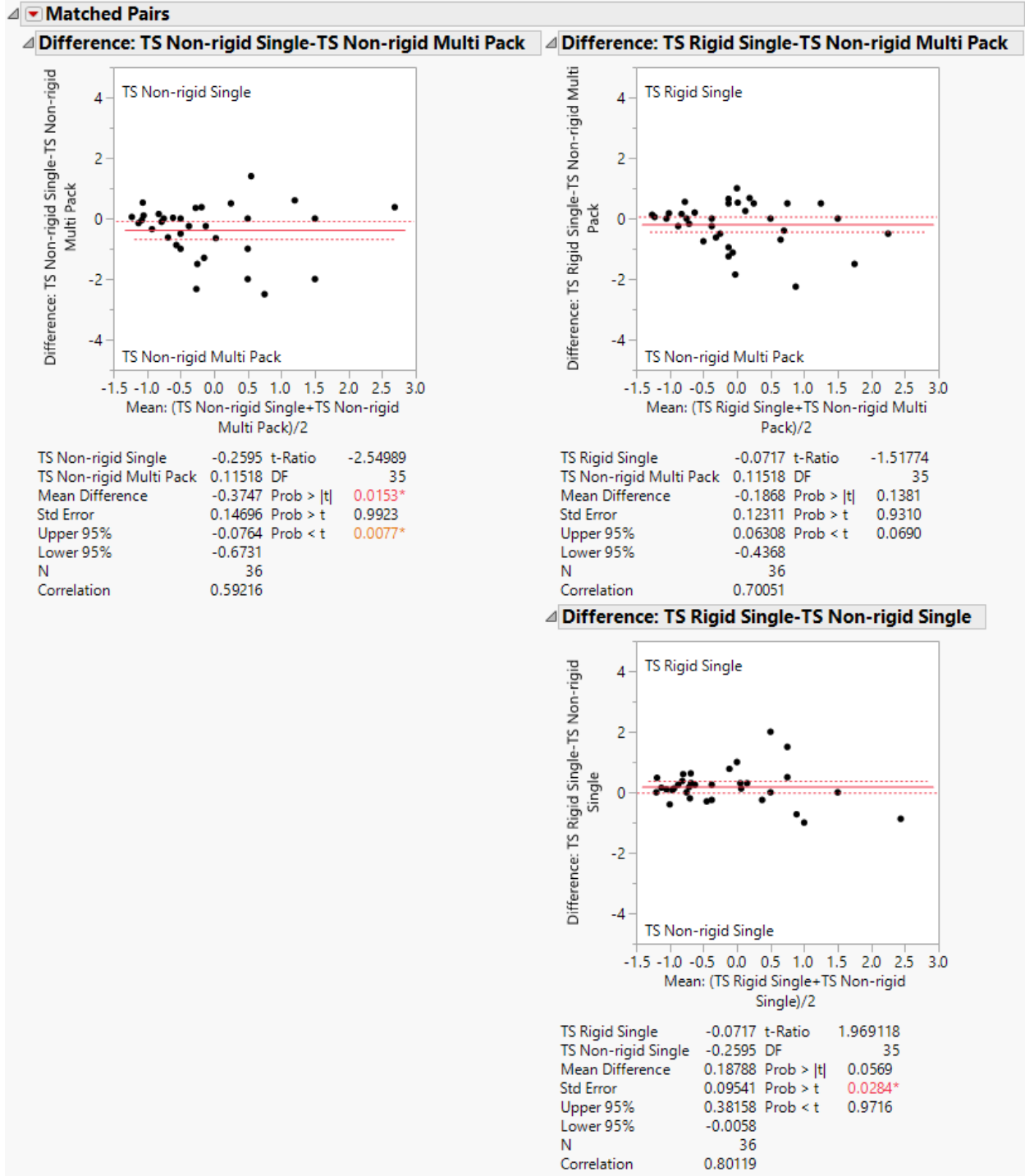


Figure 10: Result of mixed effect of tomato sauce

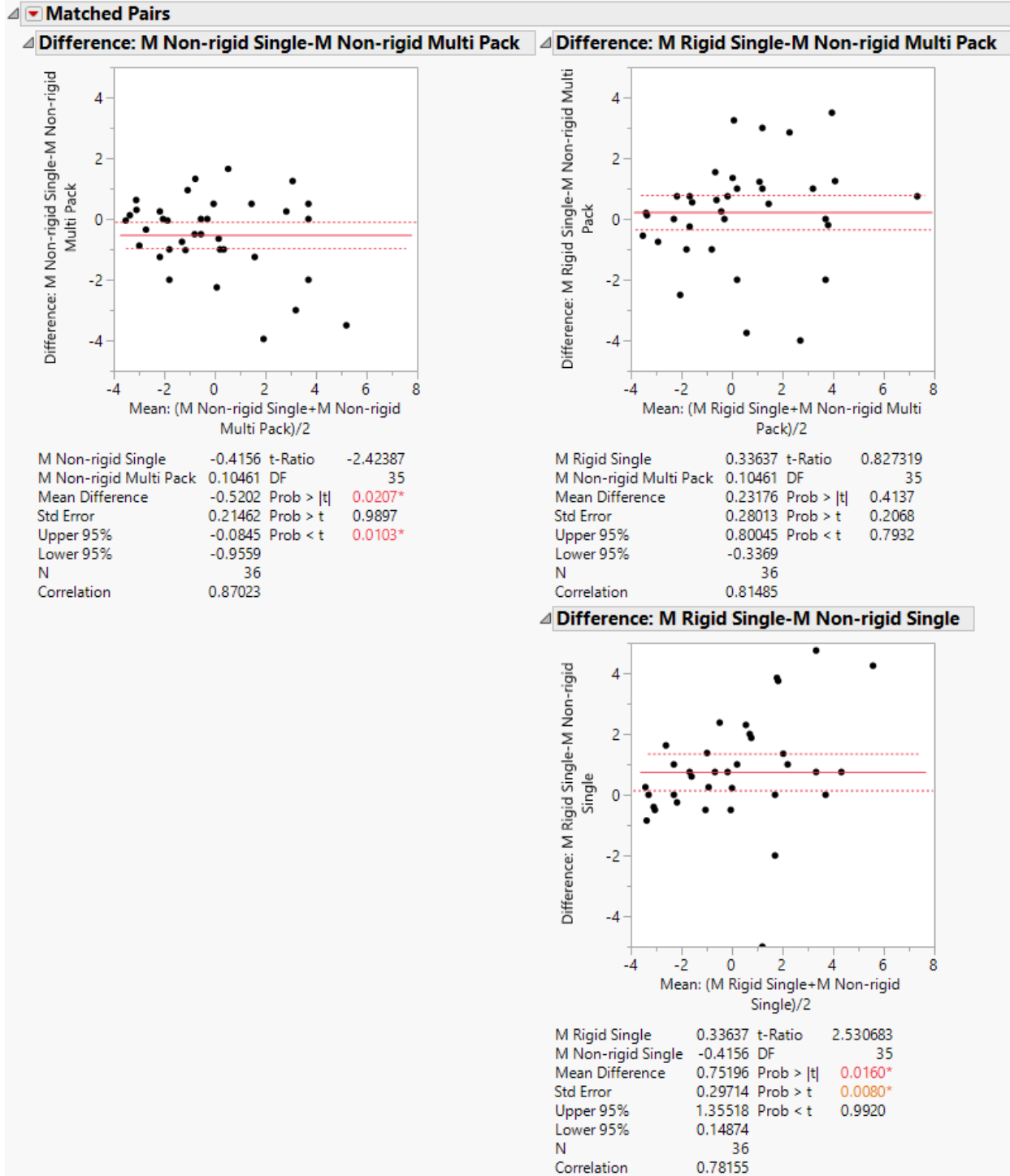


Figure 11: Result of mixed effect of milk

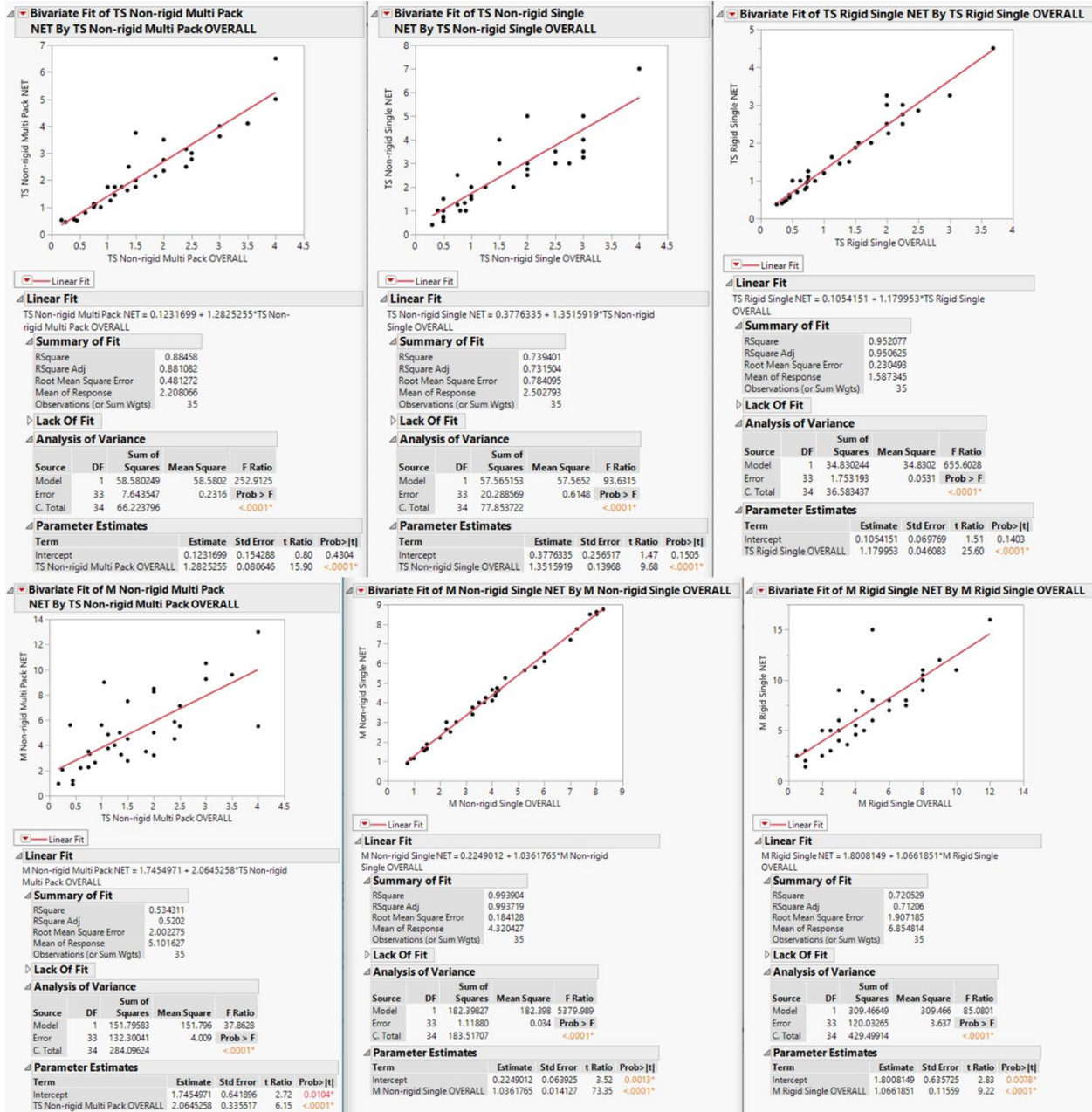


Figure 12. Net Weight vs. Overall Weight

Appendix: B
IRB Approval

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 1/31/2017

To: Ahmad Mumani
4325 Todd Drive Unit 207
Ames, IA 50014

CC: Dr. Richard T Stone
3004 Black Engineering

From: Office for Responsible Research

Title: Packaging Characteristics as determinants for the perceived heaviness, and their role in supermarket self-checkout

IRB ID: 16-499

Approval Date: 1/30/2017 **Date for Continuing Review:** 1/29/2019

Submission Type: New **Review Type:** Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- Use only the approved study materials in your research, including the recruitment materials and informed consent documents that have the IRB approval stamp.
- Retain signed informed consent documents for 3 years after the close of the study, when documented consent is required.
- Obtain IRB approval prior to implementing any changes to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- Immediately Inform the IRB of (1) all serious and/or unexpected adverse experiences involving risks to subjects or others; and (2) any other unanticipated problems involving risks to subjects or others.
- Stop all research activity if IRB approval lapses, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- Complete a new continuing review form at least three to four weeks prior to the date for continuing review as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. Approval from other entities may also be needed. For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. IRB approval in no way implies or guarantees that permission from these other entities will be granted.

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 202 Kingland, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

IRB ID: 16-499

**INSTITUTIONAL REVIEW BOARD (IRB)
Application for Approval of Research Involving Humans**

Title of Project: Packaging characteristics as determinants for the perceived heaviness, and their role in supermarket self-checkout

| | | |
|--|---------------------|---------------------------------------|
| Principal Investigator (PI): Ahmad Mumani | | Degrees: M.Sc , B.Sc. |
| University ID: 825054250 | Phone: 412-652-7567 | Email Address: aamumani@iastate.edu |
| Correspondence Address: 203 S 5 th street, Ames, IA, 50010 | | |
| Department: Industrial and Manufacturing Systems Engineering | | College/Center/Institute: Engineering |
| PI Level: <input type="checkbox"/> Tenured, Tenure-Eligible, & NTER Faculty <input type="checkbox"/> Adjunct/Affiliate Faculty <input type="checkbox"/> Collaborator Faculty <input type="checkbox"/> Emeritus Faculty <input type="checkbox"/> Visiting Faculty/Scientist <input type="checkbox"/> Senior Lecturer/Clinician <input type="checkbox"/> Lecturer/Clinician, w/Ph.D. or DVM <input type="checkbox"/> P&S Employee, P37 & above <input type="checkbox"/> Extension to Families/Youth Specialist <input type="checkbox"/> Field Specialist III <input type="checkbox"/> Postdoctoral Associate <input checked="" type="checkbox"/> Graduate/Undergrad Student <input type="checkbox"/> Other (specify:) | | |

| | | |
|---|---------------------|--|
| FOR STUDENT PROJECTS (Required when the principal investigator is a student) | | |
| Name of Major Professor/Supervising Faculty: Richard Stone | | |
| University ID: 103229126 | Phone: 515-294-3644 | Email Address: rstone@iastate.edu |
| Campus Address: 3027 Black Engineering | | Department: Industrial and Manufacturing Systems Engineering |
| Type of Project (check all that apply): <input checked="" type="checkbox"/> Thesis/Dissertation <input type="checkbox"/> Class Project <input type="checkbox"/> Other (specify:) | | |

| | |
|---------------------------|---------------------------|
| Alternate Contact Person: | Email Address: IRB |
| Correspondence Address: | Phone: OCT 19 2016 |

ASSURANCE

- I certify that the information provided in this application is complete and accurate and consistent with any proposal(s) submitted to external funding agencies. Misrepresentation of the research described in this or any other IRB application may constitute non-compliance with federal regulations and/or academic misconduct.
- I agree to provide proper surveillance of this project to ensure that the rights and welfare of the human subjects are protected. I will report any problems to the IRB. See Reporting Adverse Events and Unanticipated Problems for details.
- I agree that modifications to the approved project will not take place without prior review and approval by the IRB.
- I agree that the research will not take place without the receipt of permission from any cooperating institutions when applicable.
- I agree to obtain approval from other appropriate committees as needed for this project, such as the IACUC (if the research includes animals), the IBC (if the research involves biohazards), the Radiation Safety Committee (if the research involves x-rays or other radiation producing devices or procedures), etc., and to obtain background checks for staff when necessary.
- I understand that IRB approval of this project does not grant access to any facilities, materials, or data on which this research may depend. Such access must be granted by the unit with the relevant custodial authority.
- I agree that all activities will be performed in accordance with all applicable federal, state, local, and Iowa State University policies.

[Signature] 10/8/16
Signature of Principal Investigator Date

[Signature] 10/8/16
Signature of Major Professor/Supervising Faculty Date
(Required when the principal investigator is a student)

- I have reviewed this application and determined that departmental requirements are met, the investigator(s) has/have adequate resources to conduct the research, and the research design is scientifically sound and has scientific merit.

GILL E. KREMER
Printed Name of Department Chair/Head/Director

[Signature] 10/17/16
Signature of Department Chair/Head/Director Date

| | | |
|--|--|--|
| For IRB Use Only | Full Committee Review: <input type="checkbox"/> | Review Date: <u>January 30, 2017</u> |
| | EXPEDITED per 45 CFR 46.110(b): <u>1</u> Category <u>9.6.7</u> Letter | Approval/Determination Date: <u>January 30, 2017</u> |
| | Approval Not Required: <input type="checkbox"/> | Approval Expiration Date: <u>January 29, 2019</u> |
| Not Research: <input type="checkbox"/> | EXEMPT per 45 CFR 46.101(b): | |
| No Human Subjects: <input type="checkbox"/> | Not Approved: <input type="checkbox"/> | Risk: Minimal <input checked="" type="checkbox"/> More than Minimal <input type="checkbox"/> |
| IRB Reviewer's Signature <u>Kenny A. Agnited</u> <u>January 30, 2017</u> | | |

Research Involving Humans Study Information

Please provide answers to all questions, except as specified. Incomplete forms will be returned without review.

PART A: KEY PERSONNEL

1. List all members and relevant qualifications of the project personnel and define their roles in the research. Key personnel include the principal investigator, co-principal investigators, supervising faculty member, and any other individuals who will have contact with the participants or the participants' data (e.g., interviewers, transcribers, coders, etc.). This information is intended to inform the committee of the training and background related to the specific procedures that each person will perform on the project. For more information, please see [Human Subjects – Persons Required to Obtain IRB Training](#).

| NAME | Interpersonal contact or communication with subjects, or access to private identifiable data? | Involved in the consent process? | Contact with human blood, specimens, or other biohazardous materials? | Other Roles in Research | Qualifications (i.e., special training, degrees, certifications, coursework, etc.) | Human Subjects Training Date |
|---------------|---|-------------------------------------|---|----------------------------|--|------------------------------|
| Ahmad Mumani | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Principal investigator | Has run two IRB approved studies at ISU | 10/1/2015 ✓ |
| Richard Stone | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Supervising faculty member | Has run many IRB approved studies at both ISU and UB. | 9/2/2008 ✓ |
| Zhonglun Wang | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Co-Principal investigator | Has run two IRB approved studies at ISU | 05/17/2013 ✓ |
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | |
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | |
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| | | | | |
|--|--------------------------|--------------------------|--------------------------|--|
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
|--|--------------------------|--------------------------|--------------------------|--|

Please complete additional pages of key personnel as necessary.

| | | |
|---|--|---|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 2. Does your study include children (persons under age 18) as research subjects? |
| <p>If Yes, please read and respond to the following:</p> <p>ISU policy requires that background checks be completed for all researchers and key personnel who will have any contact with children involved in this research project. Details regarding this policy can be found here. Principal Investigators and faculty supervisors are responsible for ensuring that background checks are completed BEFORE researchers or key personnel may have any contact with children. Records documenting completion of the background checks must be kept with other research records (e.g., signed informed consent documents, approved IRB applications, etc.) and may be requested during any audits or Post-Approval Monitoring of your study.</p> | | |
| <p><input checked="" type="checkbox"/> Agreed 2.a. Please check here to indicate that you have read this information and agree that you will comply with these requirements.</p> | | |

PART B: FUNDING INFORMATION AND CONFLICTS OF INTEREST

| | | |
|---|--|--|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1. Is or will the project be externally funded? |
| <p>If No, skip to question 8.</p> <p>If Yes, please identify the type(s) of source(s) from which the project is directly funded.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Federal agency <input type="checkbox"/> State/local government agency <input type="checkbox"/> University or school <input type="checkbox"/> Foundation <input type="checkbox"/> Other non-profit institution <input type="checkbox"/> For-profit business <input type="checkbox"/> Other; specify: | | |
| <p><input type="checkbox"/> Yes <input type="checkbox"/> No 2. Is ISU considered to be the Lead or Prime awardee for this project?</p> | | |
| <p><input type="checkbox"/> Yes <input type="checkbox"/> No 3. Are there or will there be any subcontracts issued to others for this project?</p> | | |
| <p><input type="checkbox"/> Yes <input type="checkbox"/> No 4. Is or will this project be funded by a subcontract issued by another entity?</p> | | |
| <p><input type="checkbox"/> Yes <input type="checkbox"/> No 5. If ISU is the recipient of the subcontract, does it involve any federal funding, such as federal flow-through funds?</p> | | |
| <p>6. If this project will be externally funded, please provide the complete name(s) of the funding source(s); please do not use acronyms. If any subcontracts will be issued to others, please describe and include a list of all entities.</p> | | |

| | |
|---|---|
| <input type="checkbox"/> Attached | 7. Please attach a <u>complete and final copy</u> of the entire grant proposal or contract from which the project is or will be funded. |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 8. Do or will any of the investigators or key personnel listed on this application have a conflict of interest management plan in place with the Office of the Vice President for Research & Economic Development? |

PART C: GENERAL OVERVIEW – PURPOSE AND EXPECTED BENEFITS

| | |
|---|--|
| 1. Research Objectives – Briefly explain in language <i>understandable to a layperson</i> the purpose and specific aim(s) of the study. | |
| The purpose of this study is to investigate the effect of packaging characteristics on the perceived heaviness, and how consumers' characteristics affect their perception of the item's weight. Also, it will study how packaging characteristics and the perceived and actual weight affect the consumer preferences toward supermarket self-checkout options. | |
| 2. Broader Impacts/Significance – Explain in language <i>understandable to a layperson</i> why this research is important and how the information gained in this study is expected to advance knowledge and/or serve the good of society. | |
| Packaging and consumers' physical characteristics and the perceived weight of the package have different implications on both consumers' perspective and marketing sides. The sales of specific products may be affected based on the perceived heaviness, since if consumers perceived a larger/lesser weight of their purchased product, their decision about the amount purchased would be inaccurate. Also, the consumers' preferences toward a product may be affected if different/ incorrect heaviness perceived. Determining the packaging characteristics which affect this perception will help the designers to design a package which will create the required consumer responses. With a good packaging design, consumer's expectation about the package weight should be close to the actual weight, which in turn helps the consumers manage their consumption amount. In addition, this study will have implications on the self-checkout stations in which the consumers' and packaging characteristics can determine the preferred scanning technology. This will help distribute the self-checkout stations efficiently in supermarkets, and provide the consumers with the technology that fits their capabilities. | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 3. Benefits to Participants – Are there any expected direct benefits to research participants from participation in the research? Note: Monetary compensation is <i>not</i> considered to be a benefit of participation in research. |
| If Yes , please describe the expected benefits to participants. | |

PART D: PARTICIPANT SELECTION

| | |
|---|--|
| 1. How many individuals do you plan to include in the study (including those involved in screening procedures)? The number listed here is the maximum number of participants that may be included in the study. | |
| 100 | |
| 2. Inclusion Criteria – Describe the specific characteristics of persons that will be included in your study, and provide justification for these requirements. | |
| Individuals who are above 18 years old from both genders will be included in the study, this group of people is known to be frequently visiting shopping districts. Participants must be familiar with self-checkout stations. | |
| 3. Exclusion Criteria – Describe the characteristics of persons who will not be allowed to participate in your study, and provide justification for their exclusion. | |
| All participants must not have any osteoarthritis, rheumatoid arthritis problems affecting their hands, or any walking difficulties. This is because of the need to have participants do shopping and checking-out tasks. People who have experience as cashiers or working in supermarkets will be excluded from the study to eliminate the effect of previous experience bias. By implementing these criteria, the study will be more representative for the normal shopping and checking-out environments. | |
| 4. Do you intend, or is it likely, that your study will include any persons from the following vulnerable populations? (Check all that apply.) | |
| <input type="checkbox"/> Children (any persons under age 18, including ISU/college students who may be under age 18) Specify age range: <input type="checkbox"/> Prisoners <input type="checkbox"/> Persons with impaired decision-making capacity, such as those with dementia or severe cognitive impairment, those declared incompetent, persons in life-threatening situations, etc. <input type="checkbox"/> Wards of the State <input type="checkbox"/> Persons who are institutionalized <input type="checkbox"/> Pregnant women or fetuses <input type="checkbox"/> Neonates <input type="checkbox"/> Educationally disadvantaged <input type="checkbox"/> Economically disadvantaged <input type="checkbox"/> Students in a class taught by the researchers <input type="checkbox"/> Employees or subordinates of the researchers <input type="checkbox"/> Other vulnerable population, given the setting of your research; please describe: | |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 5. Will ISU students or other college students be asked to participate in your study? |
| <input type="checkbox"/> Yes see 5.a.(2) | <input checked="" type="checkbox"/> No see 5.a.(1) |
| 5.a. If Yes, do you plan to <i>include</i> college students who may be under age 18? | |
| 5.a.(1) If No (i.e., students under 18 will be <i>excluded</i> from your study), please describe how you will ensure college students under 18 do not participate in the study. The age criterion stating that participants should be above 18 years old, will be introduced to participants. Based on this criterion, they can self-select themselves for the study. Also, only the students above 18 years old will be | |

| |
|--|
| invited to join the study. |
| 5.a.(2) If Yes (i.e., students under 18 will be included in your study), please be sure to describe the parental consent and minor assent processes in <u>Appendix E</u>. |

PART E: RECRUITMENT PROCEDURES

| |
|--|
| <p>1. How will you identify or search for potential participants? (Check all that apply.)</p> <p> <input type="checkbox"/> Review of public records (e.g., voter lists, utilities lists, phone directory, ISU directory, etc.) <input type="checkbox"/> Review of private records (e.g., medical records, student records, other private records) <input type="checkbox"/> Purchased mailing lists <input checked="" type="checkbox"/> Personal contacts/knowledge <input type="checkbox"/> "Snowball" sampling <input checked="" type="checkbox"/> Participant responses to posted advertisements (electronic or hardcopy) or flyers <input type="checkbox"/> Other; please describe: </p> |
| <p>2. Please describe the details of how each of the methods checked in #1 above will be implemented.</p> <p>An invitation will be sent to ISU students through their ISU emails. They will be invited to join the experimental work in a voluntary manner. This invitation will include a description of inclusion and exclusion criteria, (Attachment 1). Also, Dr. Stone will advertise the study to his class students.</p> <p><i># see addendum for more information. DB</i></p> |
| <p>3. What methods will you use to contact potential participants? (Check all that apply.)</p> <p> <input checked="" type="checkbox"/> Letter or email <input type="checkbox"/> Phone call <input checked="" type="checkbox"/> Posting flyers <input type="checkbox"/> Posting announcement on website (Check all that apply.) <ul style="list-style-type: none"> <input type="checkbox"/> ISU Department of Psychology SONA system <input type="checkbox"/> ISU Department of Marketing/MIS SONA system <input type="checkbox"/> ISU Office of the Vice President for Research and Economic Development <input type="checkbox"/> ISU Departmental/Research Project websites <input type="checkbox"/> Other; please describe: <input type="checkbox"/> Distribution of email or advertisement via Listserves or online bulletin-boards <input type="checkbox"/> Television or radio advertisements <input checked="" type="checkbox"/> Personal or verbal announcement, such as in a class, meeting, etc. <input type="checkbox"/> Informal, personal communication <input type="checkbox"/> Other; please describe: </p> |
| <p>4. Please describe the details of how each of the methods checked in #3 above will be implemented.</p> <p>A letter will be sent to ISU students through their ISU emails. Flyers, containing the same contents of the letter, will be printed and posted on different colleges' announcement boards (Attachment 2). Also, a script will be used to advertise the study to Dr. Stone's students (Attachment 3)</p> |
| <p> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 5. Attached are copies of any letters, emails, phone/verbal scripts, flyers, announcements, or advertisements that will be used. Please know the IRB must review final and complete copies of all materials used to contact or recruit subjects. For verbal processes, a script or list of points to be covered during the discussion </p> |

| |
|------------------------------------|
| must be provided. |
| If <i>No</i> , please explain why: |

PART F: SCREENING PROCEDURES

| | |
|--|---|
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 1. Will participants be asked to provide any information about themselves (e.g., medical history, personal characteristics) for screening purposes prior to enrollment in the study? |
| If <i>Yes</i> , please describe: | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 2. Will participants be asked to take part in any interventions (e.g., fasting, blood draws, etc.) for screening purposes prior to enrollment in the study? |
| If <i>Yes</i> , please describe: | |
| 3. If <i>Yes</i> to question 1 and/or 2, please describe how you will obtain the informed consent of participants PRIOR to their participation in screening activities. | |
| | |

PART G: COMPENSATION

| | |
|--|--|
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 1. Will participants receive any of the following types of compensation for their participation in your research? (Check all that apply.) |
| <input type="checkbox"/> Money (cash or check) <input type="checkbox"/> Gift cards <input type="checkbox"/> Gifts <input type="checkbox"/> Reimbursement for expenses (i.e., costs of travel to lab, child care, meals, etc.) <input checked="" type="checkbox"/> Course credit (including extra credit) <input type="checkbox"/> Other; specify: | |
| 2. If <i>Yes</i>, please answer questions 2a through 2d. <i>This information should also be provided in the informed consent document.</i> | |

| | |
|--|--|
| | <p>2.a. Describe the specific amount of compensation to be provided (i.e., in monetary terms, points for course credit, value of gifts, etc.).</p> |
| | <p>Students from Dr. Stone's classes will receive up to 5 extra credit for participating in this study. Participants not currently enrolled in his classes will not receive any compensation.</p> |
| | <p>2.b. Explain how compensation will be provided if the participant withdraws prior to completion of the study. Note: Completion of all study procedures cannot be a requirement for research participants to receive compensation.</p> |
| | <p>Students currently enrolled in Dr. Stone's classes will receive full credit regardless of completion of the study.</p> |
| | <p>2.c. If course credit is given, describe alternative ways students can earn the same amount of credit and how these alternatives are <i>genuinely comparable</i> to participation in the study in terms of time and effort.</p> |
| | <p>Students may alternatively choose to complete an auxiliary homework based extra assignment worth the same amount of points.</p> |
| | <p>2.d. If the study involves multiple visits, sessions, or time-points, how will compensation be prorated (e.g., how much will be provided per visit/session/time-point)?</p> |
| | |
| | <p>Note: Compensation plans must be in accordance with policies set forth by the ISU Controller's Department. Detailed information is available here.</p> |

PART H: RESEARCH PLAN

| |
|--|
| <p>1. Research Procedures – Using <i>layperson's terminology</i>, please describe in detail your plans for collecting data from participants. Include a description of all <i>procedures, tasks, or interventions</i> participants will be asked to complete during the research (e.g., random assignment, any conditions or treatment groups into which participants will be divided, mail survey or interview procedures, observation protocols, sensors to be worn, amount of blood drawn, etc.).</p> <p>Note: When referencing attached documents (i.e., surveys, interview protocols, copies of stimuli, instructions for tasks, etc.), please ensure that each attachment is clearly labeled and clearly referenced in this section.</p> |
| <p>A study will be conducted at Athena Lab, at Industrial and Manufacturing Systems Engineering department. An</p> |

announcement will be posted or sent via emails to invite people to take a part in the study (Attachments 1,2,3). After having the required number of participants, sessions will be scheduled according to participant's available time. Participants will be asked to read and sign a consent form before conducting the experiment. The entire study will last for 40-90 minutes and the participants will be video recorded. The following is the experimental procedure.

- Greet the participants.
- Brief description of the study.
- Provide the participant with a consent form to be read and signed, see (Attachment 4)
- Measure the grip strength, dexterity level, pinch strength, and height of participants, see (Attachment 5)
- Provide the participant with a shopping list, see (Attachment 6).
- Participants are required to read and check the shopping list.
- Participants select from the items placed on shelves simulating supermarket shelves. To eliminate the effect of brand basis, products will be packaged using specially designed exteriors if required.
- The participant places the items in the shopping cart
- Participants estimate the item's weight while they are in the cart. Write items' estimated weight, see (Attachment 6).
- Participants report their preferences toward self-checkout methods for each item and all the items in the cart, see (Attachment 6).
- Provide the participants with a survey after the experimental tasks, see (Attachment 7)
- Debrief the participants

RESEARCH INVOLVING DECEPTION OR INCOMPLETE DISCLOSURE

| | | |
|------------------------------|--|---|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <p>2. Will participants be <i>deceived or misled</i> about anything during the study? If Yes, please answer questions 2a through 2d in Appendix A. If No, please skip to question 3.</p> |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <p>3. Do you plan to <i>intentionally withhold</i> information from participants, such as the full purpose of the study, a full description of procedures, etc.? If Yes, please answer questions 3a through 3d in Appendix A. If No, please skip to question 4.</p> |

RESEARCH INVOLVING EXISTING DATA OR INFORMATION FROM RECORDS

| | | |
|------------------------------|--|--|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <p>4. Does the research involve the collection or study of currently existing data or information to be gathered from records, such as the following? (Check all that apply.)</p> <p><input type="checkbox"/> Student/educational records (including collection of class assignments, tests, etc.)</p> <p><input type="checkbox"/> Medical records (If checked, submit the <u>Application for Use of Protected Health Information</u>.)</p> <p><input type="checkbox"/> Data collected for a previously conducted study</p> <p><input type="checkbox"/> Information from government databases, such as the US Census, Iowa Dept. of Public Health records, etc.</p> <p><input type="checkbox"/> Samples from specimen/tissue banks</p> <p><input type="checkbox"/> Other; please describe:</p> <p>If Yes, please answer questions 4a through 4g in Appendix B. If No, please skip to question 5.</p> |
|------------------------------|--|--|

RESEARCH INVOLVING OBSERVATION

| | | |
|---|-----------------------------|---|
| <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | <p>5. Does the research involve collection of data from observation of people's behaviors or activities?</p> |
|---|-----------------------------|---|

| | | |
|---|-----------------------------|--|
| <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | <p>5. Does the research involve collection of data from observation of people's behaviors or activities?</p> <p>If Yes, please answer 5a through 5d in Appendix C.</p> <p>If No, please skip to question 6.</p> |
|---|-----------------------------|--|

RESEARCH INVOLVING INTERNATIONAL RESEARCH

| | | |
|------------------------------|--|---|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <p>6. Will the research take place in an international setting?</p> <p>If Yes, please answer 6a through 6c in Appendix D.</p> <p>If No, please skip to question 7.</p> |
|------------------------------|--|---|

RESEARCH INVOLVING INVESTIGATIONAL DRUGS, DEVICES, DEXA/CT SCANS, X-RAYS, OR HUMAN CELLS OR TISSUES

| | | |
|------------------------------|--|--|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 7. Does this project involve an investigational new drug (IND)? Number: |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 8. Does this project involve an investigational device exemption (IDE)? Number: |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 9. Does this project involve DEXA/CT scans or X-rays? |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 10. Does this project involve human blood components, body fluids, or tissues? |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | <p>11. Does this project involve human cell or tissue cultures (primary or immortalized)?</p> <p>If you answered Yes to either question 10 or 11 and the cells, body fluids, etc., have not been documented to be free of blood-borne pathogens, personnel handling these substances are required to take Blood-borne Pathogens Training annually.</p> <p>Bloodborne Pathogens training is online via the EH&S website.</p> <p>If you have any questions, contact EH&S at (515) 294-5359.</p> |

PART I: DATA ANALYSIS

| |
|--|
| <p>1. Describe how the data will be analyzed (e.g., statistical methodology, statistical evaluation, statistical measures used to evaluate results).</p> |
| <p>The participants who join the study will be asked to perform the experimental tasks mentioned in part H1. For all participants the dependent variables are measured during each session, the difference between a dependent variable value resulted from different participants, will be tested using the test of hypothesis methods. Minitab or Design expert software will be used for statistical analysis purposes. Mean and standard deviation are the statistical measures included in the data analysis phase.</p> |

PART J: CONSENT PROCESS

According to federal regulations, participants can only be included in research if they, or their legally authorized representative, provide legally-effective informed consent. In some cases, the IRB can waive this requirement.

I. Consent for Adult Participants

| | | |
|--|-----------------------------|---|
| <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | A. Will you obtain the informed consent of all participants? |
| If A is Yes, please answer the following questions: | | |
| 1. Describe the procedures you will use to provide information about the details of the study to participants. | | |
| A consent form will be delivered before conducting the study, it has the experimental procedure and details. Participants will be asked to read the form and encouraged to ask any question before doing the experiment. After then, participants will be asked to sign the form. | | |
| 2. Who, in general, will obtain informed consent from participants (i.e., explain the study, collect signed forms, etc.)? Please do not list actual names of study staff; rather, describe their role such as "the principal investigator," "research assistants," etc. | | |
| The principal investigator and co-principal investigator | | |
| 2.a. What training have they received or will they receive regarding how to appropriately obtain informed consent? | | |
| NIH Web- based training course "Protecting Human Research Participants" | | |
| 3. Information conveyed to participants must be in a language understandable to them. Please describe the measures you are taking to ensure the informed consent process is understandable (e.g., translation into another language, using commonly understood terminology, assessing reading level of the consent form, etc.). | | |
| The information conveyed to participants is presented in a simple english language. Participants will be encouraged to ask any question or inquire more explanations before doing the experimental tasks. | | |
| 3.a. If translation is required, please provide the name of the person(s) who conducted the translation(s) and his/her qualifications for doing so. | | |
| | | |
| 4. When will informed consent be obtained in relation to beginning data collection? | | |
| The consent form will be signed before the beginning of data collection. | | |
| <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No | 5. Will all participants sign a consent form to document the consent process? Note: Signatures must be handwritten by the participant; typing one's name on a form does not constitute a legally valid signature according to federal regulations. |

| | | |
|--|--|---|
| If No , please explain why. | | |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 6. Do any of the researchers or key personnel involved in the study have a supervisory, evaluative, or other position of "power" over participants? If Yes, please describe the measures you are taking to minimize any coercion or undue influence (real or perceived). |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 7. Are any participants likely to be unable to provide consent for themselves, such as those who have severe cognitive impairments, dementia, are in life-threatening situations, cannot communicate, etc.? If Yes, please describe plans to obtain consent from the participant's legally authorized representative. |
| | | |
| 7.a. To the extent possible, given the condition of the participant, how will you ensure they agree to take part in the research? | | |
| | | |
| If A is No , (i.e., you will NOT obtain informed consent from all participants), please answer the following: | | |
| 8. Please provide strong and compelling justification for why you cannot carry out your study if you had to obtain informed consent. Note: The fact that obtaining consent would be inconvenient or time consuming is not considered to be sufficient justification. | | |
| | | |
| 9. Please explain why participants' rights and welfare will not be adversely affected if you do not obtain their consent. | | |
| | | |

II. Parent/Legal Guardian Consent and Child Assent (applies when participants are under age 18 or are considered to be children in the country where the research takes place)

| | | |
|---|--|--------------------------------------|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | A. Does your study involve children? |
| If A is Yes , please complete the questions in Appendix E . | | |

PART K: RISKS/DISCOMFORTS

PART K: RISKS/DISCOMFORTS

| | | |
|---|---|--|
| <input type="checkbox"/> Yes see 1.a.-1.g. | <input checked="" type="checkbox"/> No* | 1. Are there any foreseeable risks or discomforts to participants from taking part in your research? *If No, please answer the following question. |
| <p>If No (i.e., there are no foreseeable risks or discomforts to participants), please explain why you believe this is the case:</p> | | |
| <p>The experiment involves doing a task which is considered to be done in people daily lives. The shopping task is designed to simulate the real world supermarket environment. Also, the items included in the study will have a comparatively small weight (<51 Lb.) as recommended by OSHA handling weight limits. These items will be selected to be completely closed. Based on these circumstances, no significant risk is expected to happen beyond what experienced in the normal shopping environment. Also, participants can select not to continue the experiment if they would like to stop.</p> | | |
| <p>If Yes, please answer Yes or No to items 1.a through 1.g below. Indicate whether the following types of risks/discomforts are foreseeable. When Yes, please describe the risks/discomforts <u>and</u> explain how each will be mitigated or minimized.</p> | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.a. Physical Risks (e.g., injury, bruising from a blood draw, pain, side-effects from drugs administered, allergic reactions, etc.) |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.b. Psychological Risks (e.g., emotional discomfort from answering questions, stress or anxiety from procedures, mood alterations, viewing offensive or "shocking" materials, etc.) |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.c. Social Risks (e.g., harm to reputation, embarrassment, or stigmatization if participation becomes known, disruption of personal or family relationships, etc.) |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.d. Economic Risks (e.g., loss of money, loss of or harm to employment, etc.) |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.e. Legal Risks (e.g., criminal liability if information about participants' illegal behaviors is collected) |
| | | |
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.f. Informational Risks (e.g., harm if information collected about the participant were disclosed or overheard, such as embarrassment, retribution, stigmatization, disruption of personal relationships, legal liability, etc.) |
| | | |

| | | |
|------------------------------|--|--|
| <input type="checkbox"/> Yes | <input checked="" type="checkbox"/> No | 1.g. Other Risks, given the setting of your research |
| | | |

PART I: PRIVACY AND CONFIDENTIALITY

| |
|---|
| 1. Describe how participants' privacy will be protected during recruitment and data collection (e.g., discussions/procedures will be conducted in private locations, messages regarding the research will not be left on answering machines without permission of participant, documents or recordings will be kept secure, etc.). |
| During the experiment, individuals will be tested separately, in which a participant will not have an access to the test place while the test is in progress. All participants will be informed that they will be video recorded only during shopping and checking out tasks. All recordings will be kept on a Cybox. |
| 2. Please answer the following questions to describe the methods you will employ to maintain confidentiality and security of the data at all points in the research process (e.g., during data collection, during analysis, etc.): |
| 2.a. Who will have access to the data and study records? |
| The principal investigator and Dr. Stone. |
| 2.b. Describe how/where physical copies (i.e., paper files, samples, etc.) of data and study records will be stored (e.g., in cabinets, desks, shelves, etc.). |
| The paperwork will be kept in a secured cabinet at ISU, only the principal investigator and Dr. Stone will have an access to it. |
| 2.c. Describe security measures in place to maintain security of physical/paper data, samples, or study records (e.g., how access will be controlled, locks, etc.). |
| The keys will be controlled and preserved by the principal investigator. |
| 2.d. Describe how/where electronic data will be stored (e.g., a desktop computer, laptop, portable drive, shared drive, etc.). |
| Electronic data will be saved on a cybox which is accessed by the principal investigator and Dr. Stone. |
| 2.e. Describe the measures in place to maintain security of electronic data (e.g., encryption, password-protection, firewalls, using university controlled systems, etc.). |
| The cybox password will be possessed by the principal investigator. |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 2.f. Will your data include any audio recordings and/or video recordings of participants? If Yes, please answer the following: |

| | |
|---|---|
| 2.f.(1) Who will have access to the audio and/or video recordings? | |
| The principal investigator and Dr. Stone. | |
| 2.f.(2) Describe how/where the audio and/or video recordings will be stored (e.g., in a cabinet, on a computer, etc.). | |
| Records will be kept on a cybox in which only the principal investigator has an access to it. | |
| 2.f.(3) Describe the measures in place to maintain security and confidentiality of the audio and/or video recordings (e.g., how access will be controlled, locks, password protection, firewalls, etc.). | |
| Cybox will be used, only the principal investigator has its password. | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 2.f.(4) Will the actual recordings or images of participants from recordings be shared in any dissemination (e.g., manuscripts, reports, presentations, etc.) of the study results? If Yes, what measures will you take to disguise their identity (i.e., blurring facial images, voice alteration methods, etc.)? |
| | |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 2.g. Will any identifiers or identifiable information (e.g., names, social security numbers, addresses, phone numbers, exact dates of birth, etc.) be collected with or linked to the study data at any point in time? If Yes, please answer the following: |
| 2.g.(1) Describe the identifiers that will be collected or linked to the study data. | |
| Video data of participants faces | |
| 2.g.(2) Why is it necessary to collect identifiers or link identifiers to the study data? | |
| Participants faces are included on the video. Video is necessary for data collection of ergonomics. | |
| 2.g.(3) At what point in the process will identifiers be separated or removed from the data? | |
| Video data is deleted following approval of the research article. | |
| 2.g.(4) Please describe any coding systems you will use to maintain confidentiality of identifiable data (e.g., plans to replace names with ID codes or pseudonyms). | |
| Video files are named using a random number | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 2.g.(5) Will you create a "key" linking identifiers with any ID codes or pseudonyms? If Yes, how will you maintain control of the key and ensure the key is kept secure? Note: Best practice is to store the key in a separate location from the |

| |
|--|
| study data. |
| At what point will the key be destroyed? |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 2.h. Have you or will you obtain a Federal Certificate of Confidentiality for this study? If Yes, please submit a copy of the certificate materials with this application. Note: Certificates of Confidentiality are designed to protect identifiable research records against forced disclosure (e.g., subpoena). Certificates can be sought from the National Institutes of Health in certain circumstances. Visit the Certificates of Confidentiality Kiosk for more information. |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 2.i. Will the data be shared or submitted to a repository or registry, such as the Clinical Trial Registry Databank (ClinicalTrials.gov), the Database of Genotypes or Phenotypes, or via other data sharing agreements? If Yes, please describe. |
| 3. What specific steps will you take to ensure participants are not identifiable (directly or indirectly via “deductive disclosure”) when research results are reported? |
| Each participant will be assigned a random number, the characteristics of participants will be general without personal details. |
| <input checked="" type="checkbox"/> Yes 4. Please check here to confirm that you will retain research records (i.e., signed consent forms, approved IRB applications, etc.) for at least 3 years after the study is complete. Doing so is required by federal regulations. |

PART M: REGISTRY PROJECTS

| |
|--|
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 1. Does this project establish a registry or databank? |
| Note: To be considered a registry or databank: (1) the individuals whose data are in the registry/databank might be contacted in the future; and/or (2) the names and/or data pertaining to the individuals in the registry/databank might be used by investigators other than the one maintaining the registry/databank. |
| If Yes, please answer the following questions: |
| 1.a. What information/data will be included in the registry? |
| |
| 1.b. What is the reason for establishing a registry (i.e., how will data from the registry be used)? |

| | |
|---|--|
| | |
| 1.c. Who will be involved in establishing and providing oversight of the registry? | |
| | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 1.d. Will the data in the registry be available to anyone other than the investigator(s) who maintain the registry? |
| | |

Checklist for Attachments

Listed below are the types of documents that should be submitted for IRB review. Please check and attach the documents that are applicable for your study:

- Grant proposal or contract—must be the complete and final version submitted to funding agency
- Recruitment fliers, phone scripts, or any other documents or materials participants will see or hear
- A copy of the informed consent document or letter of introduction containing the elements of consent
- A copy of the assent form if minors will be enrolled
- Data-gathering instruments (including surveys, interview questions, focus group protocols, cognitive tests, observation protocols, etc.)
- When applicable, copies or detailed descriptions of stimuli participants will be exposed to, instructions for testing, investigator's brochures, etc.
- Appendices attached when applicable
 - Appendix A
 - Appendix B
 - Appendix C
 - Appendix D
 - Appendix E

The original signed copy of the application form, any completed appendices, and one set of accompanying materials should be submitted for review in hard copy to the Office for Responsible Research, 1138 Pearson, or electronically to IRB@iastate.edu.

C. RESEARCH INVOLVING OBSERVATION

| | |
|---|---|
| Continuation from Part H: #5: | |
| 5.a. Please describe the specific behaviors or activities that will be observed. | |
| The technique used in picking the items from the shelves is observed in which the items that participants choose are identified. Also, the time required to complete the experimental tasks will be documented. Subjective preferences and general information are obtained from each participant using survey and interview questions. Also, ease of handling, willingness to buy, preferred scanning technology, and estimated weight are reported. | |
| 5.b. How will you record information during observation (e.g., field notes, audio/video, etc.)? | |
| Incident checklist, video recording, stopwatch, and a note sheet will be utilized during the observation. A survey with categorical and multiple-choice questions will be used. | |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | 5.c. Will any identifying information about participants be recorded during the observations? If Yes, please describe: |
| | |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | 5.d. Will participants give informed consent to be observed? If No, please provide strong justification for why obtaining permission/consent is not necessary or not possible. Note: The fact that obtaining consent would be inconvenient or time consuming is not considered to be sufficient justification. |
| | |

Continue to Part H: #6 (International Research)

16-499 Addendum

Clarification of Recruitment Procedures Per email 1/12/17:

Dr. Stone will make an announcement during his classes about the research project. In this announcement, students will be instructed to email either the PI or him if they are interested. The students who respond with interest in the study to Dr.Stone will be placed in a list that Dr.Stone will then provide the PI. Once this list is obtained, the PI will email the flyer with more information about the study and begin scheduling the time for that participant to come to the lab.

| | |
|------------------|-----------------|
| ISU IRB # 1 | 16-499 |
| Approved Date: | 30 January 2017 |
| Expiration Date: | 29 January 2019 |

Attachment 1-Invitation letter

Packaging characteristics as determinants for the perceived heaviness, and their role in supermarket self-checkout

Greetings,

You are invited to participate in a research study about the effect of packaging characteristics on the perceived heaviness, and their role in supermarket self-checkout. We are seeking people who are above 18 years old who do not have a history of osteoarthritis, rheumatoid arthritis problems affecting their hands, or any walking difficulties, familiar with self-checking-out stations, and frequently visit shopping district. Also, you should not have previous experience as a cashier or in any supermarkets related works.

If you agree to participate, we will measure your pinch and grip strength, dexterity level, and height. Then you will be provided with a shopping list containing different items which are placed on shelves. Read the list and from the items on the shelves, select the items which you would like to buy. After then, place the selected items in the shopping cart and estimate the items' weight while they are in the cart; Thereafter, you should select the preferred method to self-checkout each item and all the items in the cart. After the experiment, you will be asked to fill a short survey. The entire study will last for 40-90 minutes and you will be video recorded only during the shopping/checking out tasks, and the recordings will be only used for ergonomic assessments.

Your participation is completely voluntary, but you must be above 18 years old and not having any of the aforementioned medical conditions. Your information will be kept confidential. In any document we may publish, we will not include any information that may identify you as a participant. If you are a student in any of Dr. Stone's classes, your choice to participate will not affect your grades or relationship with Dr. Stone in anyway. If you have any concern, you can skip any part of the study.

The principal investigator of this study is Ahmad Mumani. You are encouraged to ask questions at any time about this study. For further information, you are encouraged to contact him at Iowa State University, Industrial and Manufacturing System Engineering department, aamumani@iastate.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the principal investigator, you are encouraged to contact Dr. Richard Stone at Iowa State University, Industrial and Manufacturing System Engineering department, 3027 Black Engineering, rstone@iastate.edu.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Ahmad Mumani

aamumani@iastate.edu

PhD Student

Industrial and Manufacturing Systems Engineering

Iowa State University

| | |
|------------------|-----------------|
| ISU IRB # 1 | 16-499 |
| Approved Date: | 30 January 2017 |
| Expiration Date: | 29 January 2019 |

Attachment 2-Flyer

Packaging characteristics as determinants for the perceived heaviness, and their role in supermarket self-checkout

Greetings,

You are invited to participate in a research study about the effect of packaging characteristics on the perceived heaviness, and their role in supermarket self-checkout. We are seeking people who are above 18 years old who do not have a history of osteoarthritis, rheumatoid arthritis problems affecting their hands, or any walking difficulties, familiar with self-checking-out stations, and frequently visit shopping district. Also, you should not have previous experience as a cashier or in any supermarkets related works.

If you agree to participate, we will measure your pinch and grip strength, dexterity level, and height. Then you will be provided with a shopping list containing different items which are placed on shelves. Read the list and from the items on the shelves, select the items which you would like to buy. After then, place the selected items in the shopping cart and estimate the items' weight while they are in the cart; Thereafter, you should select the preferred method to self-checkout each item and all the items in the cart. After the experiment, you will be asked to fill a short survey. The entire study will last for 40-90 minutes and you will be video recorded only during the shopping/checking out tasks, and the recordings will be only used for ergonomic assessments.

Your participation is completely voluntary, but you must be above 18 years old and not having any of the aforementioned medical conditions. Your information will be kept confidential. In any document we may publish, we will not include any information that may identify you as a participant. If you are a student in any of Dr. Stone's classes, your choice to participate will not affect your grades or relationship with Dr. Stone in anyway. If you have any concern, you can skip any part of the study.

The principal investigator of this study is Ahmad Mumani. You are encouraged to ask questions at any time about this study. For further information, you are encouraged to contact him at Iowa State University, Industrial and Manufacturing System Engineering department, aamumani@iastate.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the principal investigator, you are encouraged to contact Dr. Richard Stone at Iowa State University, Industrial and Manufacturing System Engineering department, 3027 Black Engineering, rstone@iastate.edu.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Ahmad Mumani
aamumani@iastate.edu

PhD Student

Industrial and Manufacturing Systems Engineering
Iowa State University

Attachment 3: Advertisement Script

The following is the Script that will be used to advertise the study to Dr. Stone's students:

Dr. Stone will describe the study based on the information listed on the consent form. After then, he will introduce the compensation criteria based on the following description.

If you participated in this study, you will receive up to 5 extra credit points for participating in this study. If you only participate in a portion of the study, you will be given full credit as long as you signed the consent form. You may alternatively, choose to complete an auxiliary homework based extra assignment worth the same amount of points.

Also, Dr. Stone will say that your choice to participate will not affect your grades or relationship with Dr. Stone in anyway

If you are interested in participating, send an email to the PI " Ahmad Mumani ", his email is aamumani@iastate.edu .

Your questions are welcome.

Please note that there could be some deviations from the script based on the discussion encountered.

Experiment Document: Consent Document

| | |
|------------------|-----------------|
| ISU IRB # 1 | 16-499 |
| Approved Date: | 30 January 2017 |
| Expiration Date: | 29 January 2019 |

Attachment 4-Consent Form

Consent Form for**Packaging characteristics as determinants for the perceived heaviness, and their role in supermarket self-checkout**

You are invited to participate in a research study about the effect of packaging characteristics on the perceived heaviness, and their role in supermarket self-checkout. You were selected as a participant, because we are seeking for people who are above 18 years old from both genders, and frequently visit shopping district. You should not participate in this study if you have osteoarthritis or rheumatoid arthritis affecting your hands, or any walking difficulties and/or are not familiar with self-checking-out stations. Also, you should not have previous experience in cashiers or supermarkets related works. The purpose of this study is to investigate the effect of packaging characteristics on the perceived heaviness, and how the consumer characteristics affect his/her perception of items' weight. Also, it will study how consumers' and packaging characteristics, and the perceived and actual weight affect the consumer preferences toward different self-checking technologies. We ask you to read this form and ask any questions you may have before agreeing to participate in the study. Please discuss any questions you have about the study or about this form with the principal or co-principal investigators before deciding to participate.

This study is being conducted by Ahmad Mumani, a graduate student at Iowa State University (ISU) in the college of engineering, department of Industrial and Manufacturing Systems Engineering (IMSE).

Procedures:

If you agree to participate, we will measure your pinch and grip strength, dexterity level, and height. Then you will be provided with a shopping list containing different items which are placed on shelves. Read the list and from the items on the shelves, select the items which you would like to simulate buying. After then, place the selected items in the shopping cart and estimate the items' weight while they are in the cart; Thereafter, you should select the preferred method to self-checkout each item and all the items in the cart. After the experiment, you will be asked to fill a short survey. The entire study will last for 40-90 minutes and you will be video recorded only during the shopping/checking out tasks, and the recordings will be only used for ergonomic assessments.

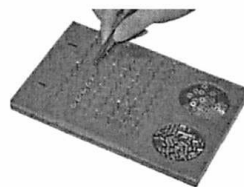
Devices that will be used



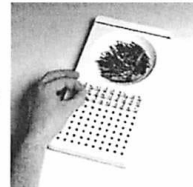
Hand dynamometer: used for testing hand grip strength.



Pinch gauge: measure the force applied between the thumb and the individual fingers on the hand.



Michigan dexterity test: used to assess for any form of work that requires the manual manipulation



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| ISU IRB # 1 | 16-499 |
| Approved Date: | 30 January 2017 |
| Expiration Date: | 29 January 2019 |

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Risks or Discomfort:

No significant risk is expected in this study beyond what experienced in the normal shopping environment.

Confidentiality:

In any document we may publish, we will not include any information that may identify you as a participant. Video recordings will not be published or shared when results are disseminated. Research records, including video recordings, will be stored securely using Cybox, ISU's secure cloud storage system. Only the research team will have access to all research records. After the study is complete and the related research article(s) approved, all video recordings will be securely deleted.

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information.

Voluntary Nature of the Study:

Your participation is completely voluntary. If you decide to participate, you are free to stop at any time without any responsibilities or penalties. Your preferences and some general information will be obtained from you after the experiment, this is by using surveys' and interview questions. You may choose not to answer any of the questions. If you are a student in any of Dr. Stone's classes, your choice to participate will not affect your grades or relationship with Dr. Stone in anyway. If you have any concern, you can skip any part of the study.

Costs and Compensation:

You will not have any costs from participating in the study.

If you are a student in one of Dr. Stone's classes and participated in this study, you will receive up to 5 extra credit points for participating in this study. If you only participate in a portion of the study, you will be given full credit as long as you signed the consent form. You may alternatively, choose to complete an auxiliary homework based extra assignment worth the same amount of points.

If you are not a student in any of Dr. Stone's classes, no compensation will be offered.

Contacts and Questions:

The principal investigator of this study is Ahmad Mumani. You are encouraged to ask questions at any time during this study. For further information or any questions later, you are encouraged to contact him at Iowa State University, Industrial and Manufacturing System Engineering

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department, aamumani@iastate.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the principal investigator, you are encouraged to contact Dr. Richard Stone at Iowa State University, Industrial and Manufacturing System Engineering department, 3027 Black Engineering, rstone@iastate.edu.

If you have any questions *about the rights of research subjects or research-related injury*, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Statement of Consent:

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's Name (printed) _____

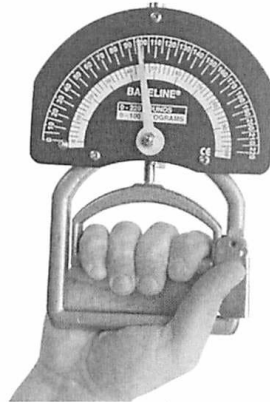
Participant's Signature

Date

Attachment 5-Devices

Hand Dynamometers

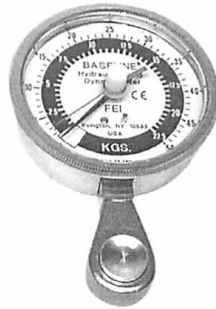
A Hand Dynamometer is used for testing hand grip strength. For some applications, they can be used to give a general index of a person's overall body strength. Grip strength testers are also used to test comparative strength in the left and right arms.



Hand Dynamometer

Pinch Gauge

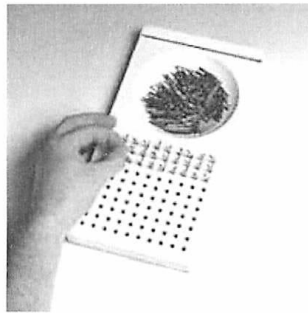
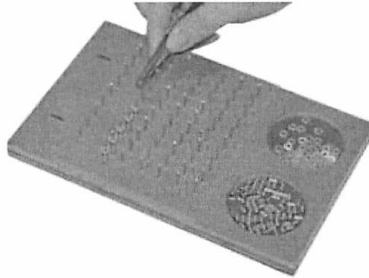
Pinch Gauges are dynamometers that measure the force applied between the thumb and the individual fingers on the hand.



Pinch Gauge

Attachment 5-Devices

Dexterity test



Michigan dexterity test

Attachment 6: Shopping list

Suppose that you want to buy the following items from the shelves in front of you, pick the items that you would like to buy. Put these items in the cart and fill columns 1-3

| Item # | Item name | 1. Check the items selected <i>For Participants</i> | 2. Estimated weight <i>For Participant</i> | 3. Preferred self-checkout method * | 3. Items ID <i>For researcher</i> |
|--------|-------------------|--|---|-------------------------------------|--------------------------------------|
| 1 | Cereal | | | | |
| 2 | Flour | | | | |
| 3 | Pickles | | | | |
| 4 | Ice cream | | | | |
| 5 | 12 pack Soda | | | | |
| 6 | Coffee can | | | | |
| 7 | Dog food | | | | |
| 8 | Egg | | | | |
| 9 | Orange juice | | | | |
| 10 | Laundry detergent | | | | |
| 11 | Pasta sauce | | | | |
| 12 | Cooking oil | | | | |
| 13 | Frozen pizza | | | | |
| | | | | All items | |

*Scanning technologies

Bi-optic scanner



handheld scanner



Attachment 7- survey

Select the choice that best represents your response

1. What is your gender?

Male Female

2. How old are you? Years

3. How tall are you? Feet Inch

4. Are you right-handed or left-handed?

Right handed Left- handed

5. On average, how many times do you visit the shopping districts each week?

1 -3 times 4-6 times 7-9 times 9+ times

6. Before visiting shop districts, usually

I prepare a list of items needed I don't prepare a list of items needed

7. Who is the primary shopper in your family?

I my dad my mother other members

8. When deciding on the items to be bought, what factors affecting your purchase decision.

Choose all that apply

Brand Name

weight of the package

Price

size of the package

The amount contained in the package

ease of handling the package

Exterior packaging (appearance)

Attachment 7- survey

9. As for the items you selected in the experiment how frequently you buy them every week.

| Item # | Item name | Frequency of purchase # |
|--------|-------------------|-------------------------|
| 1 | Cereal | |
| 2 | Flour | |
| 3 | Pickles | |
| 4 | Ice cream | |
| 5 | 12 pack Soda | |
| 6 | Coffee can | |
| 7 | Dog food | |
| 8 | Egg | |
| 9 | Orange juice | |
| 10 | Laundry detergent | |
| 11 | Pasta sauce | |
| 12 | Cooking oil | |
| 13 | Frozen pizza | |

Experiment Document: Shopping List

Attachment: 6: Shopping list

Suppose that you want to buy the following items from the shelves in front of you, pick the items that you would like to buy. Put these items in the cart and fill columns 1-3

| Item | Item name | 1. Check the items selected | 2. Estimated Net Weight | 3. Estimated Overall Weight | 4. Preferred self-checkout method |
|------|--------------|-----------------------------|-------------------------|-----------------------------|-----------------------------------|
| 1 | Milk | | | | |
| 2 | Tomato Sauce | | | | |

*Scanning technologies

Bi-optic scanner



handheld scanner



Experiment Document: Survey

Attachment 7: Survey

Select the choice that best represents your response

1. What is your gender?

Male Female

2. How old are you?.....Years

3. How tall are you?.....Feet.....Inch

4. Are you right-handed or left-handed?

Right handed Left- handed

5. On average, how many times do you visit the shopping districts each week?

I -3 times 4-6 times 7-9 times 9+ times

6. Before visiting shop districts, usually

I prepare a list of items needed I don't prepare a list of items needed

7. Who is the primary shopper in your family?

I my dad my mother other members

8. When deciding on the items to be bought, what factors affecting your purchase decision. Choose all that apply

- | | |
|--|---------------------------------|
| a. Brand Name | b. Weight of the package |
| c. Price | d. Size of the package |
| e. The amount contained in the package exterior packaging (appearance) | f. Ease of handling the package |

Attachment 7: Survey

9. As for the items you selected in the experiment how frequently you buy them every week.

| Item | Item name | Frequency of purchase # |
|------|--------------|-------------------------|
| 1 | Milk | |
| 2 | Tomato Sauce | |