QUOOKER F&B

APPENDICES

APPENDIX A: INTERVIEW QUESTIONS F&B RESEARCH

Voor mijn master Integrated Product Design ben ik in samenwerking met Quooker BV onderzoek aan het doen naar het gebruik van kokend water in de horeca. Quooker is benieuwd of het huidige product voldoende aansluit op de behoeftes in deze markt of dat er wellicht een aangepast product ontwikkeld moet worden om echt van toegevoegde waarde te kunnen zijn. Om dit te achterhalen wil ik u een aantal vragen stellen.

1. Toepassingen: over het algemeen, wat is de meeste gebruikte toepassing van kokend water binnen uw organisatie (hete dranken, koken, hygiëne)?

Hete dranken	→ Welke soort hete dranken? → Hoe belangrijk is de kwaliteit van water?
Koken	→ Welke gerechten?
Hygiene	→ Schoonmaak van wat?

2. Hoofdreden aanschaf (indien van toepassing): Wat is de hoofdreden dat u een Quooker heeft aangeschaft (tijdswinst, gebruiksgemak, veiligheid, kostenbesparing)?

3. Alternatief: Als u niet in het bezit van een kokendwaterkraan was geweest, hoe had u dan kokend water verkregen? Wat zijn de na - of voordelen t.o.v een Quooker kraan?

4. Limitaties: Zijn er limitaties waar u momenteel tegenaan loopt tijdens het verkrijgen van kokend water voor een bestelling?

5. Behoeftes: Als u een functionaliteit kon toevoegen aan de Quooker (of alternatief apparaat), wat zou dit dan zijn?

6. Tijdwinst: Waar denkt u dat momenteel in een bestelling die kokend water vereist, de meeste tijd wordt verloren/ kan worden gewonnen? Hoe belangrijk is tijdwinst bij een bestelling binnen uw organisatie?

7. Besparing : Hoeveel inzicht heeft u in de hoeveelheid water of energie die bespaart wordt door het gebruik van de Quooker? Zou u hierin geinteresseerd zijn? Waarom wel/niet?

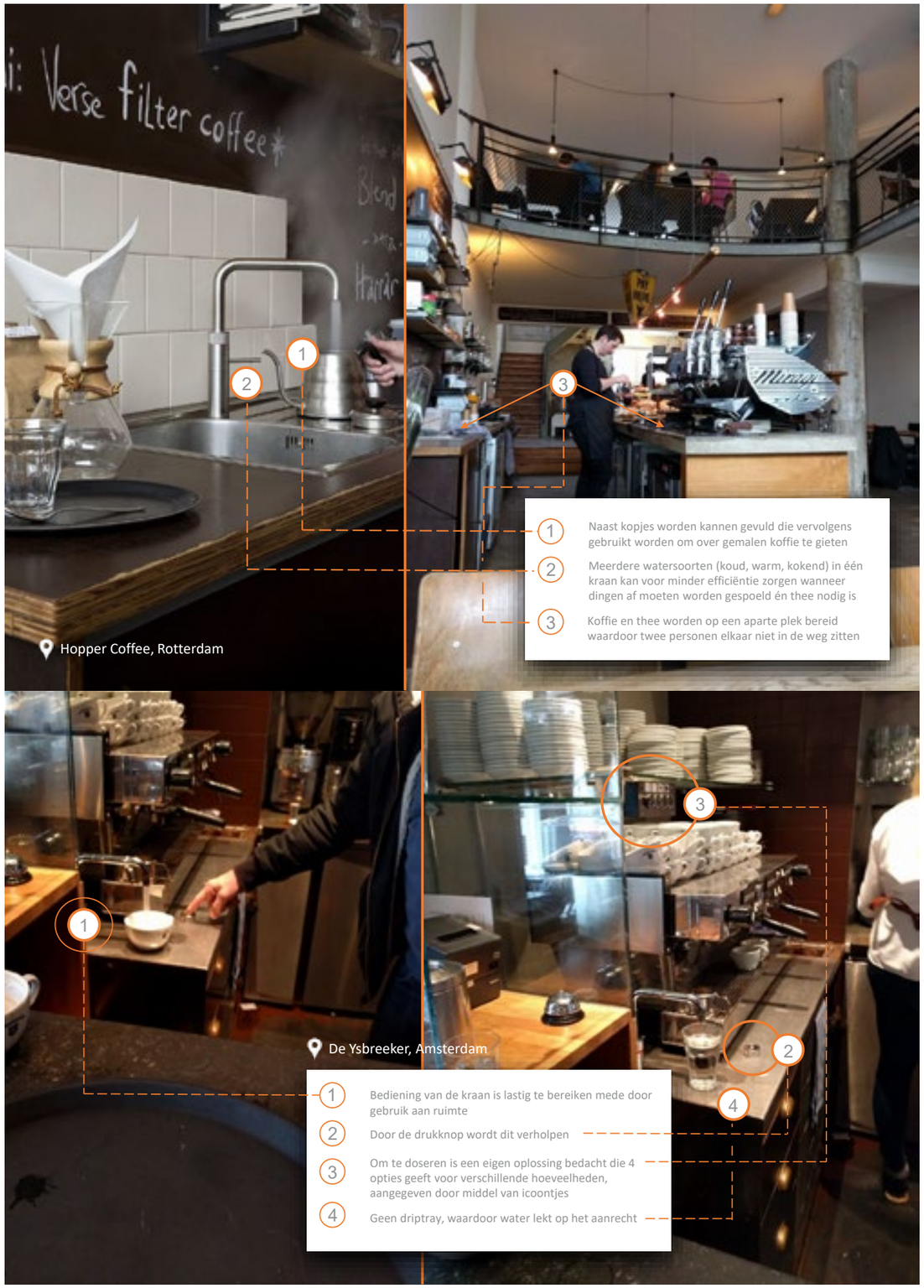
8. Flexibiliteit: Hoe flexibel bent u in het afstellen van uw kokend water (temperatuur, hoeveelheden, stroom, filter, beweeglijkheid). Bent u tevreden over deze flexibiliteit?

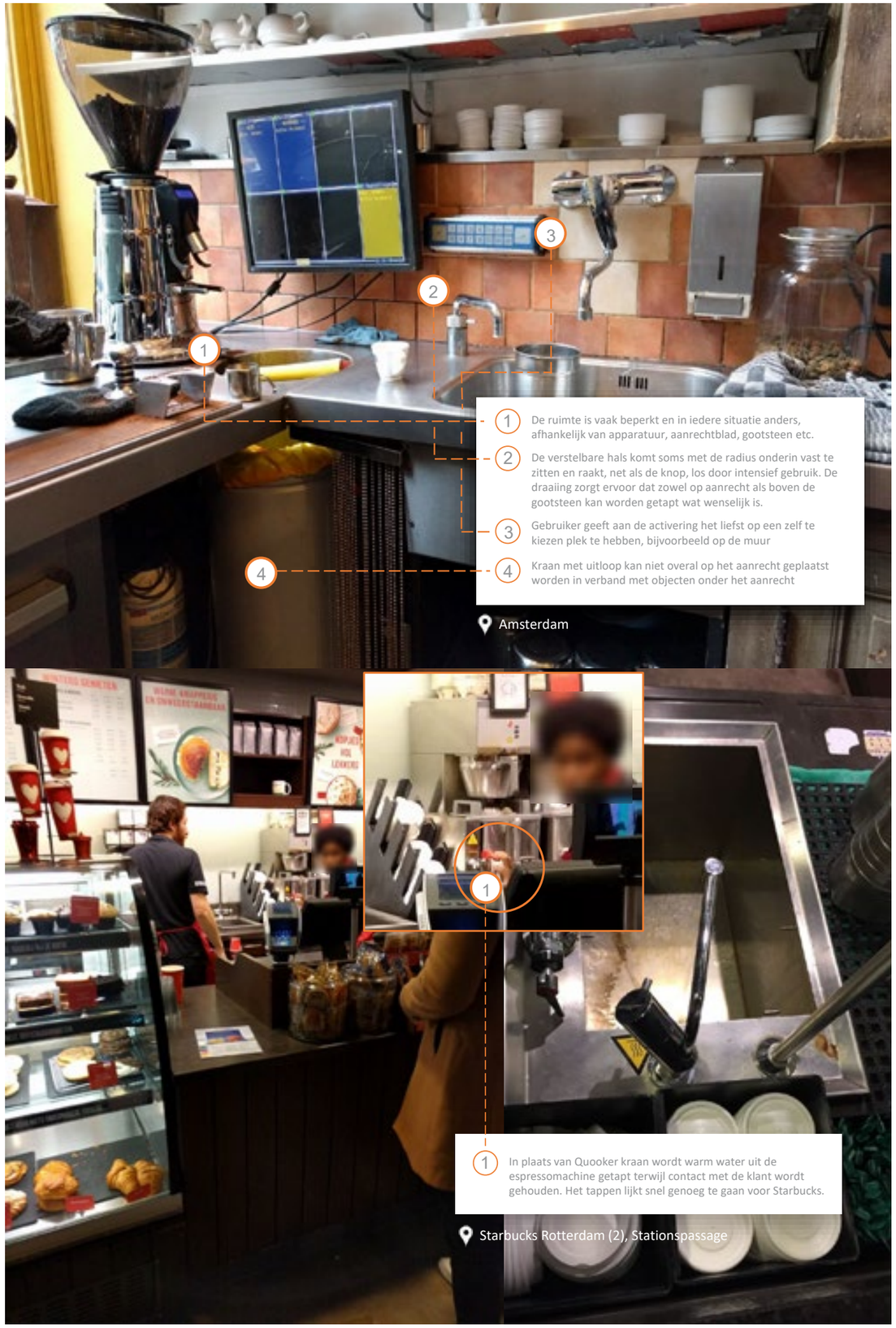
9. Types water: Wat voor types water gebruikt u binnen uw organisatie (gekoeld, bruisend etc.). Zou het voor u interessant zijn dit uit te kraan te kunnen halen?

10. Pulsknop : Bent u tevreden over de huidige pulsknop? Waarom wel/niet? Zou u zonder kunnen? Zou u het interessant vinden bepaalde standaard hoeveelheden water in te kunnen stellen?

11. Service: Bent u tevreden over de huidige service? Al u kon kiezen tussen het leasen en het kopen van een Quooker, wat zou dan uw voorkeur hebben? Waarom?

APPENDIX B: OBSERVATIONS F&B KITCHENS





1. De ruimte is vaak beperkt en in iedere situatie anders, afhankelijk van apparatuur, aanrechtblad, gootsteen etc.
2. De verstelbare hals komt soms met de radius onderin vast te zitten en raakt, net als de knop, los door intensief gebruik. De draaiing zorgt ervoor dat zowel op aanrecht als boven de gootsteen kan worden getapt wat wenselijk is.
3. Gebruiker geeft aan de activering het liefst op een zelf te kiezen plek te hebben, bijvoorbeeld op de muur
4. Kraan met uitloop kan niet overal op het aanrecht geplaatst worden in verband met objecten onder het aanrecht

Amsterdam

1. In plaats van Quooker kraan wordt warm water uit de espressomachine getapt terwijl contact met de klant wordt gehouden. Het tappen lijkt snel genoeg te gaan voor Starbucks.

Starbucks Rotterdam (2), Stationspassage

Amstel Hotel, Amsterdam

1. Door bij de gootsteen te plaatsen kunnen ook grotere kannen gevuld worden zonder verstelbare hoogte, echter kan de gebruiker dan geen andere dingen doen en heeft beide handen nodig
2. Vanaf rechts is deze kraan nauwelijks te bedienen doordat de mengkraan in de weg zit
3. Het plaatsen van een driptray mét afvoer is hier niet mogelijk door aanwezigheid van lades/kastjes onder het aanrecht

1. Door de plaatsing is de kraan moeilijk te bedienen en wordt volgens de werknemers van Starbucks nauwelijks gebruikt

Starbucks Rotterdam (1), Stationshal

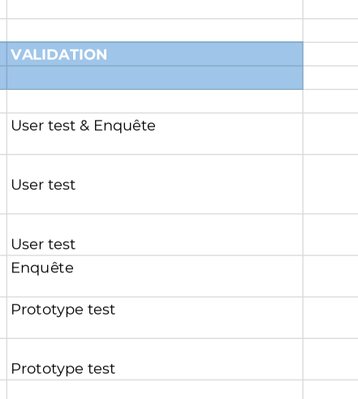
APPENDIX D: PROGRAM OF REQUIREMENTS

	REQUIREMENT	SOURCE	VALIDATION
1. Performance			
1.1	Product interaction fits with the interaction vision qualities: efficient, safe & intuitive.	Interaction vision	User test & Enquête
1.2	System allows to obtain and adjust two preset amounts of boiling water and one option for an ongoing flow	User Research (orientation phase)	User test
1.3 Wish	System allows to tap >10 cups of 200 ml per minute.	User Research (orientation phase)	User test
1.4 Wish	Product interaction appeals to all sectors within the F&B industry.	Strategic direction	Enquête
1.5	Valve for standardized amounts provides consistent volumes under different water pressure levels.	FMEA analysis	Prototype test
1.6	Interface should allow for adjustment of the tap neck to at least 2 heights.	User Research (orientation phase)	Prototype test
1.7	Interface warns user for potential danger of boiling water	Function analysis	Prototype test
1.8	Interface allows to be operated with wet hands	User interaction research	Prototype test
1.9	Interface allows to cancel orders after activation	Function analysis	Prototype test
1.10	Interface requires minimal amount of space on the kitchen counter	User interaction research	3D CAD Model
1.11	Interface can be detached from the tap and used as stand alone product	Quooker	Prototype
1.12	Should provide space for PCB and electric components of the interaction panel (chapter 8.2: 70mm x 20mm x 15mm)	Interaction panel research	Prototype
1.13	Lift the tap > 5 mm of the counter to provide space for interaction panel wire (chapter 8.2)	Housing body research	Prototype
1.14	Surfaces are easy to clean and do not hold the potential for moist and bacteria to accumulate	Norm study	Prototype
1.15 Wish	Option layouts can be easily changed	Quooker concept evaluation	Prototype
1.16	Required current < 20mA (max current delivered by connected reservoir)	Quooker	Prototype
1.17	Finger interaction areas have a minimal diameter of 11 mm	Housing body research	Prototype
1.18 Wish	Finger interaction areas are located 13mm apart	Housing body research	Prototype
1.19	Options can be activated by push- or touching motion (user interaction research)	User interaction research	Prototype
1.20	Provides tactile confirmation feedback during activation	User interaction research	Prototype
1.21	Should fixate tap in holes ranging in diameter from 35m to 38 mm.	Housing body research	Prototype
1.22	Leave space for Ø3mm wire to be pulled through and reach the reservoir	Housing body research	Prototype
1.23	LED's communicate in different colors for "stand-by" and "warning" mode	Interaction panel research	Prototype

APPENDIX C: FMEA

	Item/Function	Potential Failure Mode	Potential Effect(s) of Failure	S E V	Potential Cause(s) of Failure	O C C	Current Design Controls (Prevention)	R P N
Operational	The handle (1) allows the operator to interact with the product and activate boiling water / The spout (12) allows to adjust the height of the outlet	Radius of the spout (12) is too narrow	The handle(1) can not be turned or pushed which could be interpreted as become unusable, the boiling water inflow can not be activated	8	Too much force applied by operator while moving the spout(12) downwards	7	4	224
Operational	The handle (1) allows an operator to interact and make the double push-turn movement to activate boiling water	Crabbing or (taking) liquids deep within the internal components of the interface	Internal parts can become brittle (building the white sediment) to become unusable (breakage)	8	Open space of the handle (1) allowing for crabbing liquids (water) and cleaning liquids (vinegar)	6	6	288
Operational	The spout transports the boiling water to the object placed beneath	Operators arms or hands are in line with the outlet during activation	Operator can burn arm or hands	9	Location of the handle(1) relative operator to move the hand (or arm) in line with the outlet of the faucet	4	3	108
Operational	Turn/slide & and allows the operator to make the double-push-turn action and activate boiling water	Pins of S break loose	Turning the handle (1) does not result in the activation of the activation of boiling water	8	Rough and unintended use such as turning the handle (1) the wrong way around	4	2	64
Operational	The guiding tube (4) guides the hose (water) and allows the operator to make the double-push-turn movement	Plastic guiding tube (4) can become brittle	Pins of S break out of 4, turning the handle (1) does not result in the activation of 4 and activation of boiling water.	8	Closing (disagree) entering with the open space (in up) of the handle (1)	4	4	128
Operational	The valve(7) placed in one of the circuits activated allows the operator to obtain a shandelled amount by pushing the interface once	The valve(7) for cascaded amount does not deliver the required amount of water	Cup is only partly filled, water has no electronic which can result in an overflow of water	7	Varying water pressure in bigger organizations with multiple water outlets connected to the same water network	8	3	168
Operational	LED ring (9) warns the user for the potential danger of boiling water	LED ring (9) becomes opaque	Red LED warning the operator for danger is not observable	5	Closing (disagree) entering with the open space (in up) of the handle (1)	4	4	80
Operational	Handle allows the operator to interact with the product and activate boiling water	Handle becomes loose	The handle(1) can be operated not intentionally / Client has a lower appreciation of luxury and robustness	5	Tolerances between 1, 3 and 4	6	4	120

	Item/Function	Potential Failure Mode	Potential Effect(s) of Failure	S E V	Potential Cause(s) of Failure	O C C	Current Design Controls (Prevention)	R P N
Disposal button	The push button allows to activate boiling water by pushing the interface downwards once	Crabbing and (taking) (liquids) inside the internal components of the disposal button	Can cause internal components to become brittle and malfunctioning of electronic components such as the LED	8	Middle part of 12 which allows to be pushed downwards cannot fluids and grease into (water)	8	6	384
Disposal button	LED 4and the side for the potential danger of boiling water	LED does not function	Operator is not alerted for potential danger of boiling water	5	Fluids or grease have affected the PCB	4	3	60
Disposal button	The push button allows to activate boiling water by pushing the interface downwards once	Operators arms or hands are in line with the outlet during activation	Operator can burn arm or hands	9	Movement mechanism (pushing the button that is required to activate the boiling water	4	5	180
Disposal button	The push button allows to activate boiling water by pushing the interface downwards once	Operator is obstructed by the button in performing other tasks as the kitchen counter	Operator can not use part of the kitchen counter to place objects on	6	Button is not flush (flowed) and can not be closed	8	1	48
Disposal button	Attachment mechanism which allows the disposal button to be attached to the kitchen counter	Drilling a hole in the (steel) kitchen counter is not possible	Disposal button can not be placed	6	Thickness and material of counter does not allow drilling in space between counter & wall for storage	5	1	40



6.1	Water spillage is minimized to <1% of required amount.	Internal analysis	User test		
7. Life in service					
7.1	Product should last for at least 5 years or 780.000 repetitions.	Worst case scenario	Durability test	*Out of project scope*	
8. Maintenance					
8.1	Interface allows users to adjust the standard amounts for a cup or pot.	User Research (orientation phase) & Quooker service department	User test		
8.2 Wish	Interface does not require the drilling of additional holes in the counter.	Quooker service department	3D CAD Model		
9. Target product costs					
9.1	Increase in product costs or costs of separate component < €100,-	Based on current solutions & investment costs for producing 2,500 products	Cost price estimation		
10. Quantity					
10.1	2,500 products annually.	Strategic direction	-		
11. Production facilities					
11.1	Product can be produced in house.	Quooker's inhouse production policy	Validate with production department		
11.2 Wish	Interaction panel requires minimal assembly time	Desired max product costs	Prototype		
12. Aesthetics					
12.1	Product fits the minimalistic Jiri style embedded in the current product portfolio.	Style analysis	Questionnaire		
12.2	Stainless steel 316 for steel parts	Style analysis	Prototype		
12.3	Chamfers should be 1 mm in height with an angle of 45 degrees.	Meeting Jiri	Prototype / 3D CAD Model		
12.4	Use of circular shapes close to the diameters included in the tap.	Meeting Jiri	Prototype / 3D CAD Model		
13. Standard & regulations					
13.1	Fixing in wrong position of handles, knobs indicating position of switches or similar components not possible	Norm study	User test	*Out of project scope*	
13.2	Should fit within standard 35 mm fixation hole.	Norm study	3D CAD Model		
14 Quooker product policy					
14.1 Wish	Housing body allows to attach Quooker taps to the counter: - Nordic single tap (Ø40mm base & Ø30mm threaded bush) - Fusion (Ø39,90mm base and Ø34,80mm placeholder for thread and tubes)	Internal analysis / Strategic Direction	Prototype		
15. Reuse and recycling					
15.1	Product is detachable for maintenance or replacement.	Internal analysis /FMEA	Prototype		

2. Reliability					
2.1	Interface has adequate mechanical strengths and is constructed as to withstand rough handling (600 interaction daily).	Norm study / User Research (orientation phase)	Durability test		
2.2	Interface provides protection against harmful ingresion of grease, acids or cleaning liquids.	Norm study / Quooker	Prototype		
2.3	Interface provides protection against harmful ingression of water (IP 21).	Norm study / Quooker	IP 21 Test	*Out of project scope*	
2.4	Interface should not conflict with the radius of the tap neck.	FMEA analysis	3D CAD model		
2.5	Prevent rotation of the panel relative to the tap as a result of pushing force applied by the user	Housing body 3D prints	Prorotype		
3. Safety					
3.1	Interface does not hold the potential to be accidently activated	Norm study	User test		
3.2	Activation should require a physical interaction with the interface	User interaction research	Prototype test		
3.3	No ragged or sharp edges creating a hazard for the user in normal use or during user maintenance.	Norm study	3D CAD model	*Out of project scope*	
3.4	No excessive temperatures in normal use (<44 °C).	Norm study	3D CAD model simulation / Prototype	*Out of project scope*	
3.5	Unlikely that interface makes operator touch parts having a temperature rise exceeding the value specified (<44 °C).	Norm study	User test	*Out of project scope*	
3.6	Interface avoids operator to bring hand or arm in line with the boiling water outlet of the spout.	Interaction User Research	Prototype test		
3.7	Operates on a maximum of 12V	Quooker	Prototype test		
3.8	Interface provides adequate protection against accidental contact with live parts.	Norm study	User test	*Out of project scope*	
4. Materials					
4.1	Materials should be able to withstand 100 °C water.	FMEA analysis	Durability test		
4.2	Materials can withstand grease, acids and cleaning liquids.	Norm study	Durability test		
4.3	Materials do not have the characteristic to corrode or hold moist and bacterias.	Norm study	Durability test		
4.4 Wish	Materials do not decrease as a result of extensive and long use.	Style analysis	Durability test	*Out of project scope*	
5. Ergonomics					
5.1	Interface allows activation with one hand	User & context research / Interaction vision	User test		
5.2	Product should be understandable for novice users with minimal instructions.	User & context research	User test		
5.3 Wish	The interface should be understandable upon first use. (wish)	User Research (orientation phase)	User test		
5.4	Interface can be comfortably activated by operators aged 16-67 for 600 interactions a day.	User Research (orientation phase)	User test		
6. Environment					

APPENDIX E: MORPHOLOGICAL CHART

Allow to be connected without additonal drilling	Use tap hole	Wireless connection							
Guide up and downwards movement of the spout	Clamp bush	Spring							
Communicate options in interface	Integrated	Symbols	Light indications	Sound	Mechanical (push pins)				
Warn user for potential danger	Light	Vibrations	Sound	Symbols	Vibrations	Screw			
Prevent accidental activation	Mechanical safety step	Require use of two hands	User ID identification	Require use of one finger					
Allow hand force exertion	Touch	Button	Sensoric	Turning					
Convert hand force and choice into signal for valve	Mechanical	Magnetic	Electrical						
Transfer signal to valve and reservoir	Mechanical	Electrical	NFC	Bluetooth					
Provide stable amount under fluctuating water pressure	Timed valve	Flow sensor	Estimate volume/ IR-sensors						
Allow to cancel order	Cancel touch icon	Voice: speak to stop	Presence of cup as						
Allow other activities on the kitchen counter	Flush mount	Wireles interface	Include in tap	Dynamic interface					
Protect against ingression of water and detergents	Seal around spout	Interface above outlet	Vertically mounted						

APPENDIX F: USER INTERACTION RESEARCH

QUOOKER F&B INTERACTION RESEARCH

JANUARY 2018

Datum:
Naam:
Kraan:

Voor mijn master Integrated Product Design ben ik in opdracht van Quooker B.V. onderzoek aan het doen naar de ideale kokendwaterkraan voor de HoReCa markt. Met het volgende onderzoek zou ik graag de invloed van verschillende locaties en benodigde handelingen van de bediening met u willen evalueren.

1. LOCATIE

Op de kraan zijn naast uw standaard bediening, drie mock-ups bevestigd die mogelijke alternatieve locaties voor de bediening weergeven. In hoeverre gelden de volgende waarden voor uw huidige **locatie** van bediening:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

LOCATIE A

In hoeverre gelden de volgende waarden voor bedieningslocatie A:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Locatie A zou voor mij wel/niet optimaal zijn omdat:

LOCATIE B

In hoeverre gelden de volgende waarden voor bedieningslocatie B:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Locatie A zou voor mij wel/niet optimaal zijn omdat:

LOCATIE C

In hoeverre gelden de volgende waarden voor bedieningslocatie C:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Locatie A zou voor mij wel/niet optimaal zijn omdat:

CONCLUSIE: De ideale locatie voor activatie is locatie .... omdat:

2. HANDELING

In hoeverre gelden de volgende waarden voor de huidige **handeling** die u dient uit te voeren om de kraan te activeren:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

A: SENSORISCH

Beweeg uw hand over de interface. Hoe ervaart u deze handeling:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Een sensorische bediening zou voor mij wel/niet optimaal zijn omdat:

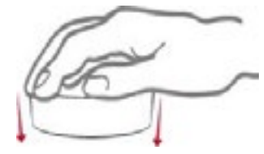
B: TOUCH

Raak met uw vinger de interface aan. Hoe ervaart u deze handeling:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Een bediening op aanraking zou voor mij wel/niet optimaal zijn omdat:

C: DRUK



Druk de interface eenmalig in. Hoe ervaart u deze handeling:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Een drukbediening zou voor mij wel/niet optimaal zijn omdat:

D: DRAAI

Draai de interface. Hoe ervaart u deze handeling:

Inefficient	o	o	o	o	o	*Extreem efficiënt*
Onveilig	o	o	o	o	o	*Extreem veilig*
Niet intuitief	o	o	o	o	o	*Extreem intuïtief*

Een bediening doormiddel van draaien zou voor mij wel/niet optimaal zijn omdat:

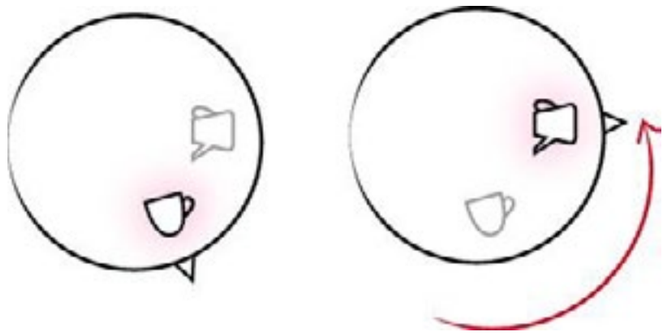
CONCLUSIE: De ideale handeling voor activatie is ..... omdat:

3. OPTIES

Binnen de HoReCa worden vaak dezelfde hoeveelheden kokend water getapt. Deze vraag naar vooringestelde hoeveelheden vraagt om een aanpassing van de interface.

3.1 Onderstaande afbeelding laat drie verschillende versies van een mogelijke gebruikersinterface zijn. Welk van deze interfaces spreekt u het meest aan? Waarom?

A



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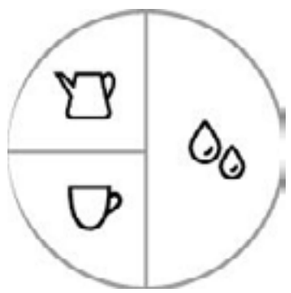


C

3.2 Denkt u dat de keuze voor een van bovenstaande interfaces invloed kan hebben op de efficiëntie, veiligheid en/of intuïtiviteit van het product?

3.3 Mocht u de ingestelde hoeveelheden willen aanpassen, welke manier zou dan uw voorkeur hebben?

3.4 Zijn er overige opmerkingen over de locatie, handeling of de keuze in opties waarvan u denkt dat ze belangrijk zijn in het ontwerp van een nieuwe interface?

In order to test the prefered location and action for activation and the level of integration of different options , a user research among F&B managers was performed. The main research questions were:

- Which location on or around the tap fits best with the desired qualities of the interaction: safe, efficient and intuitive.
- Which action for activating the boiling water fits best with the desired qualities of the interaction.
- Which level of integration of the different options into one ‘’touchpoint’’ fits best with the desired interaction qualities.

- Is the separation of interface and tap considered an essential improvement or benefit?
- Which characteristics of the product are considered when valuing the location and activation of the interface?
- Which context characteristics are considered in the perception of safety, efficiency and intuitivity.
- Which user characteristics are considered in the perception of safety, efficiency and intuivity.

Method

Location

In order to test the influence of the location of the interface on the desired interaction qaulities, different mock ups were 3D printed. These mock-ups allowed users to value the different location for activating the tap. The current location was used as ‘’0-situation’’. The possible interaction locations were found by dividing the tap in three different parts on which interaction could take place, plus the space surrounding the sink or drip tray.

Location 1: Tap frame
Location 2: Tap base
Location 3: Tap neck
Location 4: Counter top

Action

The action that users have to perform to activate the boiling water has shown to influence the efficiency of users in the F&B looking at the current ‘’double-push-turn’’ - interface. Therefore different actions for activating the boiling water where valued on the desired interaction qualities.

Touchless - sensoric
Touchpad
Push motion
Turning

Option integration

In order to obtain different standardized amounts of water, these options are to be integrated into the interface and chosen by the user. The impact of choosing to integrate or separate different options into one ‘’touchpoint’’ was valued on the aforementioned qualities.

Version 1: Cup amount, Pot amount and manual filling combined in one touchpoint
Version 2: Cup and Pot amount combined, manual filling separate
Version 3: Cup amount, Pot amount and manual filling options all separate

CONCLUSION INTERACTION RESEARCH: INSIGHTS

Location insights

High activation

Activation above the boiling water outlet of the faucet is considered as a safe and easy to reach option. By placing the interface on top, there is no danger of moving the arm into harms way. Nevertheless, if constant interaction is necessary, the steam of the boiling water spray can become an issue and result in a lower experience of safety. Guido from Lokaal mentioned: “If you place it on top, you have the steam issue ofcourse, I dont think that that comfortable”. Ed from Guliano also mentioned the steam, but did not think this would represent a problem when being able to push the interface once for a preset amount.

Besides, participants questions whether the location does not lead to a less robust product as interaction might be rough leading to an unstable faucet. A staff member of Guliano mentioned: ‘’I think placing it on top is fine, its just wonder if the tap does not starts to wiggle after multiple repetitions.’’

Body or base activation

In general, all participants are satisfied with activating the tap at the frame or base. It can however give a lower experience of safety as activation requires to move the arm and hand close to the outlet of boiling water, mentioned by Ed from Guliano. It could also be slightly less efficient as the requires movement of the arm is shorter, but this does not make a significant difference compared to activation at the neck.

Stand alone

Guido from Lokaal mentioned the stand alone concept can represent an increase in efficiency in case the tap is placed in a jammed place in which the base or neck of the tap are hard to reach. It does however lower the intuitivity and safety when not being placed close the tap as placing the cup and activation in this case take place at two different locations. Both Ed and Timon confirm this, Timon states: ‘’after a while the muscle memory starts to play a role, you just want to activate the tap at the same place you place your cup without having to move elsewhere.’’

All participants mentioned the importance of the available space at the counter. This space is often limited and used for multiple purposes. Any permanent obstacles placed in this area are therefore undesired. Guido argues: ‘’actually you are always in need of space, we just want to keep the counter surface as empty as possible for other purposes.’’ Being able to freely move the activation unit over the counter would solve this issue and provide the desired flexibility according to Guido.

Because of the different purposes the counter has in kitchens of the F&B industry, proper cleaning of the surface often happens multiple times a day. The change of accumulation around the attached interface or ingression of water and detergents is therefore high.

Action insights

Sensoric

All participants mentioned the sensoric activation is not desired in the F&B industry as the abundancy of activities taking place at the kitchen counter can lead to unintended activation and is therefore considered unsafe.

Touch and push

Compared to the current interface, participants think a pushing or touching motion would be an improvement compared to the current required turning motion. If standard amounts are available it allows for a more efficient workflow in combination with other tasks such as the preparation of coffee. None of the participants mentions the lower safety standards the touch or pushing motion would represent.

3. Integration

Options integrated in turning motion

Enabling to select the options by turning the interface is not desired as you dont want to check the status of this interface anytime you approach the tap. Both Timon, Patrik and Guido mention they do not want to check the status of the interface every time they interact with the product to make sure the right amount is selected. Guido states: ‘’you place a cup and forgot to check whether the cup amount is selected and the cup is already too full’’. Having separate options clearly indicated with symbols is therefore prefered.

APPENDIX G: CONCEPTUALIZATION

Answers on research questions

Which location on or around the tap fits best with the desired qualities of the interaction: safe, efficient and intuitive?

Concerning safety and efficiency, locating the interface on the spout seems to be prefered. However, it does not result in hige advantages compared to activation at the base of the frame which is seen as more intuitive as this is where you expect to interact with a tap. Participants doubt whether placing the interface on the spout would result in a less stable and robust tap. Locating the interface elsewhere on the kitchen counter is not seen as an advantage by all participants, espeically because the surface of the counter and the space beneath often fulfills other purposes.

Which action for activating the boiling water fits best with the desired qualities of the interaction?

A pushing or touching motion is prefered as this creates an significant increase in efficiency compared to turning. All participants mentioned sensoric activation would most likely result in unintended activation and therefore dangerous situations because of other activities happening witin the same space.

Which level of integration of the different options into one ‘‘touchpoint’’ fits best with the desired interaction qualities?

Integrating options into one ‘‘touchpoint’’, for example by turning or choosing options by touch, is not desired. According to all participants, integration would lead to a lower level of efficiency and intuitivity. One participants mentioned the increase in safety when integrating options, but mentioned to attach higher value to efficiency and intuitivty.

Is the separation of interface and tap considered an essential improvement or benefit?

None of the praticipants saw the separate dispense button as a benefit compared to placing the interface on the tap. The decrease in valuable space on the counter was an argument used in three of the four organizations.

Which characteristics of the product are considered when valuing the location and activation of the interface?

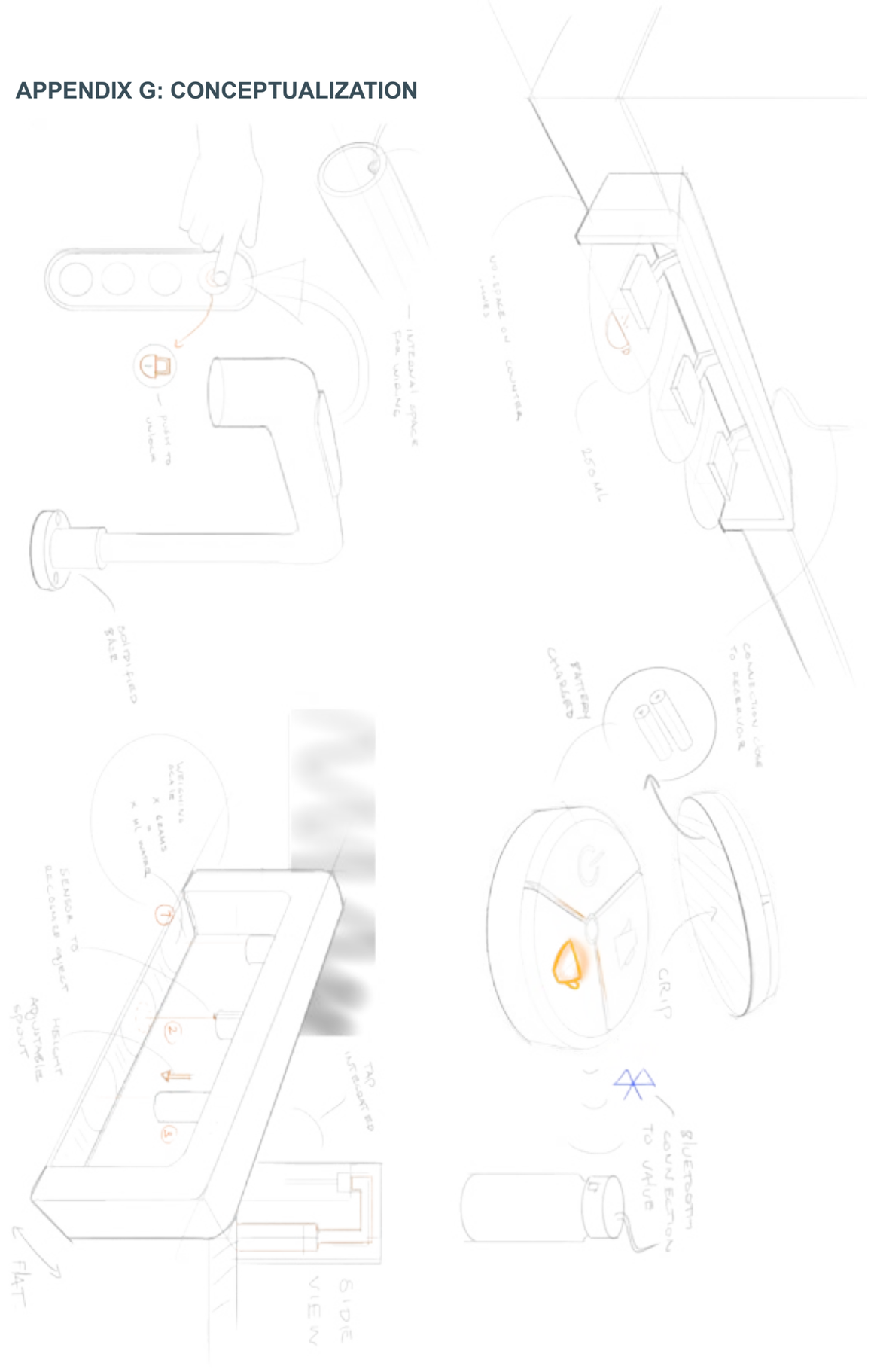
Most participants mentioned the possible efficiency as on the first things when scoring a position or action before mentioning intuitivity and safety. Next to the three interaction qualities mentioned in the research questions, the participants point out the importance of a robust product, even if this detracts from the appearance of the product (Ed - Gulaino).

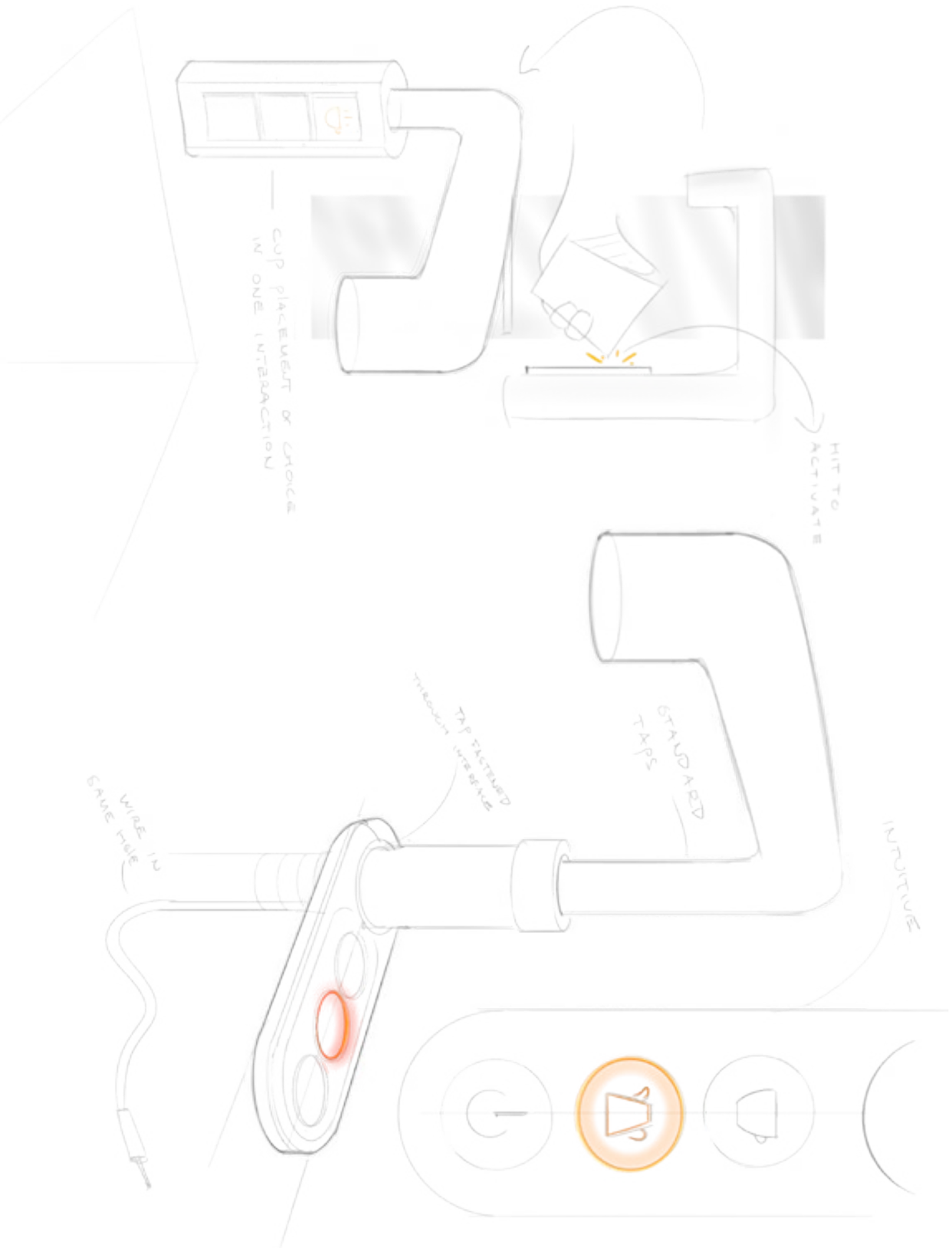
Which context characteristics are considered in the perception of safety, efficiency and intuitivity.

- Available counter space

Which user characteristics are considered in the perception of safety, efficiency and intuivity.

- Level of thinking employee
- Safety of reaching ones arms to the interface





APPENDIX H: CONCEPT EVALUATION WITH QUOOKER

The verify the evaluation of the different concept on the design criteria, a session was held internally with the Quooker panel consisting out of the following employees:

Robbin Loois: productmanager (product portfolio/commercially)
Ivo Legel: R&D Manager (technical feasibility and opportunities)
Geoffrey Put: service manager (installation and product robustness)
Roemer Linkers: R&D Engineer (technical feasibility and issues)
Folco Verlinden: program manager (product portfolio / factory capabilities)

The following remarks were made on the presented concepts. The scores of each of the concept on the list of criteria was verified with the Quooker panel.

Spout concept:

Overall, the spout concept was considered a promising solution although the representatives of the R&D department questioned the scores for safety given in the harris profile. Future issues expected included the usability of the product such as for cancelling orders while the water is evaporating into a hot cloud of steam covering the interface. As Roemer described: ‘’hanging your interface in a cloud of steam seems challenging and not in line with the desired safety, not to mentioned the challenges it poses to the materials used for the interface.’’

From a strategic point of view, Ivo and Robbin made comments as to the ease with which the new interface could be used for different taps of the portfolio. The spout concept would require to develop a dedicated spout which allows for interaction at the top and can withstand the resulting moment force around the base.. As all taps have different spout dimensions, developing a dedicated spout with the interface on top could only be used for one model unless a version is made for each of the taps included in the product portfolio, which supports the low scores given for the commercial criteria in the Harris profile. As Ivo (R&D manager) mentioned: ‘’we would need to develop a new spout and more stable connection, a lot of new parts, it would turn into a whole new product which can only be connected to one tapmodel unless multiple spout versions are made.’’

Base concept:

The Quooker panel agreed with the base concept coming out as the most promising concept to proceed with. The location was considered an intuitive place for activation while it can create a more robust solution compared to the spout and stand-alone interface as the resulting forces on the actual tap are low.

From a strategic point of view, the base concept allows to attach different taps from the product portfolio to the interface without necessary adaptations to the product portfolio. The high scores given for the commercial and strategic criteria were confirmed by the panel.

Additional comments were made by Roemer concerning the ease with which the new interface could be cleaned, as it still placed on the counter where dirt might get stuck. The desire to have an interface which is easy to clean was taken into account during the embodiment phase.

Stand-alone:

The stand alone concept was considered a less interesting option, especially because the panel all agreed the wireless connection would not allow for the level of robustness desired in the F&B sector. Furthermore, the context research and interaction research convinced the panel that the required space on top and beneath the kitchen counter are limited which can lead to issues in case the wireless connectivity would be substituted for a wired solution.

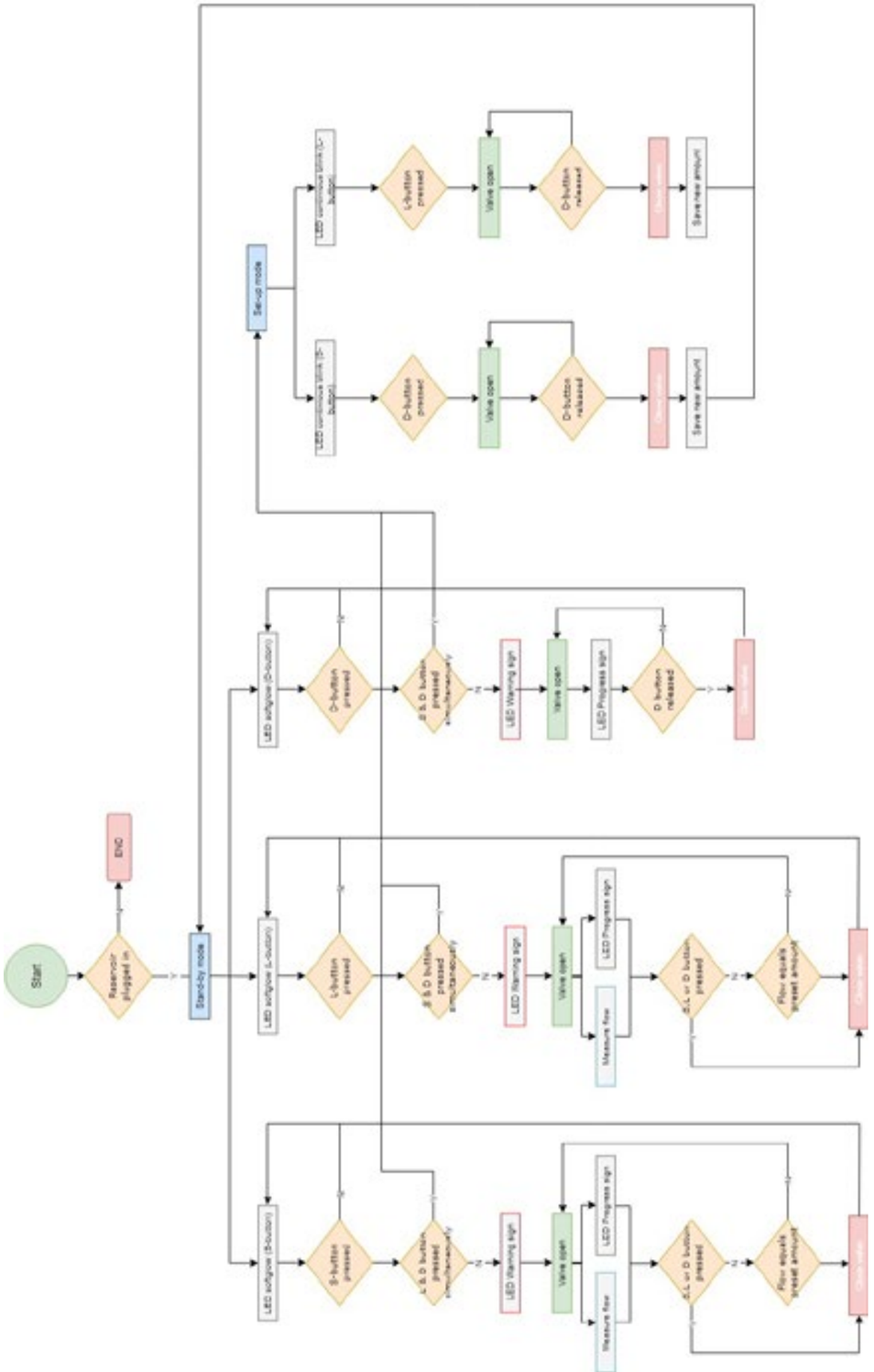
APPENDIX I: CHOICE FOR FUSION & NORDIC TAP

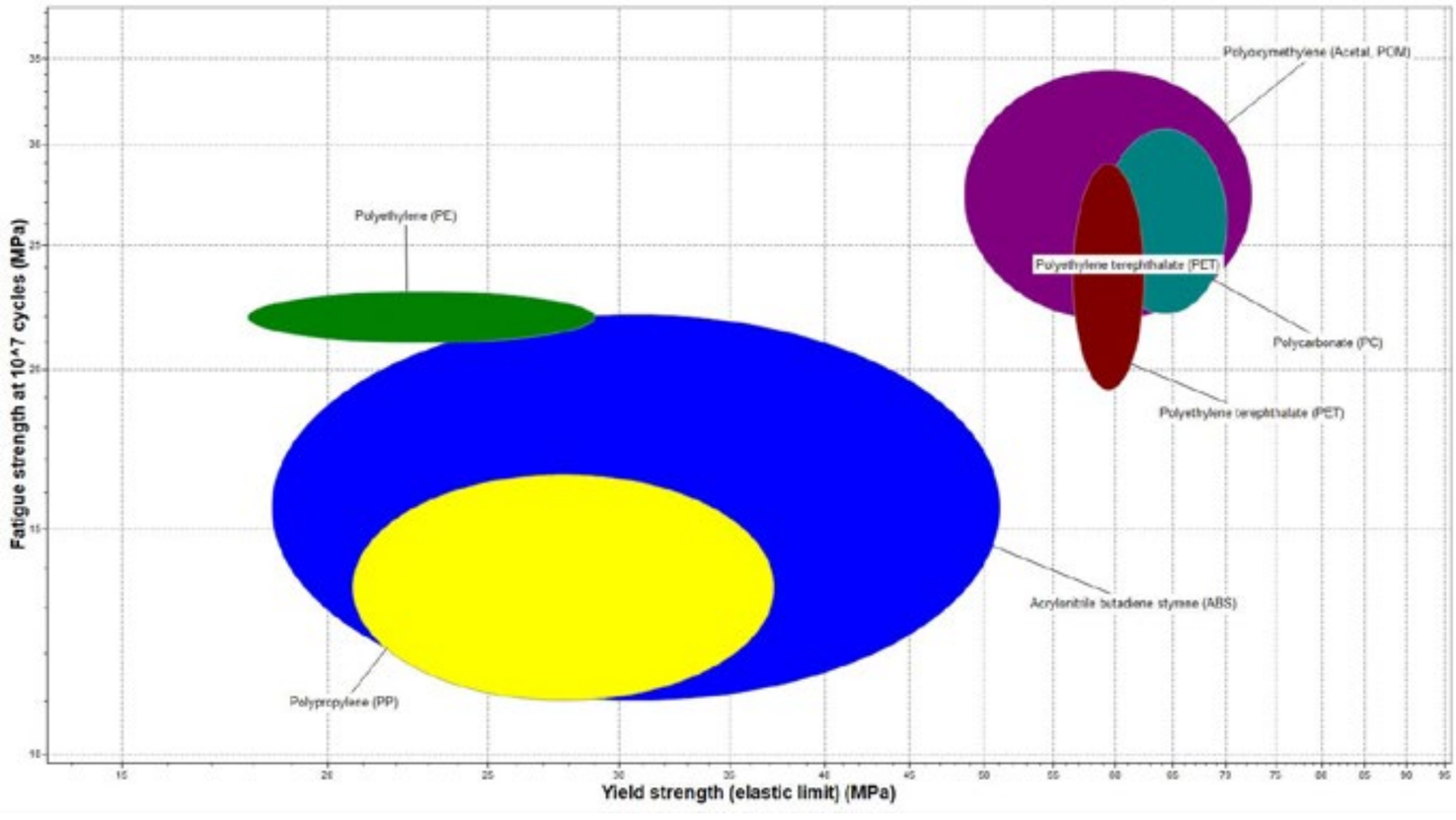
Before starting the embodiment phase, the range of taps which should be possible to connect with the interface was determined. The current production lines are focused on the development of the Fusion, Nordic and Flex tap. From these taps, the Nordic is most used in the F&B industry as it is dedicated to just boiling water while the Fusion and Flex tap also include canals for mixed water.

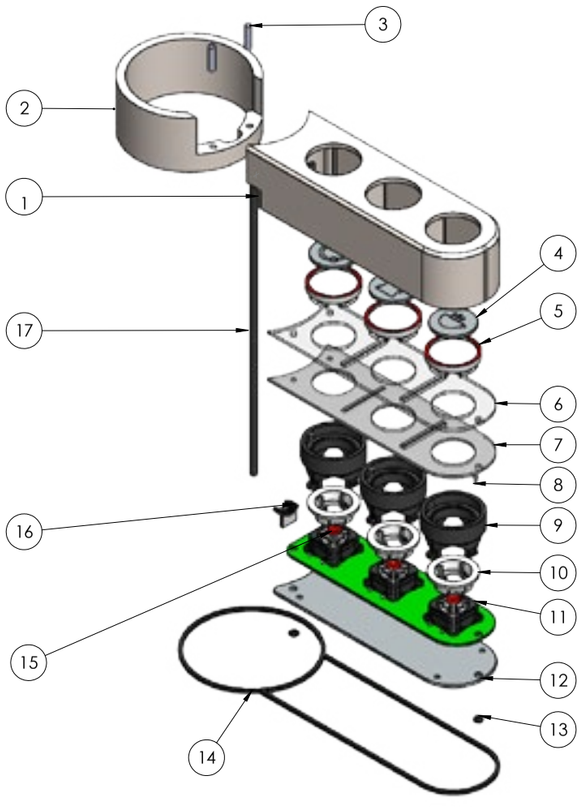
For the embodiment phase, the choice has been made to proceed with an interface which can be attached to the Nordic and Fusion taps. This would allow users to choose for both a dedicated boiling water (Nordic) and a combined tap (Fusion) and attach the interface to be developed. As the diameters of the Fusion and Nordic tap base are equal (40mm), the one size for the housing body can be maintained while including the Flex tap would require the interface to be attached to multiple diameters (40 & 46mm).

As the main use of the interface and tap in the F&B industry will be focused on boiling water, the flexible hose is not expected to provide benefits as it can not carry boiling water and represents a vulnerable part seeing the rough circumstances and use. Moreover, the Flex tap already contains an interface orientated sideways. This means attaching the F&B interface should always be placed on the opposite side of the standard tap interaction location (see figure below).

APPENDIX J: FLOWCHART







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2	Body ring	Stainless steel 316	1
3	Pin	Stainless steel 316	2
4	Icon Buttons	Stainless steel 316	1
5	Button holder	POM	3
6	Housing sealing	Silicone	1
7	Pressure layer	POM	1
8	Screw M1.5	Stainless steel	6
9	Switch housing	-	3
10	Switch actautor	-	3
11	EAO Switch	-	3
12	Housing bottom	POM	1
13	Nut M1.5	Stainless steel	3
14	Counter sealing	Silicone	1
15	Bi-Color LED	-	3
16	3 Pin- Molex connector	-	1
17	3 Pin-Cable	Black PVC	1

Rev.	Description	By	Date	App.
		-		

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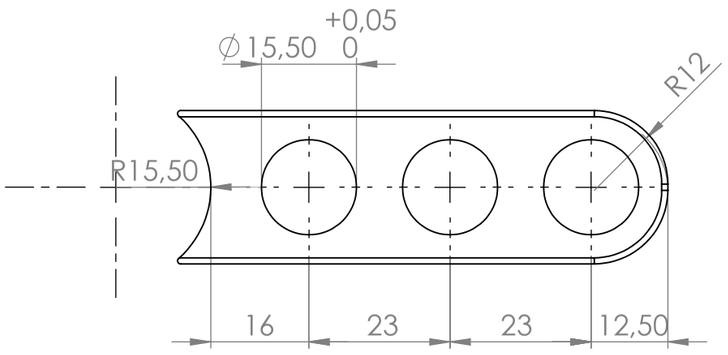
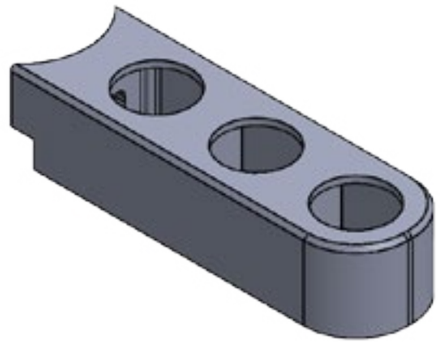
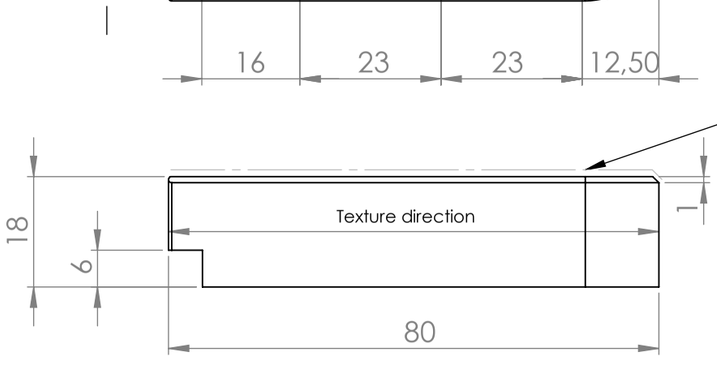
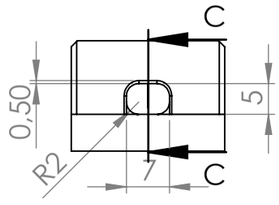
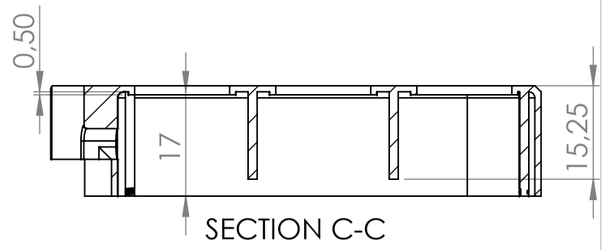
			Drawing Number	Part Number / Revision



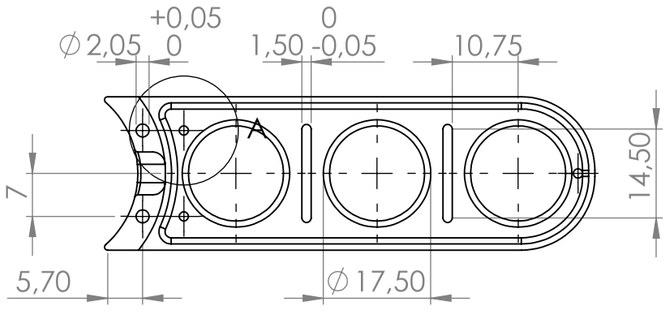


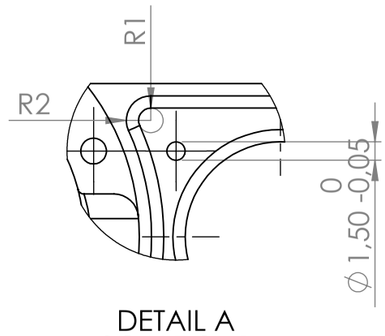






SECTION C-C





DETAIL A
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Fits:	NEN-ISO 286-2	Dimensions in mm	Print Date: 10-4-2018
			Date last saved: 10-4-2018

Quooker

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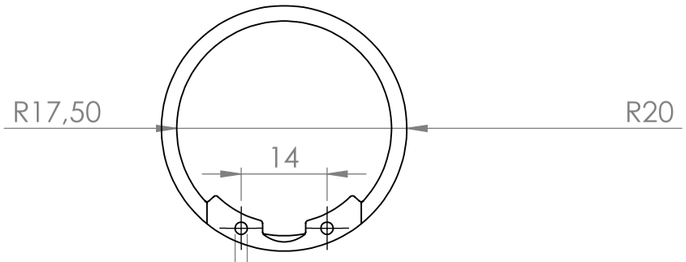
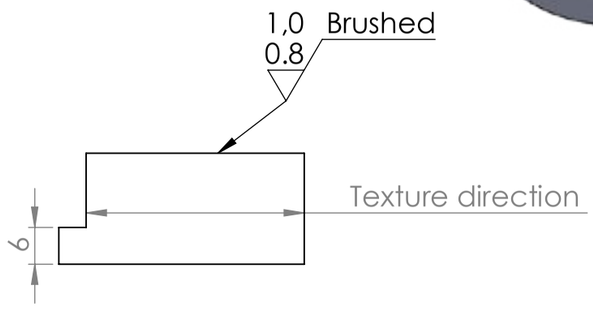
Description	**Housing body**		
Drawing Number	Part Number **1**	Revision	





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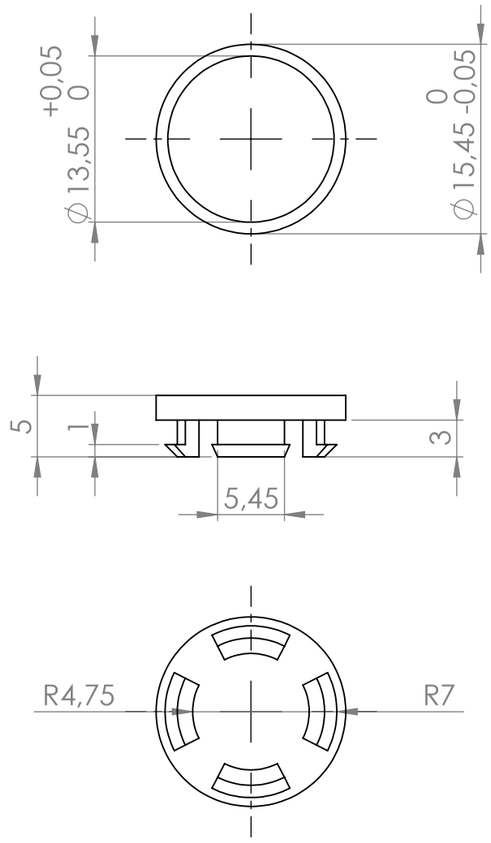
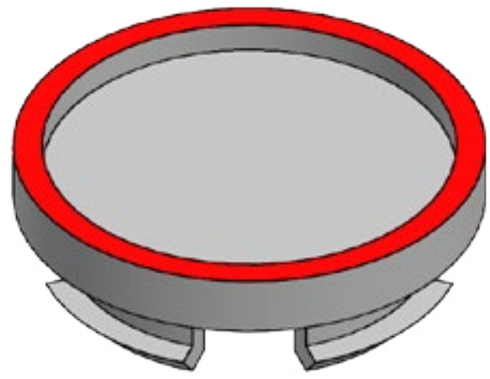
Fits:	NEN-ISO 286-2	Dimensions in mm	Print Date: 10-4-2018
			Date last saved: 10-4-2018

Quooker

Material	**Stainless steel 316**		
Description	**Body ring**		
Drawing Number	Part Number	Revision	





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Dimensions in mm

Released:
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Author:
Print Date: 10-4-2018
Date last saved: 10-4-2018

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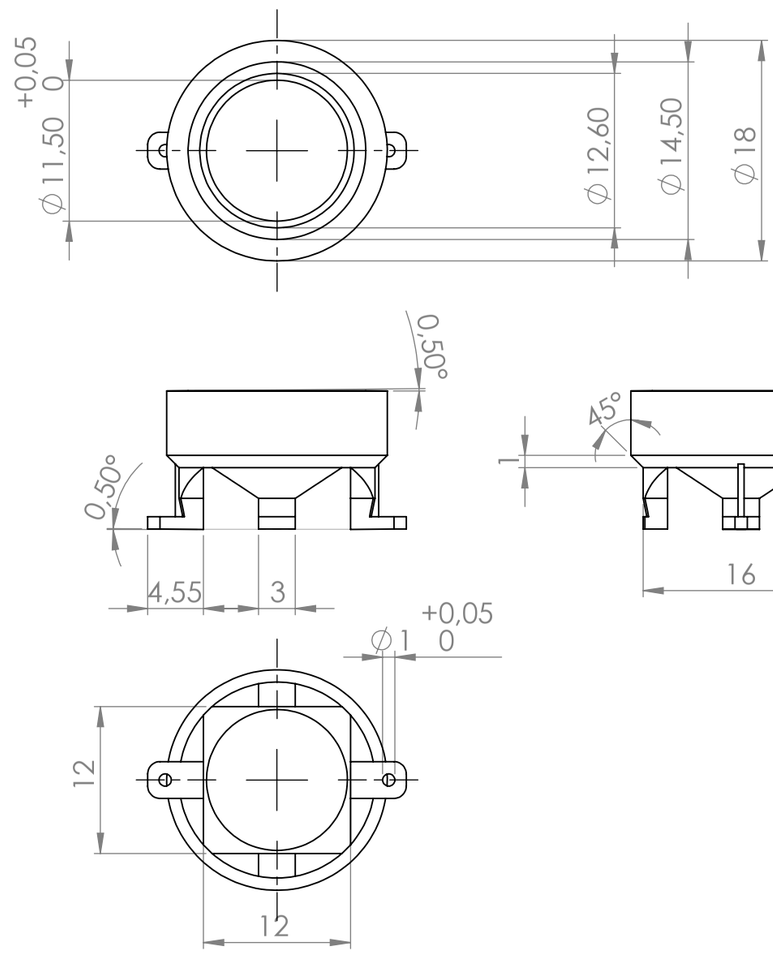
Description: **Button holder**
Drawing Number
Part Number
Revision



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Fits: NEN-ISO 286-2

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A4L Scale 2:1
Dimensions in mm

Released:
Drawing Date: 10-4-2018
Author:
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Date last saved: 10-4-2018

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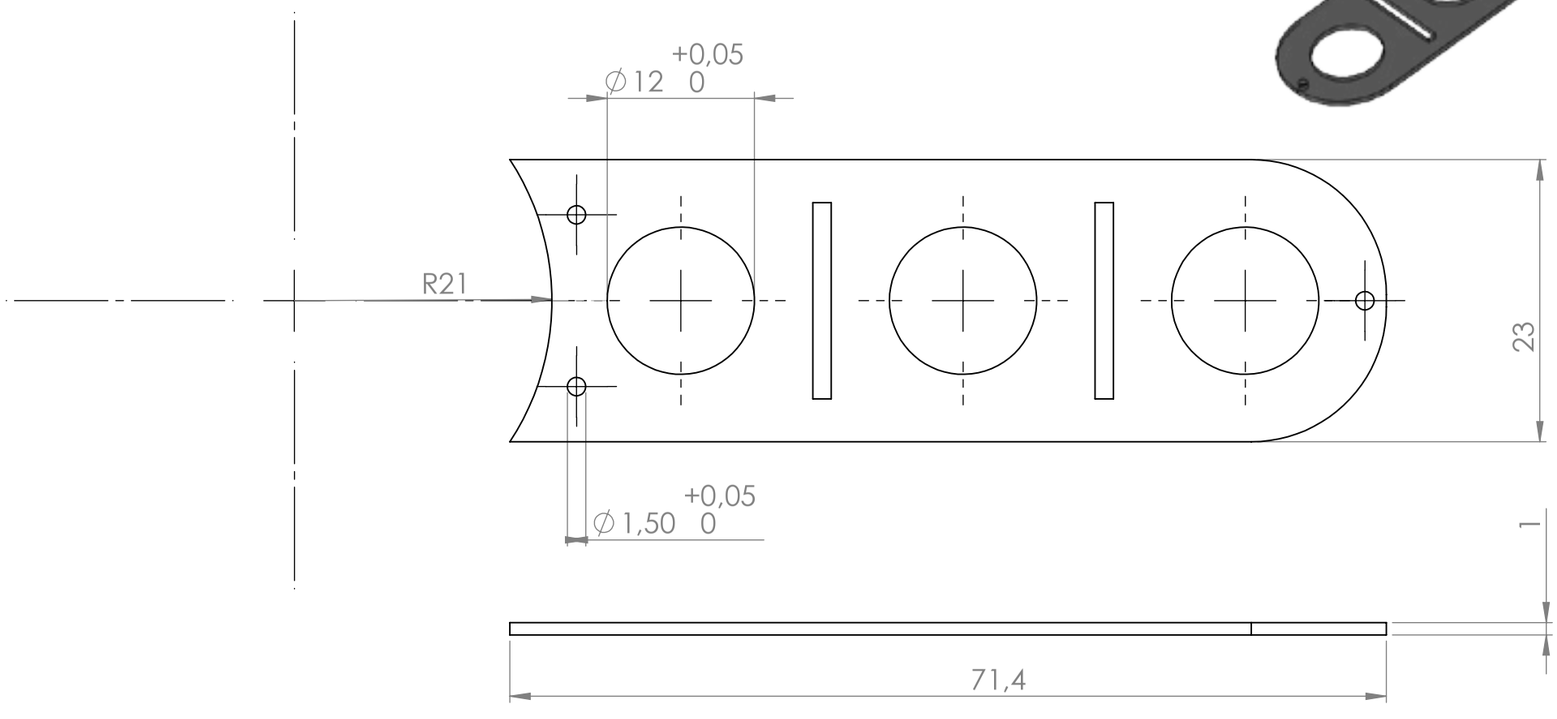
Part Number
Revision



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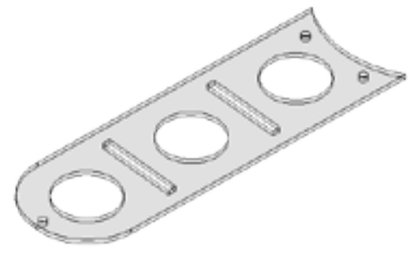

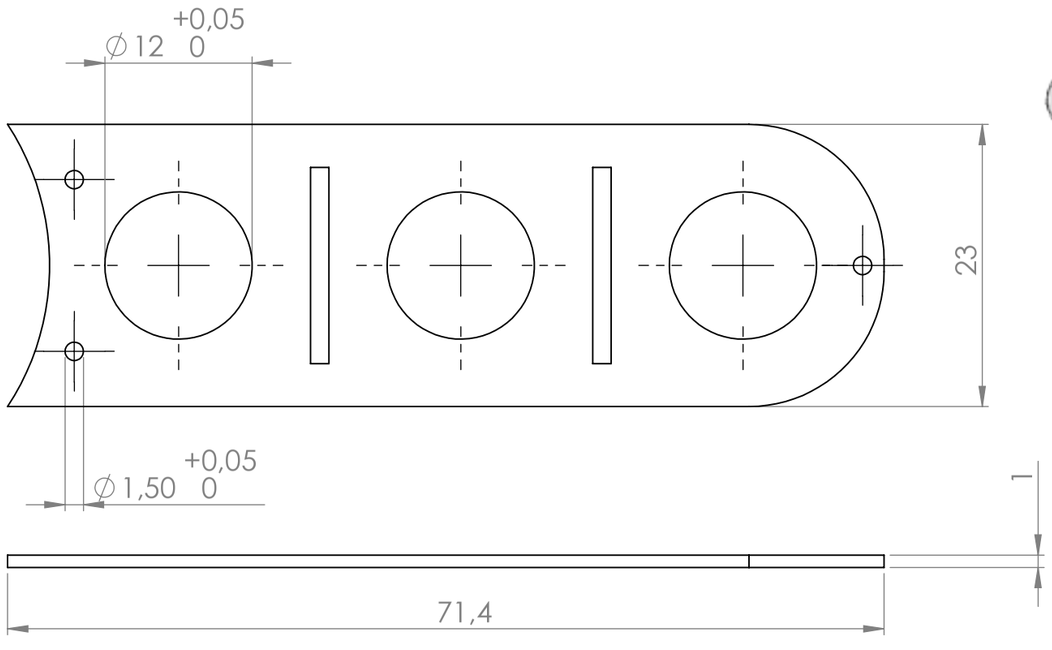

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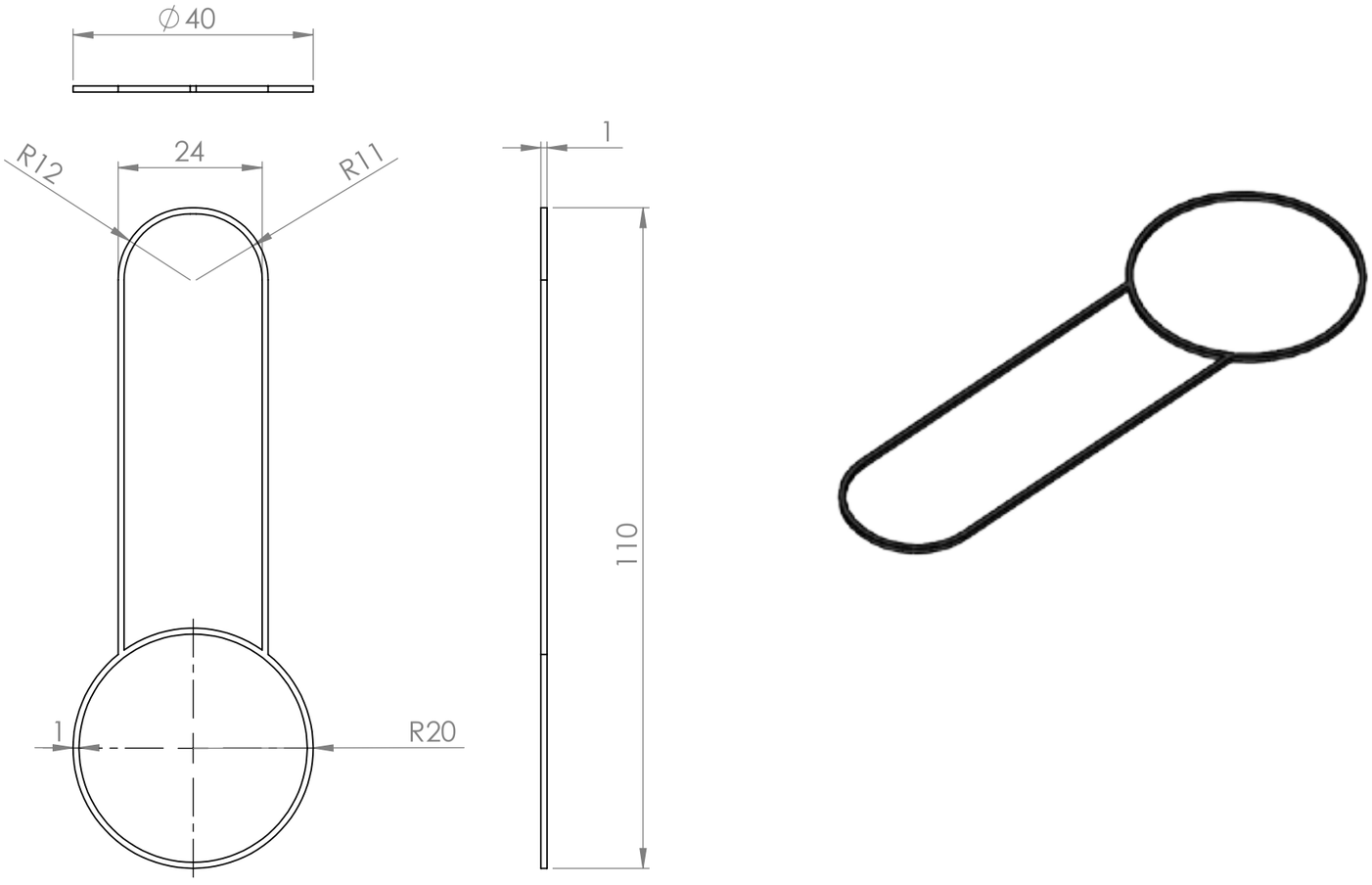

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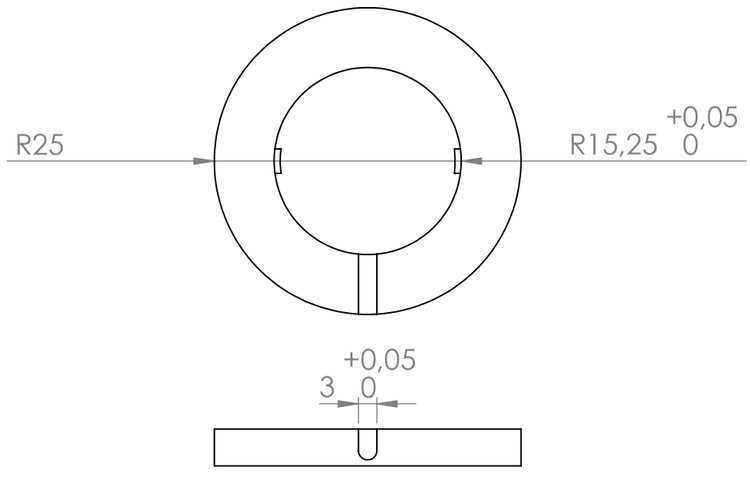
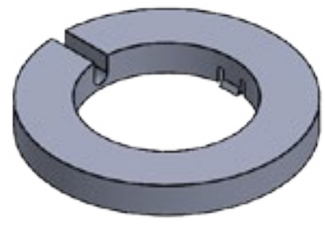
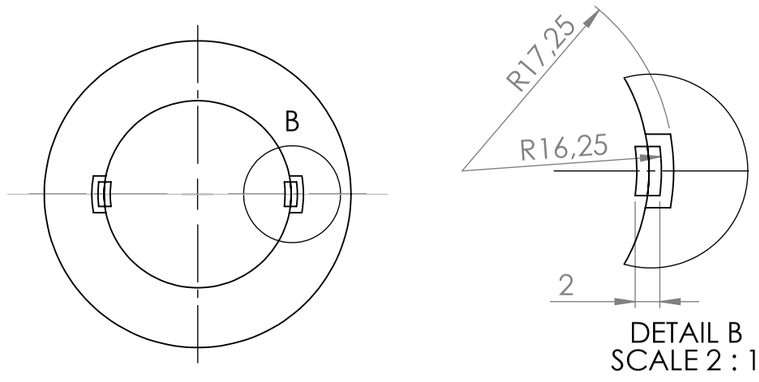
Rev.	Description	By	Date	App.	Quooker® This drawing remains the property of Quooker B.V., Ridderkerk. It may not be fully or partially copied or made available to third parties without written permission.		Drawing Number	Part Number		Revision







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APPENDIX M: END-USER EVALUATION

GEBRUIKSONDERZOEK 5-04-2018

Voor mijn master Integrated Product Design aan de TU Delft heb ik in samenwerking met Quooker B.V. onderzoek gedaan naar het gebruik van kokend water in de HoReCa en de mate waarin de huidige kokendwaterkraan van Quooker hier op aansluit. De uitkomst van mijn afstudeeropdracht is een alternatieve interface welke in gedurende dit onderzoek graag met u zou willen evalueren.

Ik stem geheel vrijwillig in met deelname aan dit onderzoek en ben op duidelijke wijze ingelicht over het doel, de methode en mogelijke risico's van dit onderzoek. Ik behoud me daarbij het recht voor om op elk moment zonder opgaaf van redenen mijn deelname aan dit onderzoek te beëindigen.

Ik geef toestemming en begrijp dat film-, foto, en videomateriaal of bewerking daarvan uitsluitend voor analyse en/of wetenschappelijke presentaties zal worden gebruikt.

Naam: **Handtekening:**

Datum:

---

1. **Interactiewaardes:**

    a. In hoeverre denkt u dat het ontwerp een veilige interactie faciliteert? Wat maakt de interactie voor u veilig/onveilig?

Onveilig ○ ○ ○ ○ ○ *Extreem veilig*

    b. In hoeverre denkt u dat het ontwerp een intuïtieve interactie faciliteert? Wat maakt de interactie voor u intuïtief/lastig te begrijpen?

Onveilig ○ ○ ○ ○ ○ *Extreem veilig*

    c. In hoeverre denkt u dat het ontwerp een efficiënt interactie faciliteert? Wat maakt de interactie voor u efficiënt/efficiënt?

Onveilig ○ ○ ○ ○ ○ *Extreem veilig*

2. **Ruimte op het aanrecht**: In hoeverre denkt u dat de huidige interface andere activiteiten op het aanrecht kan verstoren? Waarom wel/niet?

3. **Opties**: Denkt u dat de drie opties van de interface voldoende zijn voor alle toepassingen van de kokend waterkraan binnen uw organisatie?

    a. Stel u gebruikt de kraan 100 keer op een dag, hoe zouden deze dan verdeeld zijn over de drie opties (kopje, kan, vrije uitloop)

Kopje: *Kan:* *Vrije uitloop:*

4. **Prijs**: Gezien de huidige prijs van de Quooker die rond de € 1500 ligt, hoeveel extra zou u bereid zijn te betalen voor de toegevoegde functionaliteit?

..... €

5. **Robuustheid**: Hoe denkt u over de robuustheid van dit ontwerp? Past deze binnen de context van uw organisatie? Zijn er dingen die u zou veranderen?

6. **Overig**: Heeft u andere opmerkingen die niet in dit onderzoek aan bod zijn gekomen?

USER RESEARCH: FIT OF THE F&B PANEL WITH F&B MARKET DESIRES

Introduction

In order to validate whether the final design meets the desired functionalities and experience described in previous user research, the prototype was tested with the target group. Participants were asked to experiment with the functionalities of the interface followed up by a semi structured interview in which the fit with the desired interaction qualities and characteristics of the product was examined.

Method

Participants

A total of three participant from two different organizations participated in the research, one lunchroom and a coffee bar. Interviews in the F&B market showed that in the bigger organisations ,more than 100 seats, the increased speed is a strong wish as well as the increased intuitivity in situations where the tap is open to be used by guests. Whereas the potential added value of the new interface in these market segments is high, the added value in the coffee-bars and lunchrooms can be more critical as the number of seats are lower and the tap is only being used by staff. In order to realize the aim of selling 2,500 products annually, including these markets is critical as they represent around 30% of the total amount of F&B organisations. This qualitative research could give insights in to the feasibility of offering a product attractive for all the different market segments and reach the desired sales numbers.

Materials

The following materials were used to carry out the research

- A Quooker Nordic single tap
- Quooker demo furniture
- F&B Panel prototype
- PRO VAC3 Reservoir
- Water pump
- Arduino
- 5V Powerbank
- Cable reel
- Go-pro clamp mount
- Go-pro camera
- Interview sheet
- Pen
- Nexus 5X phone
- Quooker bus
- Pallet
- Consent form

Procedure

First, the participants were informed about the purpose of the research and asked to sign the consent form. Next, the participants were asked to describe the expected functionalities of the three buttons by looking at the symbols. After discussing these, the researcher assigned the task to try each of the functions from left to right. During the process of the second''big amount'' function, the participant was asked to cancel the order.

After experiencing the prototype, a semi structured interview was carried out by means of the following questions:

Measures

Participants were video and audio recorded during the try out session as well as during the interview. Important quotes made by participants on the interview topics were written down digitally with help of the recordings.

Results

Interaction Qualities

Participants in both organisations confirmed the interaction met the desired qualities of safe, intuitive and efficient. Concerning the symbols, the Quooker logo which was used for the dispense function was not immediately understood.

One participant mentioned the requirement of not being able to activate without intending to which is described in the list of requirements. In the prototype, not all buttons were exactly lined out with the housing body, which means leaning your hand in the interface will activate the tap which can lead to dangerous situations. This indicates the tolerances in the housing body other sub assemblies are important to guarantee a safe interface.

Space on the counter

Asking about the possible obstruction the interface would present of performing other activities on the counter, the participants from both organizations mentioned the size of the interface would not limit the staff.

An observation made during the try-out part of the research, showed the user was not able to have a clear view on the interface once the pot was placed beneath the outlet (figure X). This was also caused by the fact the furniture with tap was placed inside a van which did not equal the height of a regular counter.

Options

The owner and one of the staff members of ''Guliano'' lunch café mentioned the big amount option would not be necessary normally as 90% of their boiling water tap use is for cups. However, they would not be disturbed by the options as for certain occasion such as high-teas for big groups, pots are being used. The owner of ''Lokaal koffie bar'' explained to use both pots and cups and would benefit from having all three options.

Both participants indicated to see the adjustability of the cup and pot amounts as a benefit in case tableware or the drinks menu change.

Price

When being asked about the additional price both organisations would be willing to pay, Lokaal and Guliano mentioned the amount of, respectively, 250 and 500 euros.

Robuustheid

The expected robustness of the interface was seen as a benefit of this product by both organisations. As one of the staff members of Guliano mentioned the "simple" buttons would likely be more sustainable than the "double-push-turn" interface which has a more complex geometry and working principle.

Conclusion

Evaluating the prototype with two F&B organisations provided some first feedback and insights into the fit of the solution with the desires and characteristics of the lunchroom and fastfood (coffee-bar) segments. The results of this qualitative research showed the clarity of the icon indicating the dispense function can be improved as , different from the cup and pot icon, this function was not recognized upon first use.

Concerning the safety of the of the interface, one organization mentioned the probability of activating one of the buttons accidentally. Although buttons should include an efficient way of activating, the top of the buttons should not stand out from the top of the housing body, to prevent accidental activation when, for example, the user rests his or her hand on the interface.

The try-out part of the research showed that the line of sight users have relative to the interface should be taken into account as icons might be blocked in case big objects are placed in front. Preferably, users should have a clear view on the interface which means the height and depth on which the tap is placed should be taken into account if possible.

Discussing the robustness of the system, both organisation only questioned the ease of cleaning and the probability of grease gettick stuck in the sealing or other cavities of the interface. This was taken into account in the choice of the materials and the geometry of the design, for more information regarding the cleaning recommendations, see chapter X.

APPENDIX N: LIST OF REQUIREMENTS CHECK

	REQUIREMENT	SOURCE	VALIDATED IN PROJECT	VALIDATION	EXPLANATION
1. Performance					
1.1	Product interaction fits with the interaction vision qualities: efficient, safe & intuitive.	Interaction vision		User test & Enquête	
1.2	System allows to obtain and adjust two preset amounts of boiling water and one option for an ongoing flow	User Research (orientation phase)		User test	
1.3 Wish	System allows to tap >10 cups of 200 ml per minute.	User Research (orientation phase)		User test	
1.4 Wish	Product interaction appeals to all sectors within the F&B industry.	Strategic direction		Enquête	Evaluation research in all the different markets segments is needed to verify whether this wish is met
1.5	Valve for standardized amounts provides consistent volumes under different water pressure levels.	FMEA analysis		Prototype test	For this requirement a flow sensor is to be used which is currently not included in the system
1.6	Interface should allow for adjustment of the tap neck to at least 2 heights.	User Research (orientation phase)		Prototype test	
1.7	Interface warns user for potential danger of boiling water	Function analysis		Prototype test	
1.8	Interface allows to be operated with wet hands	User interaction research		Prototype test	
1.9	Interface allows to cancel orders after activation	Function analysis		Prototype test	
1.10	Interface requires minimal amount of space on the kitchen counter	User interaction research		3D CAD Model	
1.11	Interface can be detached from the tap and used as stand alone product	Quooker		Prototype	
1.12	Should provide space for PCB and electric components of the interaction panel (chapter 8.2: 70mm x 20mm x 15mm)	Interaction panel research		Prototype	
1.13	Lift the tap > 5 mm of the counter to provide space for interaction panel wire (chapter 8.2)	Housing body research		Prototype	
1.14	Surfaces are easy to clean and do not hold the potential for moist and bacteria to accumulate	Norm study		Prototype	
1.15 Wish	Option layouts can be easily changed	Quooker concept evaluation		Prototype	In the current model the product should be diassembled to change the lay-out. Further development should enable a more convenient way of changing the button lay-out
1.16	Required current < 20mA (max current delivered by connected reservoir)	Quooker		Prototype	LED's tested in the prototype require a current of 20mA each. Therefore the functionality with indsutrial LED's should be verified.
1.17	Finger interaction areas have a minimal diameter of 11 mm	Housing body research		Prototype	
1.18 Wish	Finger interaction areas are located 13mm apart	Housing body research		Prototype	Interaction areas are placed 8mm apart, none of the participants mentioned the space on the interface was too small.
1.19	Options can be activated by push- or touching motion (user interaction research)	User interaction research		Prototype	
1.20	Provides tactile confirmation feedback during activation	User interaction research		Prototype	

1.21	Should fixate tap in holes ranging in diameter from 35m to 38 mm.	Housing body research	Prototype		
1.22	Leave space for Ø3mm wire to be pulled through and reach the reservoir	Housing body research	Prototype		
1.23	LED's communicate in different colors for "stand-by" and "warning" mode	Interaction panel research	Prototype		
2. Reliability					
2.1	Interface has adequate mechanical strengths and is constructed as to withstand rough handling (600 interaction daily).	Norm study / User Research (orientation phase)	Durability test		Durability tests should verify wether this requirement is met
2.2	Interface provides protection against harmful ingresion of grease, acids or cleaning liquids.	Norm study / Quooker	Prototype		Durability tests should verify wether this requirement is met
2.3	Interface provides protection against harmful ingression of water (IP 21).	Norm study / Quooker	IP 21 Test	*Out of project scope*	
2.4	Interface should not conflict with the radius of the tap neck.	FMEA analysis	3D CAD model		
2.5	Prevent rotation of the panel relative to the tap as a result of pushing force applied by the user	Housing body 3D prints	Prorotype		
3. Safety					
3.1	Interface does not hold the potential to be accidently activated	Norm study	User test		
3.2	Activation should require a physical interaction with the interface	User interaction research	Prototype test		
3.3	No ragged or sharp edges creating a hazard for the user in normal use or during user maintenance.	Norm study	3D CAD model	*Out of project scope*	
3.4	No excessive temperatures in normal use (<44 °C).	Norm study	3D CAD model simulation / Prototype	*Out of project scope*	
3.5	Unlikely that interface makes operator touch parts having a temperature rise exceeding the value specified (<44 °C).	Norm study	User test	*Out of project scope*	
3.6	Interface avoids operator to bring hand or arm in line with the boiling water outlet of the spout.	Interaction User Research	Prototype test		
3.7	Operates on a maximum of 12V	Quooker	Prototype test		
3.8	Interface provides adequate protection against accidental contact with live parts.	Norm study	User test	*Out of project scope*	
4. Materials					
4.1	Materials should be able to withstand 100 °C water.	FMEA analysis	Durability test		
4.2	Materials can withstand grease, acids and cleaning liquids.	Norm study	Durability test		
4.3	Materials do not have the characteristic to corrode or hold moist and bacterias.	Norm study	Durability test		
4.4 Wish	Materials do not decrease as a result of extensive and long use.	Style analysis	Durability test	*Out of project scope*	
5. Ergonomics					
5.1	Interface allows activation with one hand	User & context research / Interaction vision	User test		
5.2	Product should be understandable for novice users with minimal instructions.	User & context research	User test		
5.3 Wish	The interface should be understandable upon first use. (wish)	User Research (orientation phase)	User test		The dispense icon should be reconsidered and evaluated with the target group to meet this wish
5.4	Interface can be comfortably activated by operators aged 16-67 for 600 interactions a day.	User Research (orientation phase)	User test		

6. Environment					
6.1	Water spillage is minimized to <1% of required amount.	Internal analysis	User test		
7. Life in service					
7.1	Product should last for at least 5 years or 730.000 repetitions. (5 years of 400 daily interactions)	Worst case scenario	Durability test	*Out of project scope*	
8. Maintenance					
8.1	Interface allows users to adjust the standard amounts for a cup or pot.	User Research (orientation phase) & Quooker service department	User test		
8.2 Wish	Interface does not require the drilling of additional holes in the counter.	Quooker service department	3D CAD Model		
9. Target product costs					
9.1	Increase in product costs or costs of separate component < €100,-	Based on current solutions & investment costs for producing 2,500 products	Cost price estimation		
10. Quantity					
10.1	2,500 products annually.	Strategic direction	-		
11. Production facilities					
11.1	Product can be produced in house.	Quooker's inhouse production policy	Validate with production department		
11.2 Wish	Interaction panel requires minimal assembly time	Desired max product costs	Prototype		
12. Aesthetics					
12.1	Product fits the minimalistic Jiri style embedded in the current product portfolio.	Style analysis	Questionnaire		Questionnares among the target group should be done to verify whether this requirements is met
12.2	Stainless steel 316 for steel parts	Style analysis	Prototype		
12.3	Chamfers should be 1 mm in height with an angle of 45 degrees.	Meeting Jiri	Prototype / 3D CAD Model		
12.4	Use of circular shapes close to the diameters included in the tap.	Meeting Jiri	Prototype / 3D CAD Model		
13. Standard & regulations					
13.1	Fixing in wrong position of handles, knobs indicating position of switches or similar components not possible	Norm study	User test	*Out of project scope*	
13.2	Should fit within standard 35 mm fixation hole.	Norm study	3D CAD Model		
14 Quooker product policy					
14.1 Wish	Housing body allows to attach Quooker taps to the counter: - Nordic single tap (Ø40mm base & Ø30mm threaded bush) - Fusion (Ø39,90mm base and Ø34,80mm placeholder for thread and tubes)	Internal analysis / Strategic Direction	Prototype		
15. Reuse and recycling					
15.1	Product is detachable for maintenance or replacement.	Internal analysis /FMEA	Prototype