

AC2 Report: Potato Peeler Testing and Evaluation

Summary:

The aim of this report is to develop and evaluate new high-end potato peeler designs.

I have conducted research into the development of two new potato peeler designs with the emphasis on ease of use and focus on users with impaired use of the hands. (Impaired dexterity, muscular dystrophy, arthritis, etc.) After the research I had ended up with two different designs with different blade orientations. The aim of this report is to evaluate the effectiveness of these two designs through the use of a test group of users who will scrutinise two prototypes of the designs against off the shelf competitors.

Design Issues:

After completion of research I identified a few problems with existing products which I feel would help me in the design stage.

With regards to the type 1 peeler, during empathetic testing I noticed that the narrow handle was difficult to hold with reduced hand strength and finger traverse. I should aim to take this with an enlarged handle which will allow the user to grip the handle with less movement of the fingers. This will likely also help users without the impairments since the enlarged handle will allow for grip in a more open hand reducing joint stress in the fingers.

I felt that the use of more exaggerated ergonomic shaping would help the type 2 peeler. When conducting practical testing I identified that the smooth surface of the tested type 1 design had the potential to become rather slippery given particular circumstances. The improved shaping should allow the user more grip at a macro level rather than relying on friction which would have reduced effectiveness if a fluid were allowed to come between the users hand and the handle. Also worth noting, when looking at user with reduced finger strength they would have to be less reliant on friction since reduced hand strength makes for lessened grip effect from friction.

With the same model of peeler I noticed that the peeler needed to be used with a particular technique. The technique in question required the user to hold the peeler with their 4 fingers while pushing the vegetable being peeled through the blade with the thumb on the same hand, supporting the vegetable with the other hand. I feel that this technique is a little complicated for some uses who might not peel vegetables regularly and also probably requires too much hand strength for a user with dystrophy or arthritis. I should aim to either make it easier to use this technique or just eliminate the need to use it. This might be achieved by either removing the handle replacing it with a different structure to hold the blade or designing a tool to go with the peeler that will make the process easier.

An improvement which I feel might be necessary to either peeler type would be finger holes, holes in the handle which the user would slot their fingers into. The aim of this would be allow solid grip of the peeler without any movement of the fingers. The effect of this would be zero stress in the fingers given that no movement is necessary. This would enable grip for users with impaired use of the hands to be equal to that of a user with perfectly healthy hands.

Design interventions

Description of the two designs taken forward discussing the features and enhancements applied.

For the type 1 peeler design I produced I decided to focus on the ability to grip the peeler when in use. This was due to a tendency to drop caused by an unusual method which required you to grip the peeler without using your thumb. Instead using your 4 fingers to grip and your thumb being used to push the vegetable through the blade. This method is difficult to get used to quickly, so I designed the new one, so the user doesn't have to use this method unless they prefer it. I achieved this using two handles, a narrow one to make the traditional method possible and a wider one to make a proper grip more comfortable and more effective.

For peeler type 2 I decided to take the ergonomic features as seen in existing products and greatly enhance them. I chose to enhance features such as the Thumb rest on the top of the blade and the curved surface on the underside which in theory would provide for a better grip and an overall better experience with regards to comfort and usability.

Test Method

To assess the effectiveness of the new designs I will need to measure a few aspects of the prototypes and the chosen existing products to determine whether an improvement has been reached.

I would like to measure the following:

- User opinion on comfort
- User opinion on Aesthetics
- User opinion on Usability
- User impression on overall experience
- Amount of peel removed from vegetable/efficiency of the peeler
- Time taken to peel the vegetable

Given that some of these variables are subjective qualities I will require a substantial test group to counter to variation in opinion and judge each aspect for all peelers tested to get an average rating.

The testing itself will be carried out using a questionnaire and a testing session. The questionnaire will use a scale on which a score can be given for each tested quality and all tested users will be able to rate their opinion on this scale from a 0, very negative, to a 10, very positive and a rating of 5 would indicate indifference. This would provide a reasonably accurate way of determining what people think of the product. The weight of the potato before will be recorded on the questionnaire for ease of application to results tables later in the experiment.

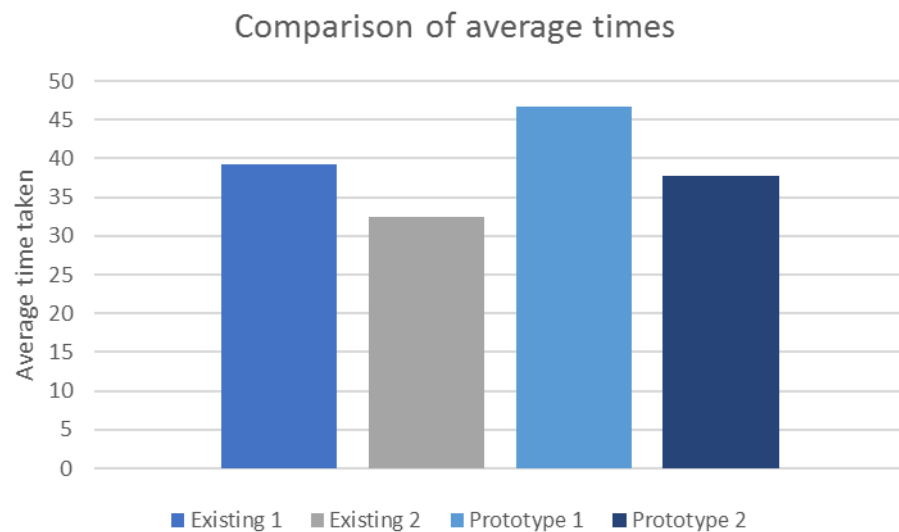
The Questionnaires will be completed during a test session which will be carried out 1 user at a time. At the start of the session the test user will be instructed on how to fill in the question sheet and what they will be required to do. The users will peel a single potato with one of the peelers and will be asked upon completion to fill in the questionnaire meanwhile I as the invigilator will measure the weight of the tested potato before and after to get an initial weight and a weight change while also timing the user to peeling the potato. This will be done for each peeler and results will be put into a table which will allow for later manipulation.

Results

Here I will discuss the results of the experiment. I will look at the implications of the results and what they indicate as far as the design is concerned.

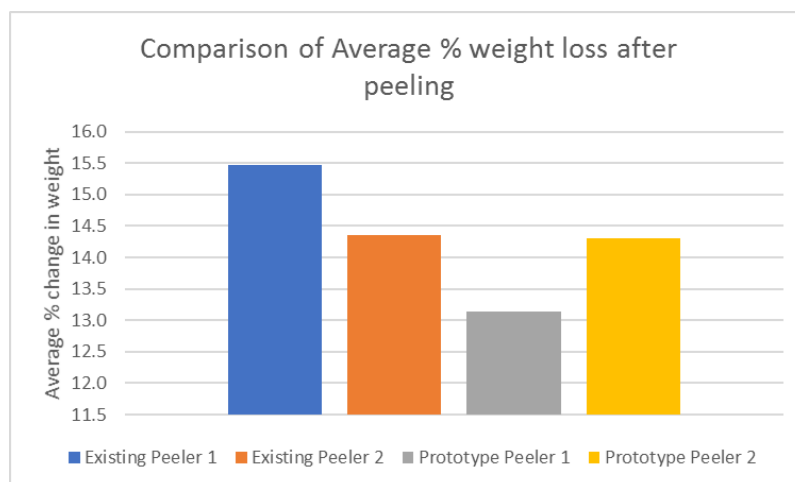
I will look at each measured aspect and compare the results between each peeler then identify whether the prototype peelers are improved over the two existing products I tested initially.

Difference in average time taken to peel a single potato



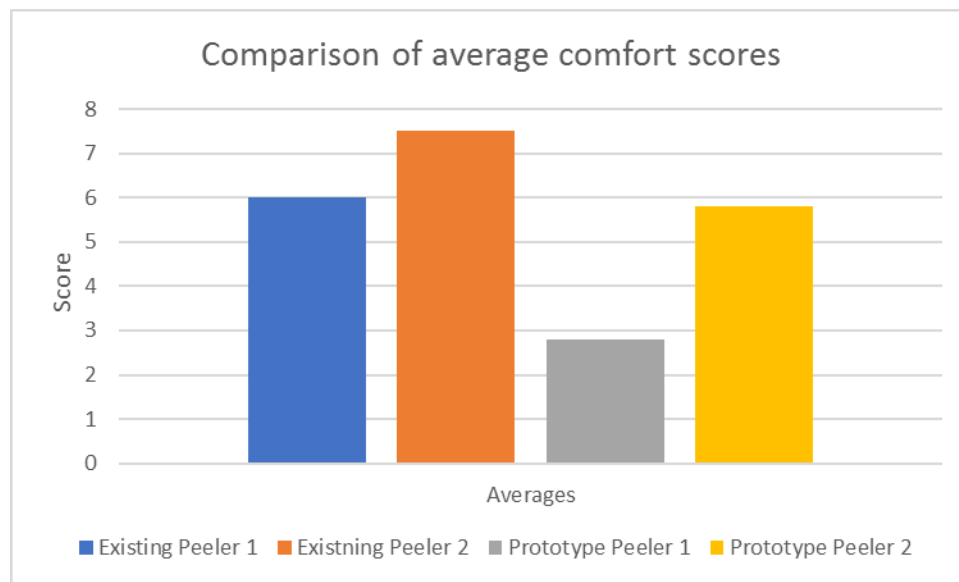
Lower is better. The time taken is a good comparative indicator of the type of efficiency which can be expected from the different peelers. As can be seen in the graph the prototype peelers are in fact slower on average than the existing products. Prototype 1 is 8 seconds slower than the existing type 1 peeler and prototype 2 is slightly better at 5 seconds slower than the competitor product.

Amount of waste produced when peeling



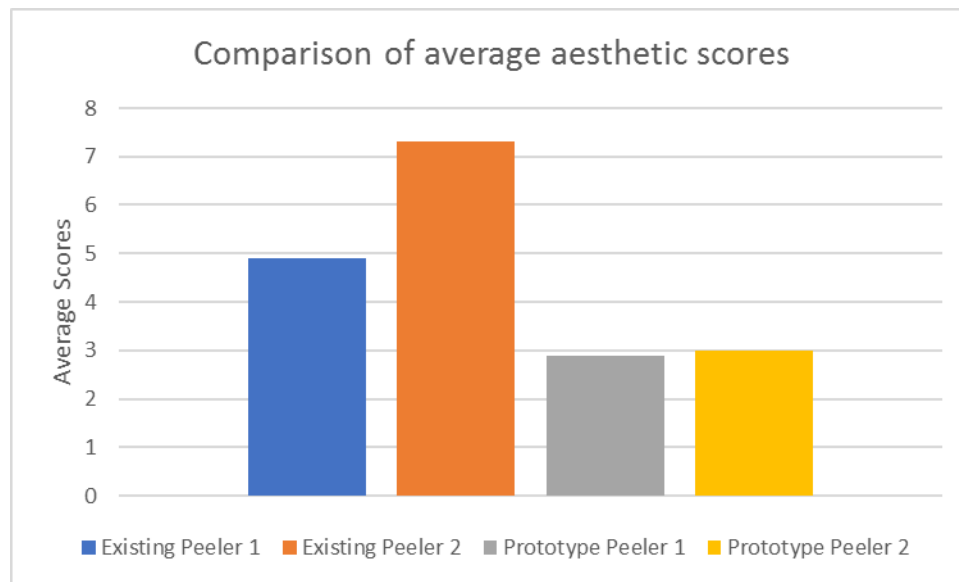
Lower is better. The data indicates that the prototypes performed favourably in this metric. The Type 1 prototype peeler was around 2% more efficient and the Type 2 prototype had pretty much the same level of efficiency.

Average comfort score



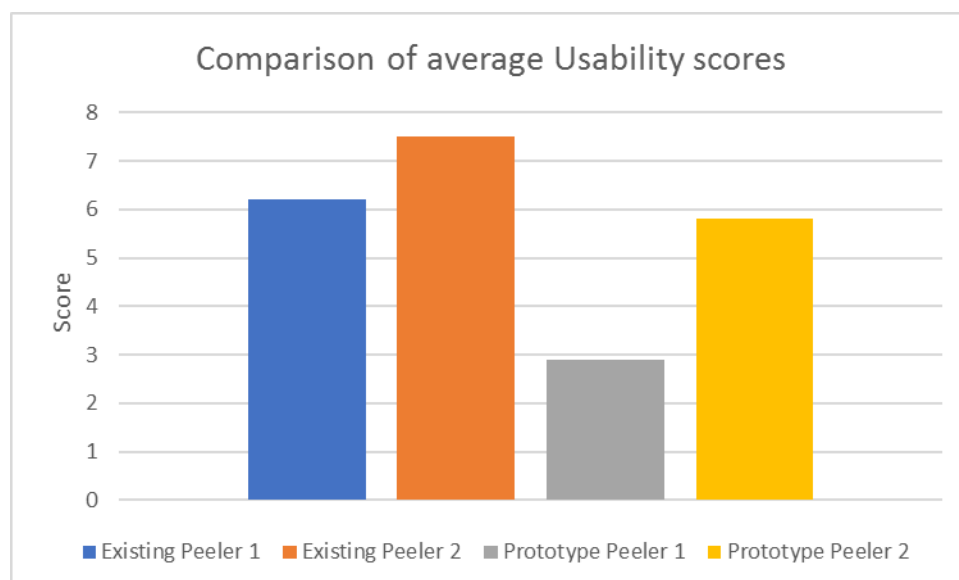
Higher is better. The data clearly shows a significant difference between the prototypes and the existing products in terms of their comfort score. The prototype peelers both scored lower than their existing off the shelf competitors. In the case of type 1 the prototype scored less than half of what the existing product did. This is clearly an area in which major improvement is needed. From initial analysis it seems that the likely causes of this difference is likely to be material and production quality. The wood used for the prototypes has a noticeably coarser surface texture and the lower quality production led to sharp edges and irregular shapes which was not consistent with the design.

Average aesthetic score



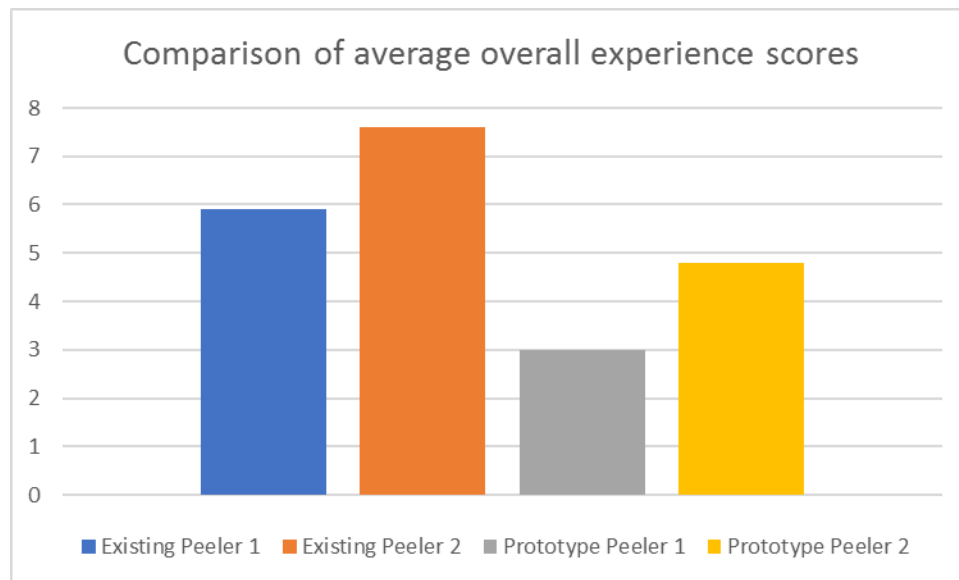
Higher is better. The data shows clear inferiority on the part of the two prototypes. Similar but a more exaggerated version of what can be observed with the 'Comfort' score averages. On analysis I can concur that the prototypes are significantly less 'pretty' than the existing products and will put it down to build quality and material used. The prototypes weren't properly representative of the intended final concept in that the final concept didn't feature the intended finish or materials, this was due to a lack of resources. In future it might be worth considering a computer-generated model with more accurate representation of the visual aspect of the product if it cannot be achieved in physical form.

Average Usability score



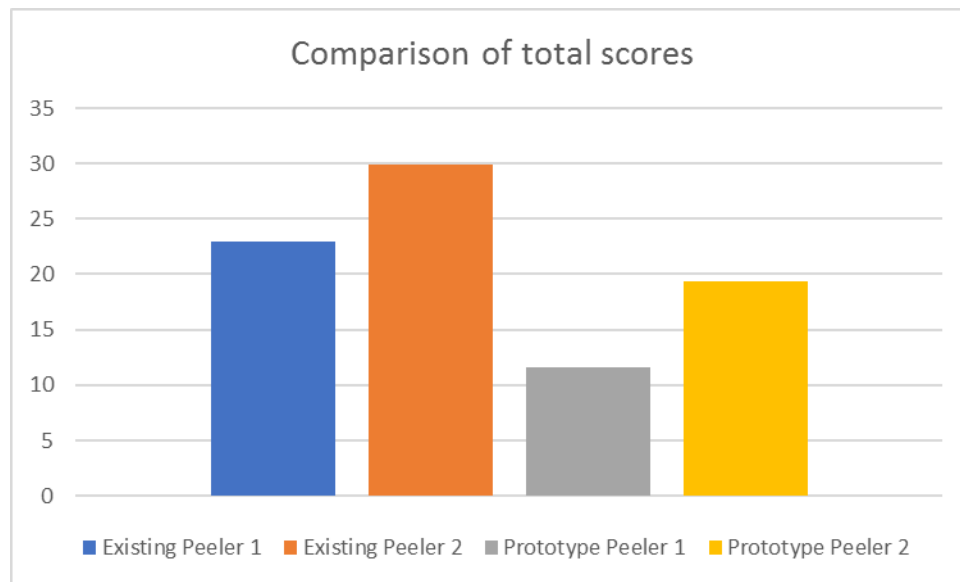
Higher is better. According to the data, the existing prototypes are the stronger scorers again. The type 2 prototype scored well falling not far lower of the type 1 existing product. However, the type 1 prototype scored very low. Upon analysis of the prototype it seems that the unrefined shape and lack of space in the finger hole in the handle may be to blame for the especially low score. This means that there are some serious developments to be made to the aforementioned aspects of the type 1 prototype design.

Average overall user experience score



Higher is better. The trend continues as the prototypes scored less than the existing product which is entirely predictable as this is the overall experience category. The purpose of this category is to account for things which aren't comfort, usability or aesthetics. However, given the wording of the question it is to be expected that they would play a part in the scoring. The leader in this category is the type 2 existing, around 1.5 points behind is the existing type 1 then 1 point behind that is the type 2 prototype. The lowest scorer in this category is the Type 2 prototype with a score of 3 (~1.8 lower than the other prototype).

Average total score



The total score in this case is to be used as an indicator of true all-round quality of the designs/products. As can be predicted the existing product beat out the prototypes, which is to be expected. The prototypes are meant to simulate the use of the final concepts.

Therefore, it is to be expected the Existing off the shelf products are superior to the prototypes. Looking at the graphs you can clearly see that the Type 2 peelers performed better overall than the type 1 peelers and you can also see that the existing performed better than the prototype. The Type 2 existing came first and is the best product in the opinion of the average user. Second came the Existing type 1, third the type 2 prototype and the lowest scoring design was the Type 1 prototype peeler.

Evaluation of results

I feel the prototypes did worse than the existing products for a couple different reasons. I feel the build quality was significantly worse than the existing products. This is to be expected given that the existing products are finalised versions of the product which are being mass produced by machines with a tolerance. This means that the makers of the existing can easily create their products to with an industry standard quality. On the other hand, my prototypes were single handmade productions by a maker with little skill and to add the actual design isn't properly finalised.

Because of the lack of development and the quite experimental nature of the type 1 prototype they were not perfectly ergonomic which led to some damage as far as performance is concerned. I'd be comfortable saying that this design needs far more refinement with regards to ergonomics and shape. It is simply not comfortable or easy to use making it not appropriate for distribution.

The type 2 prototype's performance I'm happy with. It managed to compete at a decent level in comparison to the type 1 existing product despite inferior build quality and materials. However, it wasn't perfect, and I feel that it needs some refinement with regards to the palm rest and the addition of a thumb rest.

Test method

The test method was successful in producing credible answers reasonably quickly. I feel there could have been a couple areas for improvement. For instance, I feel like the main area for improvement was the lack of detail when users were giving feedback. This would make it far easier to identify problems with the prototypes and resolve them in further development.

However, overall I feel the report achieved what it set out to do and got a satisfactory result.

Appendix

Time comparison table

	Existing 1		Existing 2		Prototype 1		Prototype 2	
PARTICIPANTS	Time	Difference	Time	Difference	Time	Difference	Time	Difference
P1	47	-9	32	-4	56	9	36	4
P2	31	-11	24	-8	42	11	32	8
P3	37	-4	30	-23	41	4	53	23
P4	27	-7	27	-7	34	7	34	7
P5	41	-5	29	3	46	5	26	-3
P6	50	-9	35	-4	59	9	39	4
P7	26	-4	25	-10	30	4	35	10
P8	40	-2	37	3	42	2	34	-3
P9	63	-16	56	-1	79	16	57	1
P10	30	-8	29	-3	38	8	32	3
Averages	39	-8	32	-5	47	8	38	5

Peeling efficiency table

Participants	Existing Peeler 1			Existing Peeler 2			Prototype Peeler 1			Prototype Peeler 2		
Participants	Mass of potato	Mass removed	% removed	Mass of potato	Mass removed	% Removed	Mass of potato	Mass removed	% Removed	Mass of potato	Mass removed	% Removed
P1	65.00	10.00	15.38	59.00	8.00	13.56	66.00	8.00	12.12	65.00	9.00	13.85
P2	67.00	9.00	13.43	65.00	9.00	13.85	68.00	10.00	14.71	66.00	9.00	13.64
P3	66.00	11.00	16.67	62.00	10.00	16.13	66.00	9.00	13.64	62.00	10.00	16.13
P4	59.00	10.00	16.95	61.00	9.00	14.75	62.00	8.00	12.90	75.00	12.00	16.00
P5	58.00	7.00	12.07	62.00	10.00	16.13	70.00	12.00	17.14	78.00	14.00	17.95
P6	62.00	10.00	16.13	56.00	7.00	12.50	64.00	7.00	10.94	69.00	11.00	15.94
P7	61.00	10.00	16.39	58.00	8.00	13.79	67.00	9.00	13.43	62.00	8.00	12.90
P8	58.00	8.00	13.79	60.00	9.00	15.00	56.00	6.00	10.71	56.00	7.00	12.50
P9	61.00	12.00	19.67	58.00	8.00	13.79	62.00	7.00	11.29	54.00	6.00	11.11
P10	57.00	8.00	14.04	65.00	9.00	13.85	66.00	9.00	13.64	56.00	6.00	10.71
Averages	61.40	9.50	15.47	60.60	8.70	14.36	64.70	8.50	13.14	64.30	9.20	14.31

Comfort score table

	Existing Peeler 1	Existing Peeler 2	Prototype Peeler 1	Prototype Peeler 2
P1	6	7	5	7
P2	7	8	2	5
P3	6	7	3	6
P4	7	7	4	5
P5	5	9	3	6
P6	4	7	2	6
P7	6	8	1	7
P8	5	6	3	3
P9	7	7	2	6
P10	7	9	3	7
Averages	6	8	3	6

Aesthetics score table

Participants	Existing Peeler 1	Existing Peeler 2	Prototype Peeler 1	Prototype Peeler 2
P1	5	7	3	2
P2	5	8	3	2
P3	6	9	5	3
P4	5	7	3	4
P5	4	7	4	3
P6	6	7	2	3
P7	5	8	2	2
P8	4	7	2	3
P9	2	6	3	5
P10	7	7	2	3
Averages	5	7	3	3

Usability score table

Participants	Existing Peeler 1	Existing Peeler 2	Prototype Peeler 1	Prototype Peeler 2
P1	6	8	6	5
P2	8	8	4	6
P3	7	7	3	6
P4	6	9	1	5
P5	6	7	3	5
P6	5	7	2	6
P7	7	8	3	7
P8	6	6	3	6
P9	3	8	1	7
P10	8	7	3	5
Average score	6	8	3	6

Overall experience table

Participants	Existing Peeler 1	Existing Peeler 2	Prototype Peeler 1	Prototype Peeler 2
P1	6	7	5	5
P2	7	8	3	4
P3	5	7	2	6
P4	6	8	3	5
P5	5	8	3	5
P6	6	7	3	6
P7	6	8	2	6
P8	5	6	3	3
P9	6	9	2	3
P10	7	8	4	5
Averages	6	8	3	5

Total score table

Participants	Existing Peeler 1	Existing Peeler 2	Prototype Peeler 1	Prototype Peeler 2
P1	23	29	19	19
P2	27	32	12	17
P3	24	30	13	21
P4	24	31	11	19
P5	20	31	13	19
P6	21	28	9	21
P7	24	32	8	22
P8	20	25	11	15
P9	18	30	8	21
P10	29	31	12	20
Averages	23	30	12	19

Questionnaire: Potato peelers

The aim of this questionnaire is to gather your opinion on new prototype peelers currently under development.

You will be asked to use the prototype peelers and two other 'currently for sale' examples of peelers. For each peeler, you will be asked 4 questions and to place your answer on a 1 to 10 scale to demonstrate your opinion on the topics addressed on the questionnaire. An answer lower than 5 will represent a negative reaction to the question, an answer closer to the middle of the scale will show indifference and an answer higher than 5 will show a positive reaction to the question.

If you have any specific feedback not addressed in the questions asked please use the notes section to record your feedback.

Peeler no 1: Wilkos Straight bladed peeler

Q1: How comfortable or uncomfortable was the peeler in question to hold?

(please use the scale below to record your answer)

1 ←————→ 10

Q2: How much do you like or dislike the appearance of the potato peeler in question?

(please use the scale below to record your answer)

1 ←————→ 10

Q3: How easy or difficult was it to use this particular peeler?

(please use the scale below to record your answer)

1 ←————→ 10

Q4: How would you rate your overall experience of using this product?

(please use the scale below to record your answer)

1 ←————→ 10

Notes:

Peeler no 2: Wilkos Y-shaped peeler

Q1: How comfortable or uncomfortable was the peeler in question to hold?

(please use the scale below to record your answer)

1 ←————→ 10

Q2: How much do you like or dislike the appearance of the potato peeler in question?

(please use the scale below to record your answer)

1 ←————→ 10

Q3: How easy or difficult was it to use this particular peeler?

(please use the scale below to record your answer)

1 ←————→ 10

Q4: How would you rate your overall experience of using this product?

(please use the scale below to record your answer)

1 ←————→ 10

Notes:

Peeler no 2: Wilkos Y-shaped peeler

Q1: How comfortable or uncomfortable was the peeler in question to hold?

(please use the scale below to record your answer)

1 ←————→ 10

Q2: How much do you like or dislike the appearance of the potato peeler in question?

(please use the scale below to record your answer)

1 ←————→ 10

Q3: How easy or difficult was it to use this particular peeler?

(please use the scale below to record your answer)

1 ←————→ 10

Q4: How would you rate your overall experience of using this product?

(please use the scale below to record your answer)

1 ←————→ 10

Notes:

Peeler no 4: Prototype Y-shaped peeler

Q1: How comfortable or uncomfortable was the peeler in question to hold?

(please use the scale below to record your answer)

1  10

Q2: How much do you like or dislike the appearance of the potato peeler in question?

(please use the scale below to record your answer)

1  10

Q3: How easy or difficult was it to use this particular peeler?

(please use the scale below to record your answer)

1  10

Q4: How would you rate your overall experience of using this product?

(please use the scale below to record your answer)

1  10

Notes:

To finish, please tick or fill boxes appropriate to your demographics

Sex: ☐ Male
☐ Female

Age:

Handedness: ☐ Right
☐ Left