KETTLE

RETHINKING CIRCULARITY OF HOUSEHOLD APPLIANCES

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4/25/2025

Content

Abstract

This project started with a simple question: What does it take to make kitchen appliances easier to fix and recycle? By focusing on the electric kettle, I followed a path of curiosity that led me through reverse engineering, conversations with users, design-led experiments, and reflections on the broader systems that shape how products are made and discarded. What began as a technical exercise quickly unfolded into a bigger story about access, empowerment, and the unseen choices built into our material world.

Through dismantling a kettle, I saw how layers of design decisions that are often invisible to the users lock materials together and make repair or recycling

almost impossible. I listened to people talk about why they fix things, why they don't, and what it would take for that relationship to change. Along the way, I tried designing a new kettle: one where every piece could be separated, and its function understood. It wasn't about reinventing technology but about making its logic accessible and tangible.

A series of initiatives by the Museum of Modern Art (MoMA) during the 1930s shaped the definition of Good Design as a product that is functional, aesthetically pleasing, and affordable. In today's context, circularity must be seen as part of that definition. However, what can designers do to make that happen when faced with the complexity of industrial production and consumer culture? This project explores how an individual designer, working with limited means, can challenge industrial patterns by making technology transparent and knowable.

Keywords

Circular Design, Repairability, Reverse Engineering, Design for Disassembly, Household Appliances

Prologue: Who Am I In The Story

I grew up in Jordan, where recycling was not an everyday thing, and separating waste from trash was not practiced. However, there was a culture of repair, maybe because it made more sense financially to people, but the norm was that if something broke, you tried to repair it, even if the item was inexpensive. If it is broken but still works, and you want to buy a new one, you would give it to another person who might be in need. And growing up, I used to observe my father fixing things around the house, like a water pipe, a chair, a simple electric device... I built an affinity to do things with my hands, and this might have influenced my decision to study mechanical engineering. After my degree, I worked as a design engineer in a fabrication lab called TechWorks. The lab falls under an NGO called the Crown Prince Foundation (CPF). TechWorks was one of many initiatives by the CPF focusing on developing the Jordanian community and ecosystem. In one project, the CPF collaborated with the United Nations High Commissioner for Refugees (UNHCR) to develop a makerspace inside a refugee camp named AL Zaatari. I was selected to work with a group of refugees to help them learn how to run the machines and use design software to build projects for the camp community. They showed me the projects they built with hand tools and found materials. I was amazed at how they use limited resources and scrap objects to build things that have value, such as a clothes dryer they built from a broken bike, a fan, a salvaged coil from a heater, and some metal wires. As I walked around the camp, there was a duality of how waste was present. On one hand, it was abundant and a symbol of neglect, on the other hand, it was used as a source of innovation. It is no secret that disadvantaged and marginalized communities are the ones that suffer most from waste accumulation and pollution of industrialization.[1] However, in the midst of the crisis, people found opportunities to make meaningful things and to enjoy luxuries that are otherwise so remote.

My connection with circularity and the repair became more intentional after I joined the Healthy Materials Lab at Parsons as a researcher. I got introduced to the concept of design for remanufacturing and how effective it is for the purposes of recycling, repairing, and reusing. The Healthy Materials Lab is a research lab with the mission to transform how the building industry evaluates and uses materials by prioritizing both human and environmental health. After studying the design for remanufacturing concept in construction assemblies, I wanted to explore it more in everyday products, and especially where separating materials is most complicated: in consumer electronics. And here I reflected, how can these features – being able to deconstruct and build products with simple hand tools and having easier access to useful parts and components - change the experience of the making team and the whole community in Al Zaatari Camp. And henceforth, I started my journey of exploring circularity in household appliances.

Part 1: Context

1.1 The Intersection of Design, Appliances, and E-Waste

With today's increasing reliance on consumer products in our daily lives, there is an expanding impact of design on social, health, and environmental systems. The rise in consumption of such products has consequently escalated challenges in both resource management and waste mitigation. According to a report by the United States Environmental Protection Agency (EPA) in 2018, it shows that in that year alone, out of nearly 2.2 million tons of small appliance waste in the US, only 5.6% were recycled.[2] The World Health Organization reported that e-waste is one of the fastest-growing solid waste streams in the world, with approximately 62 million tons globally produced in 2022, and only 22.3% documented as collected and recycled.[3] This discrepancy shows the insufficiency of current waste management. An additional persisting problem is that many practice informal e-waste recycling, which has its own dangers to health and the environment, including the release of toxic substances such as lead into our ecosystems.[4]

Waste management has been a topic of discussion for a long time, yet manufacturers are not effectively working towards sustainability. Faced with complex supply chains and the higher costs of sustainable materials, many companies prioritize short-term profits, favoring lower manufacturing costs and optimizing user experience only during the consumption phase. The book Natural Capitalism (1999) has challenged the economic logic of this industrial system, arguing that the failure to account for the full ecological costs of production leads to systemic inefficiencies and long-term environmental degradation.[5]

However, the answer to a healthier practice might not be in recycling, since the recycling process of e-waste usually includes a very complex process of sorting materials, high energy consumption throughout the process, and substantial material degradation with each recycling cycle, all of which might lead to a higher carbon footprint. According to the book Cradle to Cradle (2002), conventional recycling tends to diminish the quality of materials, limiting their usefulness in future applications. Instead, the book advocates for a radical rethinking of product design, mimicking natural systems and creating "technical nutrients" in which waste becomes food for new products.[6]

Architect William McDonough envisions how systems and products could be designed in a way that allows them, at the end of their life, to be disassembled, then repurposed or biodegraded, eliminating waste and inventing a fully closed-loop life cycle.[7] This concept, Design for Disassembly (DFD), has been adopted by many designers, especially in architecture, interiors, and furniture. Some electronics have also adopted values of the design for disassembly, like the Fairphone, which is a smartphone designed to be taken apart for easier repair, component replacement, and longer use-life.[8] In the realm of small appliances, some companies are also moving towards modular or easier-to-dismantle products, but there aren't many products or studies that adopt a fully closed-loop design.

Household electronics are particularly illustrative of these systemic challenges. Literature over the past few decades has continued to critique the current industrial system, and many movements are addressing topics such as sustainable design principles, material choices, user repairability, and policy reform. Kitchen appliances are seeing some progress; for instance, in France in 2023, the recycling rate of electric kettles rose by 15%.[9] Still, this is far from enough to offset the growing consumption and dependence on such products. The interconnected systems of industrialization, waste management, and global supply chains, intertwined with geopolitics, capitalism, and demand for cheap, convenient goods, leave the topic deeply complex and far from sustainable.

So, what could I, an individual designer, in 8 months, do in the face of this system? To understand how we arrived at this paradigm, it is essential to study the emergence and development of consumer electronics.

1.2 Emergence of Consumer Electronics and Their Design Evolution

Between the 1930s and 1950s, the Museum of Modern Art (MoMA) launched a series of exhibitions and initiatives named Good Design, highlighting well-designed everyday objects to show the democratizing potential of design.[10] This democratizing potential started gaining momentum earlier, during the late 19th century, when there was a rapid evolution in scientific and technological innovation and industrialization. This was a prime time for designers, who were seen as innovators and who introduced innovations that would change the lifestyle of people henceforth. The industrial revolution was behind this acceleration, especially by introducing mass production, which made products more affordable and accessible, and prioritizing function over form and quality.[11] Then came movements like the Arts and Crafts Movement, led by William Morris, which reacted against industrialization's poor craftsmanship, advocating for hand-made designs that elevated imperfections as a symbol of beauty.[12] The MoMA reflected similar ideals and propelled the concept of Good Design along with industrialization to show high-quality, practical, and aesthetically pleasing objects for everyday life. After the MoMA exhibitions, designers later used the Good Design concept to refer to "well-designed, relatively affordable, contemporary consumer products."[13]

These ideals were further refined during the mid-20th century through what came to be known as mid-century modern design. Designers such as Charles and Ray Eames and Dieter Rams embodied the ethos of minimalism and "form follows function"[14]. Their work emphasized clean lines, efficiency, and the belief that well-designed products should improve everyday life. These principles influence today's design discourses, including those around sustainability and circularity.[15]

Back to the electric kettle, the first one created in the 1890s had a delayed acceptance due to the potential hazard of combining water with electricity and the slow rate of boiling water compared with a conventional kettle. However, a later model in 1909 by the German manufacturer Allgemeine Elektricitäts Gesellschaft (A.E.G) overcame those inadequacies by "effective branding, high-quality materials and construction, and modern styling".[16] With time, the efficiency of electric kettles improved, with features such as safety measures and automatic turn-off becoming essential to a well-designed kettle. Its aesthetics changed with time as well to become more accommodating to its functionality. However, in today's world, where the scale and pace of consumer production have increased dramatically, and where mounting electronic waste and resource scarcity challenge the future of manufacturing, the old definition of Good Design is no longer sufficient. Design now has far-reaching implications, not only for aesthetics and usability but also for environmental sustainability, public health, and social equity. So, what does a well-designed kettle in the future look like, and how does circularity fit in defining the Good Design of kitchen appliances?

1.3 Community of Practice and Addressing the Issue

The challenge of managing e-waste and designing for sustainability is not one that can be tackled by designers or manufacturers alone, it requires the coordinated efforts of a broader community of practice. This includes policymakers, repair advocates, artists, manufacturers, and citizen groups who contribute to a shared understanding and response to the problem. Wenger defines a community of practice as a group of individuals who share a concern or passion for something they do and learn how to do it better through regular interaction.[17] In the context of sustainable electronics, this approach highlights the value of collective learning and action across sectors.

Several kitchen appliance manufacturers have begun to integrate sustainability into their brand ethos, though with varying levels of commitment and impact. For example, SharkNinja emphasizes product durability and energy-efficient designs, with claims around recyclability and repairability in select product lines.[18] Smeg, known for its high-end aesthetics, has positioned itself around longevity and reduced energy consumption.[19] However, some critics argue that its sustainability efforts remain mostly incremental and under-communicated in the public domain.[20]

More systemic responses are found within the Right to Repair movement, which has gained momentum globally, and advocates that consumers should have the legal right and access to tools, parts, and information necessary to repair their own devices, including kitchen appliances.[21] This movement addresses both environmental concerns and consumer rights, challenging the dominance of planned obsolescence. In the EU, regulatory responses such as the WEEE Directive (Waste Electrical and Electronic Equipment Directive) mandate manufacturers to manage end-of-life collection, treatment, and recycling of electronics. The most recent revisions to the directive push for greater producer responsibility and design for disassembly.[22]

Citizen-led repair initiatives such as the Fixers Collective in New York embody the spirit of participatory sustainability. These grassroots gatherings create spaces where people share skills, tools, and stories while repairing broken appliances together. Such practices not only divert waste from landfills but also reinforce a culture of care and maintenance, values often overlooked in consumer societies.

In the realm of art and critical design, projects like Ore Streams by Formafantasma challenge dominant narratives about recycling and e-waste.[23] This project explores the geopolitical and material flows of discarded electronics, drawing attention to the invisible labor and toxic consequences of informal recycling systems. Through speculative design, Formafantasma visualizes how aesthetic and functional design choices can align with circular economic principles.

Other notable projects include the Restart Project in the UK, which combines public repair events with advocacy and education, and iFixit, a platform that democratizes repair knowledge through crowdsourced manuals and repairability scores. Together, these initiatives demonstrate how community-driven practices can complement and sometimes outperform institutional efforts in addressing sustainability challenges.[24]

1.4 Bridging The Gap: How Can Design Make a Difference?

While policies like the Right to Repair and efforts by activist groups are helping move the conversation forward, many products are still not made with repair or reuse in mind. Designers and companies could do more to recognize the value of what's already happening in repair communities, where people are extending product life through care, creativity, and shared knowledge. As argued in the book Natural Capitalism 26 years ago, natural resources are still declining while human resources and demand are increasing.[25] This means, even if it might cost more to recycle compared with the use of virgin materials, it is important to do so to preserve natural resources as much as possible. However, we are looking at a huge, complex system where the stakeholders are not just the manufacturers and users, but also policy makers, investors, countries' economics, political relations, consumption culture... and the list goes on.

In the book Making Trouble, Von Busch frames designers and makers as activists who use DIY, craft, and hacking to push back against dominant systems.[26] Instead of designing within the system, he suggests "making trouble", disrupting norms and opening space for alternative ways of doing things. Connecting this idea to circular design, both designers and users have a role to play, whether it's designing for repair or choosing to fix and reuse electronics. But how does an individual designer face this system? To answer this, first, we must understand the complexity of the system, then find the leverage points, and explore how to build a connection with the users through design, enabling them to repair and reuse.

Part 2: Exploration

This research employed a transdisciplinary approach combining various methods such as desk research, semi-formal interviews, reverse engineering, quantitative data collection, and design-led inquiry. The first phase involved extensive desk research, including the review of books, academic articles, company websites, and technical data sheets to form a foundational understanding of circular design principles, the definition of Good Design, and the industry of kitchen appliances. This was followed by focusing on one specific kitchen appliance to carry out the design-led research with one centerpiece. For this purpose, I picked the electric heating kettle, mainly because of its simplicity and availability. Electric kettles have simple functions and straightforward technology. They are also affordable and available in almost every house and office. Especially in the UK, around 95% of households owned an electric kettle in the year 2023.[27] According to a report analysis on Coolest Gadgets, the global market value of electric kettles in 2023 was around 4.29 billion USD and was projected to grow to 27.09 billion USD by 2031.[28] Although it is not an essential item, its practicality makes it a widespread item that people prefer to use over traditional, less energy-consuming alternatives (like boiling water on a stovetop kettle).

2.1 Gathering Knowledge: Desk Research

Desk research was essential to establish a foundational understanding of historical, technical, and environmental contexts influencing the design of kitchen appliances. To understand more about the development of designing small appliances, I read design history books like Design: The Whole Story and articles about the MoMA Good Design exhibitions. I also visited the MoMA's exhibition Pirouette: Turning Points in Design earlier this year. Those readings and explorations informed my literature review and paved the way to think about how I would approach my project. Key findings were forming a story arc of how kitchen appliances started developing after the Industrial Revolution, and how their design started focusing on different aspects with time.

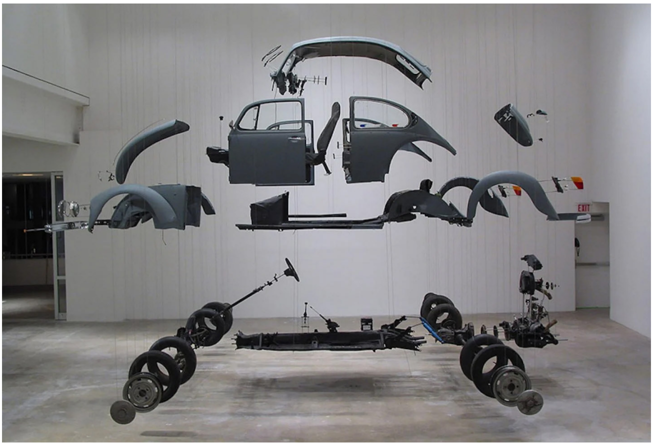
After studying design history, I wanted to learn how designers and practitioners are integrating sustainability values into their design and projects. I started collecting secondhand research and documentation of projects relevant to the topic of circular kitchen appliances. I stumbled upon Osiris, the circular electric kettle that was designed by Gabriel Kay, which is very similar to my project. His product is essentially a kettle that has a detachable part that you can buy separately and replace when broken.[29] It might offer a solution, but in my opinion, it does not solve the bigger problem of e-waste and consumerism. It still promotes replacement culture, and embedded materials might still be problematic.

Further desk research investigated statistics of e-waste generated by kitchen appliances. A report by the Environmental Protection Agency showed that in 2018, only 5.6% of e-waste generated by small appliances was recycled. It indicates the scale at which the amount of small appliance waste is growing with time. In the US, it increased from 460 thousand tons in 1992 to 2,160 thousand tons in 2018.[30] More texts and studies were reviewed and discussed in the literature review to show the dimensions of the e-waste issue and increasing reliance on consumer electronics.

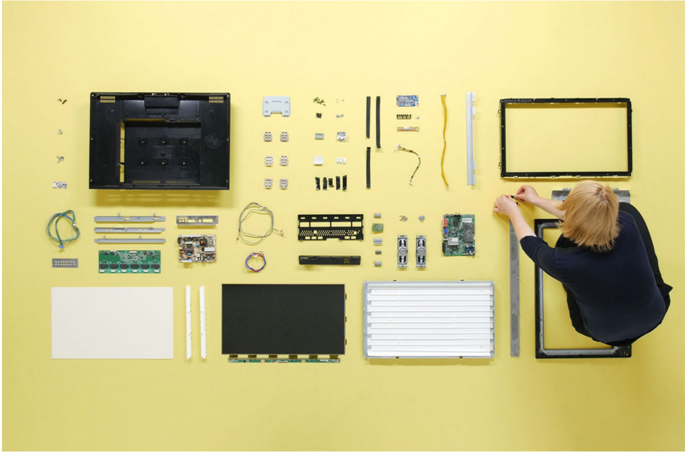
2.2 Voices of Insight: Conversations

To complement the desk research with real-world insights and transdisciplinary thinking, I conducted semi-formal interviews with faculty members and students engaged in creative practice, sustainability, design, and engineering. These conversations, a total of 34, ranging from 20 to sometimes 90 minutes, provided diverse perspectives on the challenges and opportunities of circularity in product design and helped refine the scope of the project. Persons in creative practice, such as the Design and Technology program faculty, gave more artistic and speculative insights about relevant projects that addressed the issue of e-waste, like Ore Stream by Formafantasma[31] and Damián Ortega's Disassembled Art Installations,[32] which included an installation of a deconstructed Volkswagen. The new, unusual perspective of a known vehicle offered a powerful medium to discuss topics of consumption culture and politics. Ore Stream was a research-based project that explored electronic waste as a resource and used different media, such as videos, animations, and physical objects, to comment on the global systems of e-waste management. The conversations with faculty members of creative practices and the insightful resources they provided, such as those two projects, worked as an inspiration that shaped my approach to my enquiry.

Other faculty and students who had a more reality-grounded practice gave insight into doing lifecycle assessments, collecting data about waste impacts,



Picture 1: Ortega, Disassembled Art Installation



Picture 2: Ore Steam, Taxonomy

and researching communities of practice that are part of the conversation. To gain technical insight as well, I connected with some students at Stanford Design School and arranged a visit to the Product Realization Lab (PRL) at Stanford University, which is the main workshop that serves engineering students' projects and has manufacturing machines like injection molding and sheet metal forming. The design students there had more engineeringoriented practice, and their insights were as such. Their conversation suggested thinking about what parts could be redesigned and manufactured differently, and offering an alternative material/component in an already existing design to reduce the carbon footprint or improve the recyclability of the product. Their expertise, along with the tour they gave me at the PRL, helped me form a better understanding of manufacturing processes that can influence the circularity of the product. The concept they suggested could be a way to work toward a more circular product, but it might not be sufficient to address the full complexity of the system, especially given the stronger influence of factors like material availability, resource sourcing, and manufacturers' drive to minimize production costs.

2.3 Deconstructing Instruments: Reverse Engineering

After the exploration phase, it was time to get hands-on. I started by deconstructing the first appliance that I could get my hands on, which happened to be a used nonfunctional blender. The main goals for this method were to understand how the item works and to assess how easy it is to deconstruct it with simple hand tools for potential repair work. The blender had four main parts that were designed to be combined and separated between use cycles. Those are the lid, the container, the blade assembly, and the base of the part that contains the functional and power components. The most critical of those was the last part, which contains the technology that makes the blender blend, and is the source of electronics waste. The bottom of the blender was easy to remove using a screwdriver. The pushbuttons were also easy to remove, but the rest of the components could not be separated without the need to make irreversible damage.

I did not continue the process of deconstructing the blender, hoping I could put it back together and give it back to its owner. I used the deconstructed parts, however, as a showcase when I spoke with peers about the topic of design for remanufacturing. It helped open conversations about communities of practice and potential approaches that would shape my project. After this experiment, I decided that I should be more intentional with what appliance I want to deconstruct next, and when I decided that I would focus my research on electric kettles, I bought one from Amazon.

I picked the heating kettle as my piece of inquiry and was set on designing one, but first, I wanted to understand how it functions and how it is being produced. I bought a common electric kettle from Amazon for 16$ and deconstructed it with basic hand tools. The reverse engineering helped me to analyze its construction, materials, and assembly methods. Following that, I evaluated each component of the kettle, what it's made of, and how circular it is. The outcomes of this method took the form of pictures of the disassembled components laid out in a grid formation, followed by a table of contents listing each component, its function, and material.

2.4 Story in Numbers: Quantitative Research

The exercise of deconstructing the kettle and seeing how easy it was to take this specific product apart and then rebuild it made me want to understand how users usually act with their kettles if they need repair. I started by listing common issues that electric kettles undergo, relevant to each main component I listed in my table of contents. The issues were as follows:

1. Limescale accumulation on the bottom surface.
2. Switch malfunction or damage.
3. General wear and tear.
4. Leakage or fracture in the body of the kettle.
5. Power cord issues.
6. Deteriorated heating element.

I created a Google Form survey that would take no more than 1 minute to fill out, asking three multiple-choice questions, with the six issues listed as options for all of the questions. The first one was whether any of the issues caused the user to throw away their kettle. For this question, I added an extra option that says “other” and gives the choice of adding their own issue. The second question was to see if they have ever faced and fixed any of the issues. And lastly, the third one questions their interest in repairing the issues if given the right tools and guidance. The survey was distributed to 30 persons of various backgrounds in different places of the world, but mainly in the same age group (20 – 30), which is the age group that was exposed to modern technology, has enough experience to handle products and repairs, has a level of independence, and will be influencing the future of design and consumerism. I followed the survey with conversations with some of the applicants to understand more about their experiences and thoughts. The patterns of use that the survey results displayed, along with the follow-up conversations, gave insights about what motivates people to fix things, how willing they are to fix, what the components that are usually fixed look like, and a general understanding of the consumption behaviors.

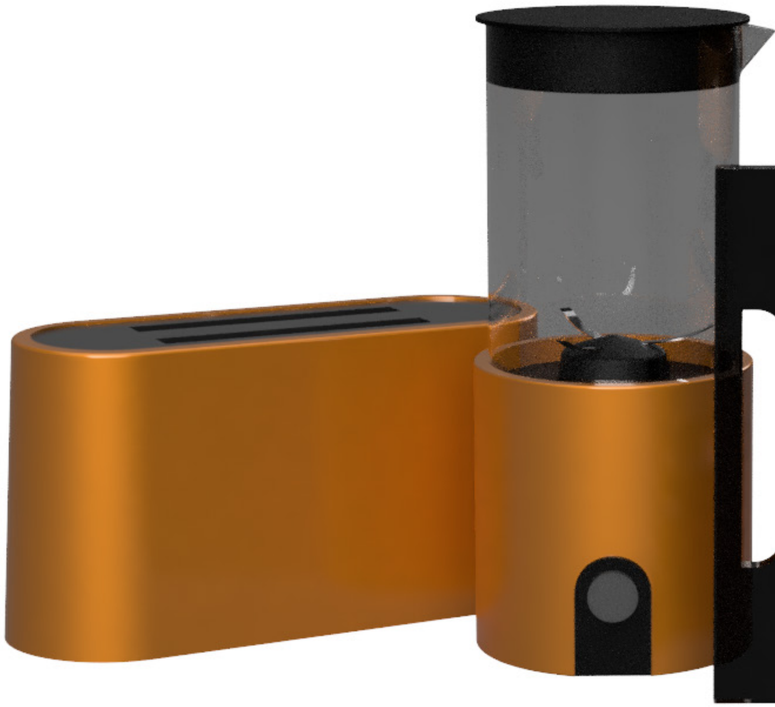
Note: The full survey form can be found in the Appendix.

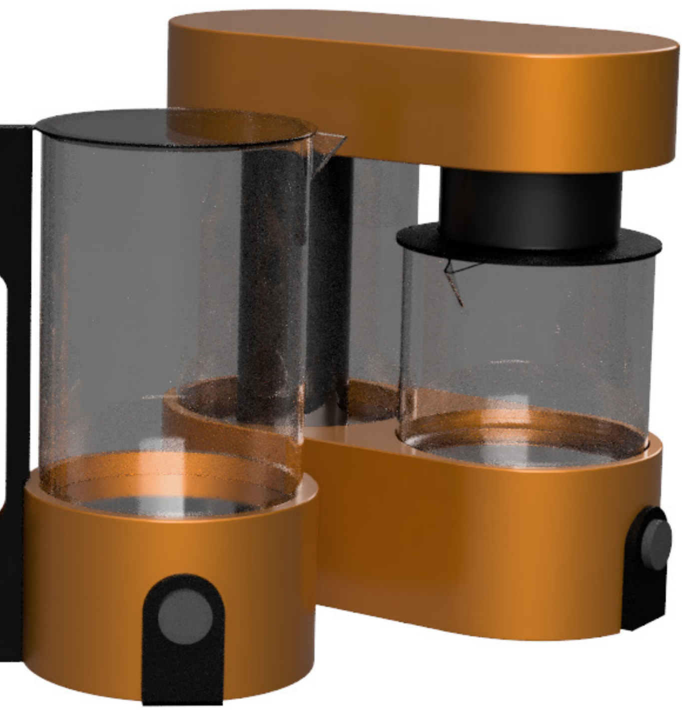
2.5 Thinking Through Making: Design-Led Research

Finally, I did design-led research by designing a new kettle that affords complete circularity, meaning that each material could be separated from the other one using a simple hand tool – a screwdriver, and without destroying any of the components. Moreover, each component is made of materials that could be recycled or reused.

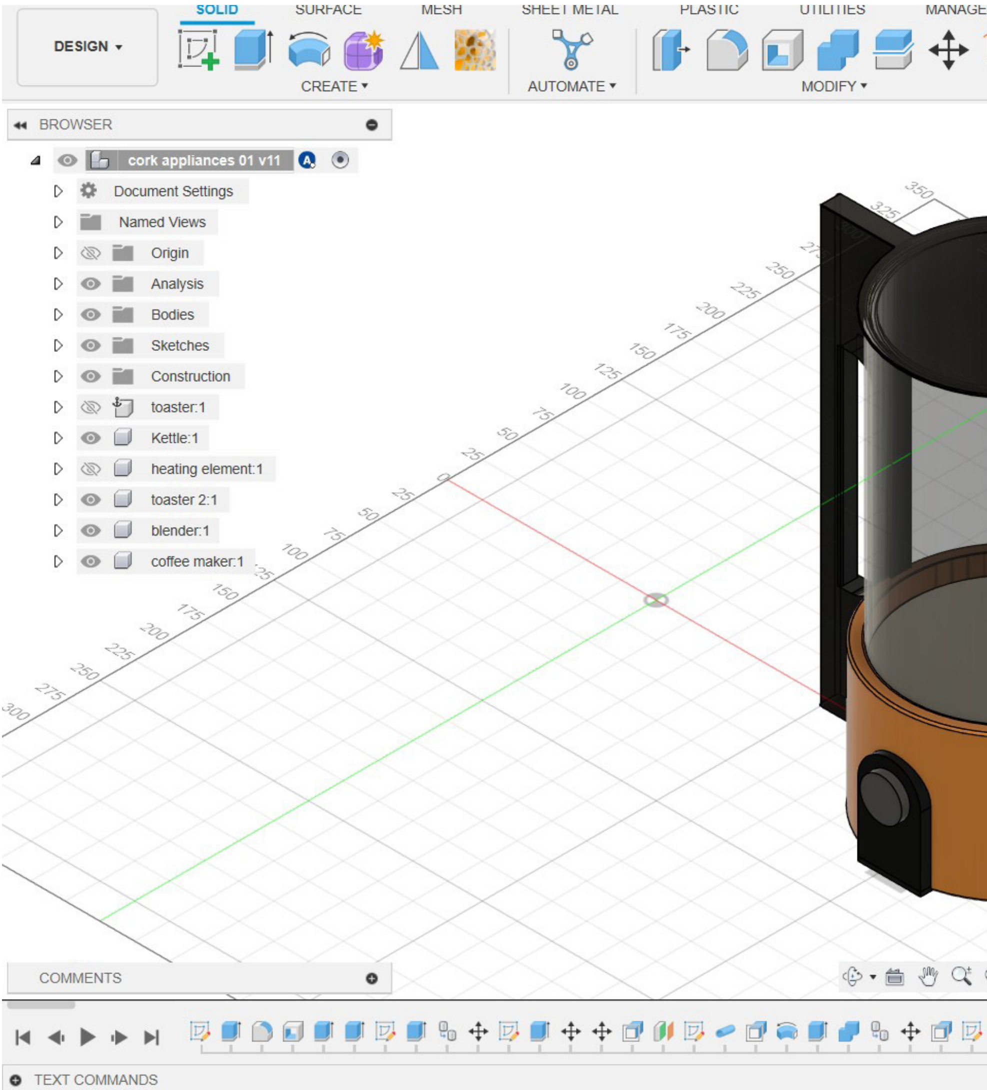
The goal of the design practice is to explore design possibilities and forms of materials, to understand what could be done from a design and manufacturing perspective, what could provide a good user experience, and what the design decisions should be. I started with a rough concept design of the kettle, making sure I used simple and neat shapes that would provide practicality and an easier manufacturing process. I made a sketch and followed it with a 3D model that shows what the kettle would look like. I tried to think of a family of kitchen appliances that share a visual identity.

Picture 3: Sketch of A Blender And A Kettle

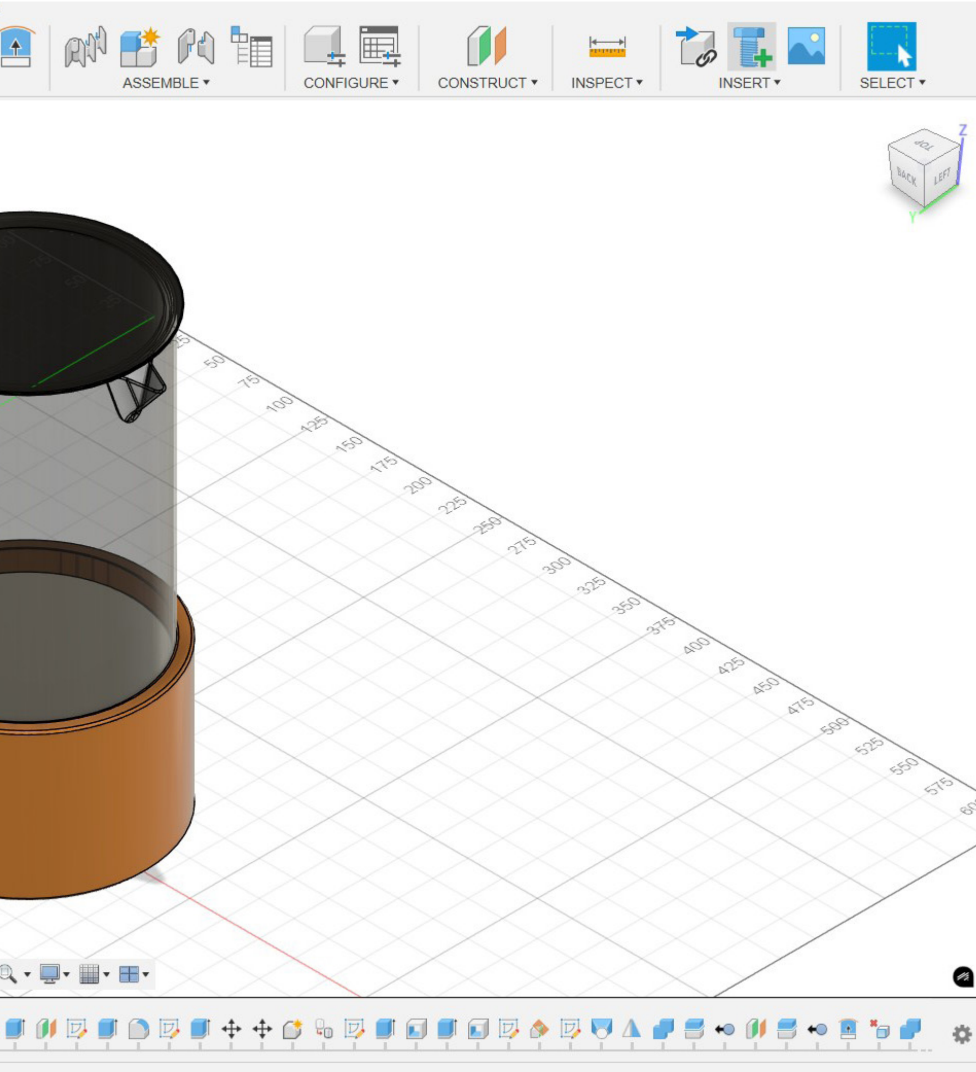




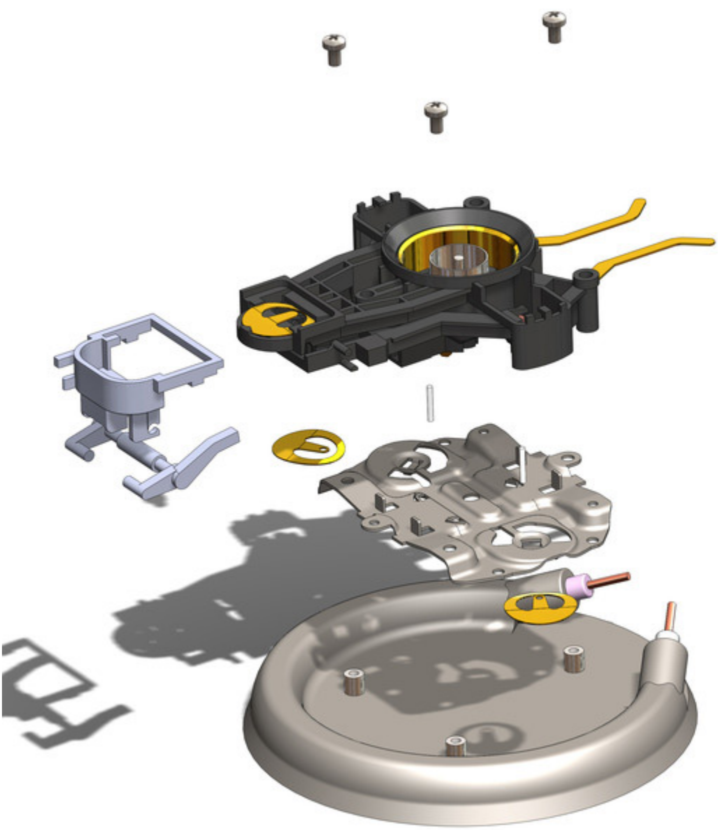
Picture 4: Kitchen Appliances Family



Picture 6: 3D Modelling on Autodesk Fusion

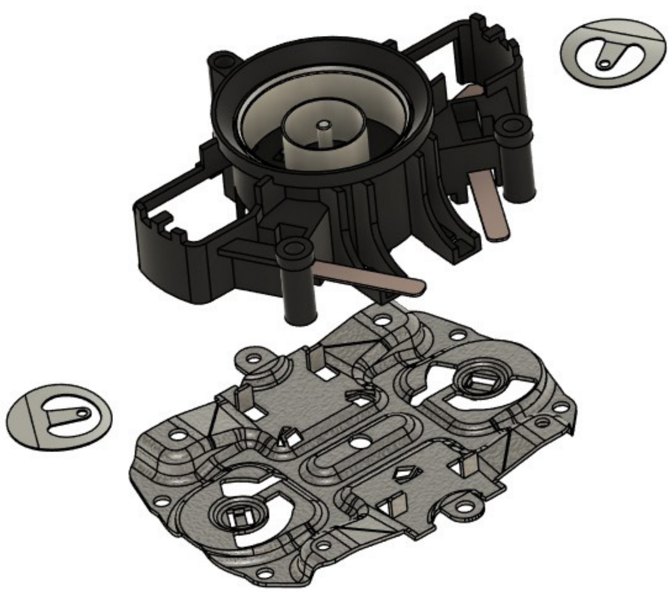

ASSEMBLE
CONFIGURE
CONSTRUCT
INSPECT
INSERT
SELECT

Then, guided by my findings from the reverse engineering phase, I started adding details to make the kettle functional. I realized that I don't need to reinvent most of the functional parts, so I just looked for a coupling mechanism option and picked one design with a 3D model I found on Grab CAD. I modified the design a little bit using Autodesk Fusion and integrated it into my design.

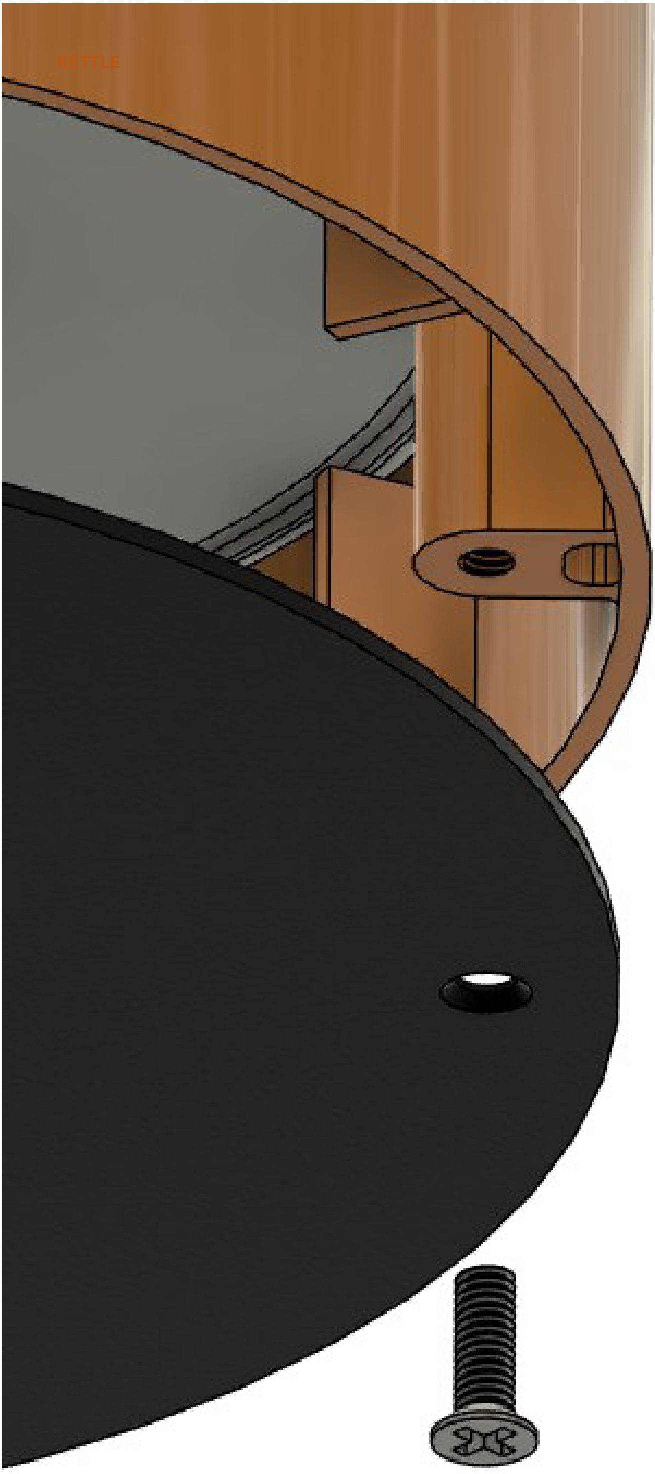


Picture 7: Steen Winther, Strix U1855 control system for electric kettles (GrabCAD, 2012)

I arranged the functional components inside the aluminum orange housing and made sure I kept the assembly mechanism in mind, adding threaded slots and screws to connect parts together. But the most significant change I wanted to implement is to make the heating element separable and not welded to the kettle and heating surface.

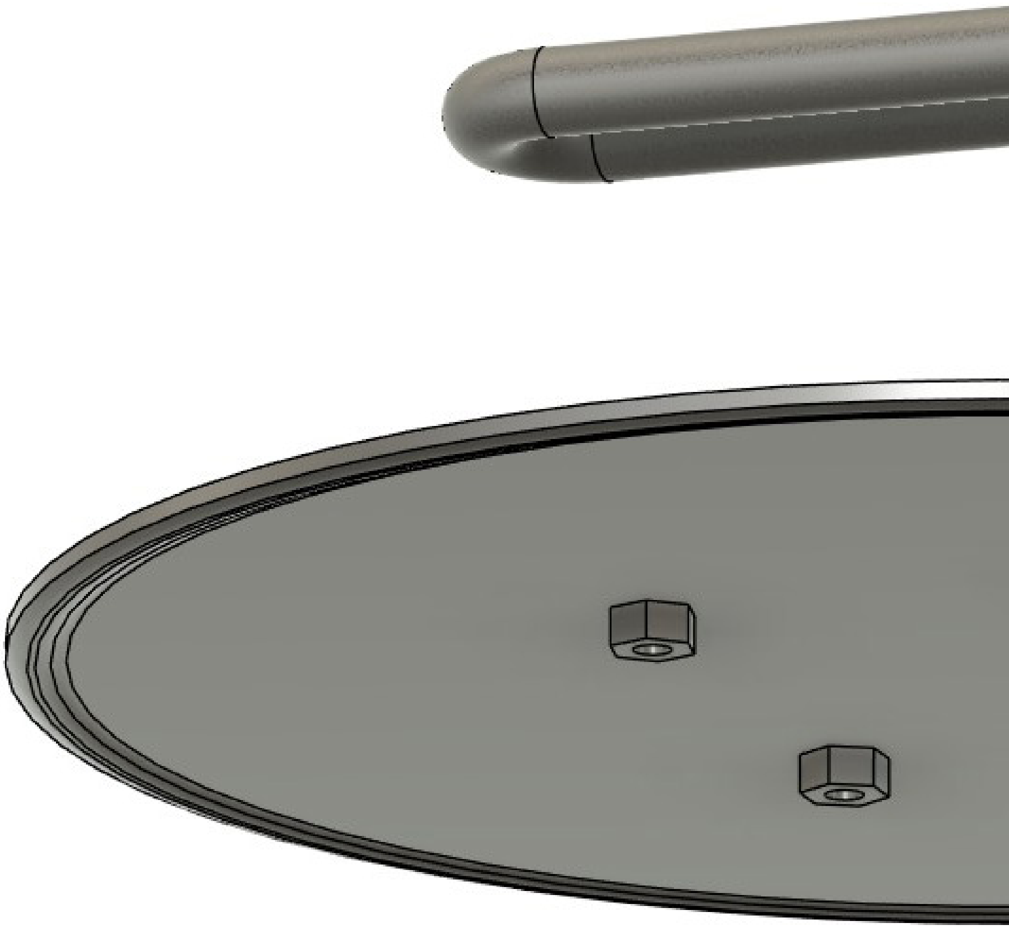


Picture 8: Modified Coupler



Picture 9: Exterior Assembly Requires Only A Screwdriver

Picture 10: Kettle and Heating Element as one piece.



Picture 11: Heating Element Assembly, Requires only a Screwdriver

Part 3: Realization

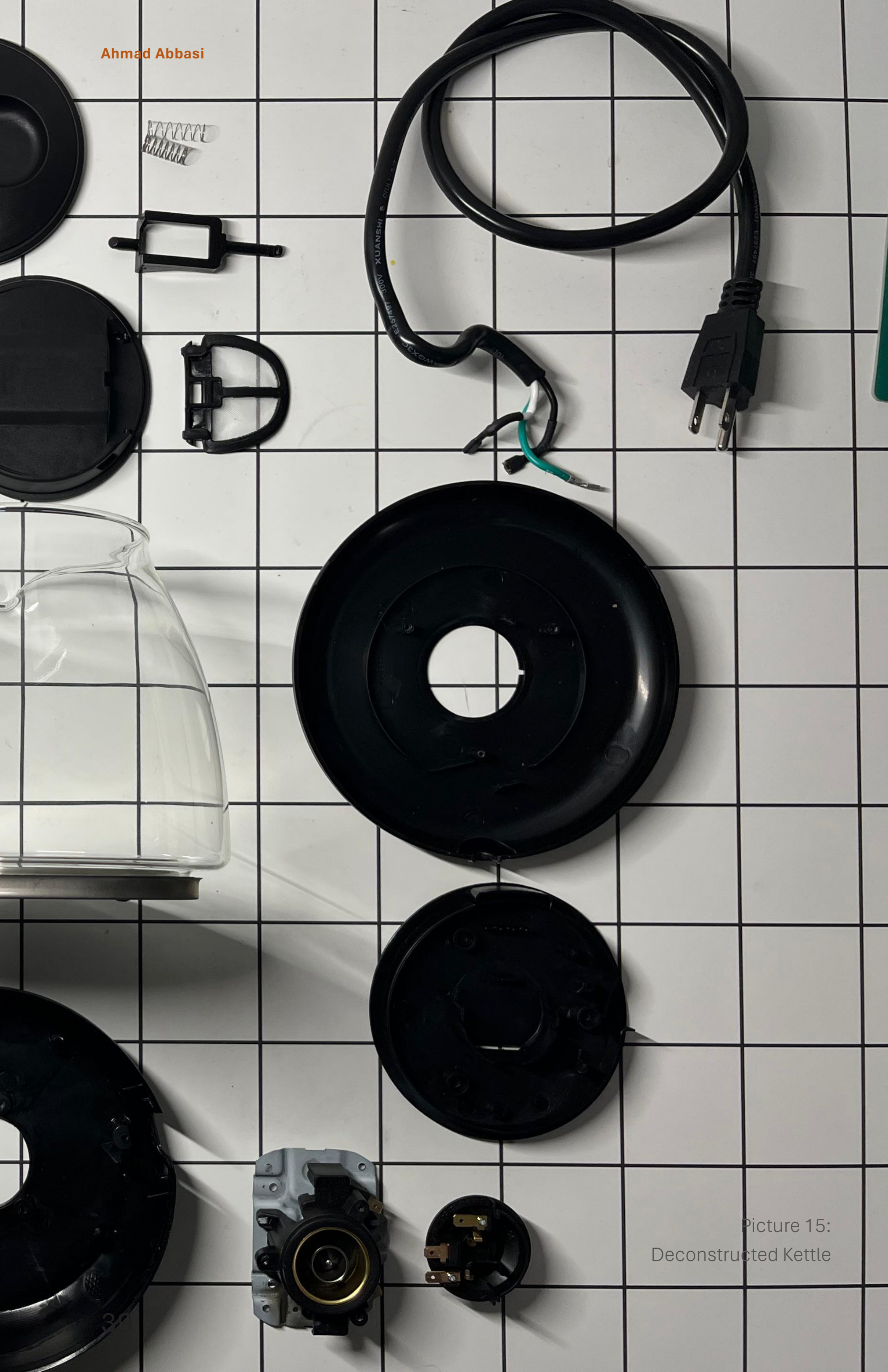
3.1 The Unpacking

The reverse engineering part of the research started with deconstructing two kitchen appliances. One was a used, broken blender, and the other was a heating kettle purchased from Amazon. The result of the deconstruction process was, first, understanding the components and materials that the appliance is made of and, second, assessing the ability of disassembly and sorting of materials for repair or recycling purposes.

Picture 12: Electric Kettle From Amazon

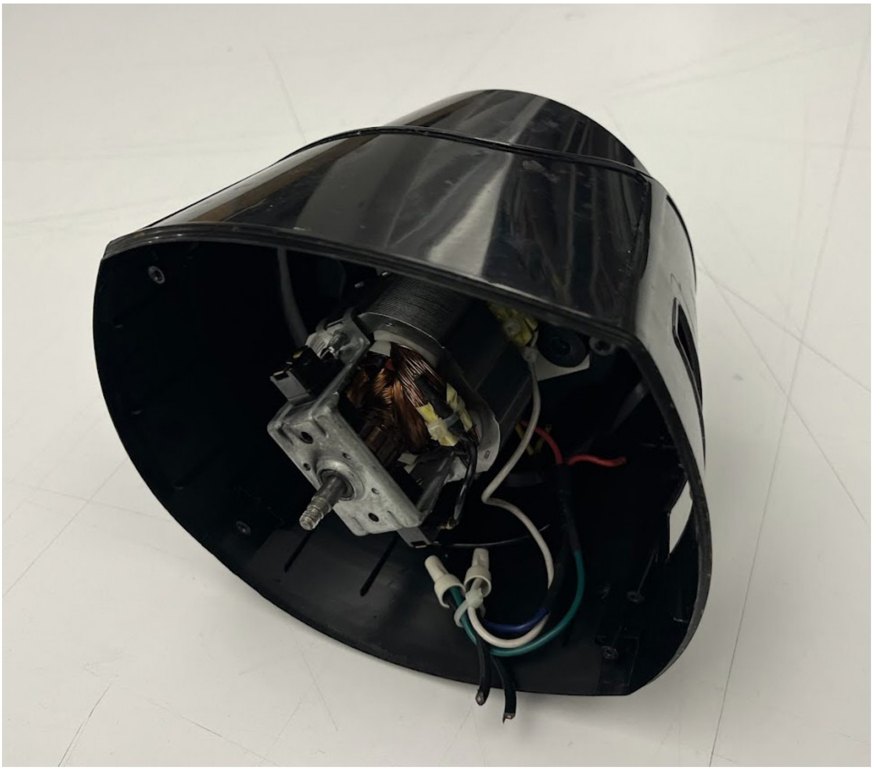
Picture 13: Hamilton Beach lender

Picture 14: Deconstructed Blender



Picture 15:
Deconstructed Kettle

The first attempt at deconstructing a kitchen appliance was the blender. Soon after the process started, I was not able to disassemble it completely with basic hand tools. As I removed the cover and started making my way to separate each component, I was met with components that were bonded together, mainly the cutting blade assembly, the motor of the blender, and the push buttons.



Picture 16: Base of Blender Not Designed for Disassembly

For the cutting assembly, it makes sense to have it as one item to make repairing easier for any non-specialized person. The buttons are made in one piece for better fidelity. Even the motor would be intentionally designed in that arrangement, but it means that if, for example, the coils of the motor were damaged, the whole product would no longer be useful. It also means that we are left with a big chunk that contains plastic, copper, aluminum, steel, and other materials inseparable, making the recycling process more complicated.

The second object, and the one that relates to the making part of this project, is the electric heater. The deconstruction process was much easier in comparison to the blender, and at the end, a few items were left inseparable. The table on the following page shows a breakdown of the components that make up the electric kettle. The table lists each component, the materials that compose the component, and their circularity. For circularity, things that could be reused by the user for any other project or device are marked as Reusable, things that are sorted as a mono material that is ready for recycling are marked as Recyclable, and things that have a complicated structure and mix of materials are marked as e-waste. The table was used while presenting the findings to a group of multidisciplinary design practitioners, and at first glance, there was an audible gasp at the results. It was not expected that a very basic kettle could have this range of components, which gives an insight into people's awareness of how things are built and the possibilities of repairing or tinkering with them, even though the audience here were designers (not hardware designers) and daily users of similar appliances.

The main functional part of the appliance, which is the kettle itself, consists of key parts that are inseparable: the glass vessel, the stainless-steel surface, and the heating element. Looking at Life Cycle Assessments and deconstruction of various kettles online, it shows that in some cases, the heating element is not fixed to the heating surface, and in some other cases, the vessel is made of stainless steel, just like the surface. However, this

Object No.	Piece	Function	Material	Circularity
1	Cable	Power supply from wall socket	Mixed	Reusable
2	Base Cover 1	Forms the base platform that holds the power connecting part	Plastic	Recyclable
3	Base Cover 2	Forms the base cover that contains the power connecting part	Plastic	Recyclable
4	Wiring	small cables used to connect electrical components and switches.	Mixed	Reusable
5	cable with LED and resistor	wiring and lighting to indicate power on	mixed	e-waste
6	transparent Ring	Used to display the LED light	Plastic	Recyclable
7	Kettle	heating element attached to the base of the kettle that is used to contain water	Glass, metal, conductive materials	e-waste
8	Kettle coupler LIANG JI LJ-06	connects the electrical componenets to the power socket in the Base piece	Mixed (plastic, metal, conductive materials)	e-waste
9	bottom cover	to cover the componenets at the buttom of the kettle	Plastic	Recyclable
10	handle	adjusts to the kettle for handling and houses a switch	plastic	Recyclable
11	handle cover	covers the components attached to the handle main piece and links with the cover part	Plastic	Recyclable
12	switch button	on-off switch button	Plastic	Recyclable
13	switch holder	small piece to hold the switch in place	Plastic	Recyclable
14	DY 03G T125	Switch to turn the device on and off manually	plastic and copper	e-waste
15	HHB 1006	cover lock mechanism	Plastic	Recyclable
16	mesh filter	to catch limescale or other impurities when pouring water	plastic and nylon mesh	Recyclable

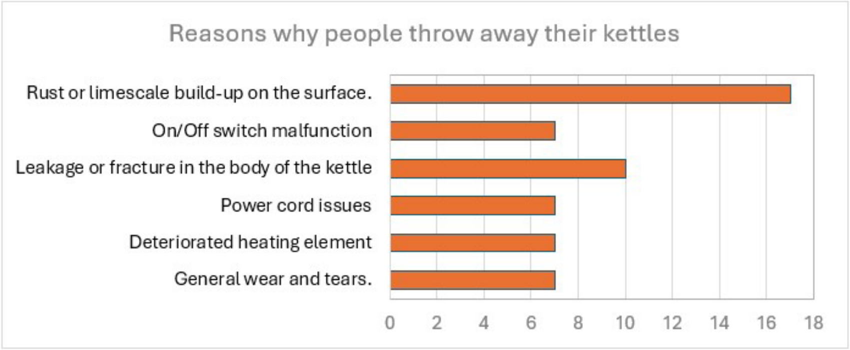
kettle represents the vast majority of affordable and practical heating kettles available in the market, of which's demands also indicate that they provide a good user experience. The non-mechanical bonding of the materials that shape the kettle means that adhesives were used, which in most cases means harmful chemical materials. From collecting data from users and complemented by desk research, I found that the most common causes for throwing away an electric kettle are:

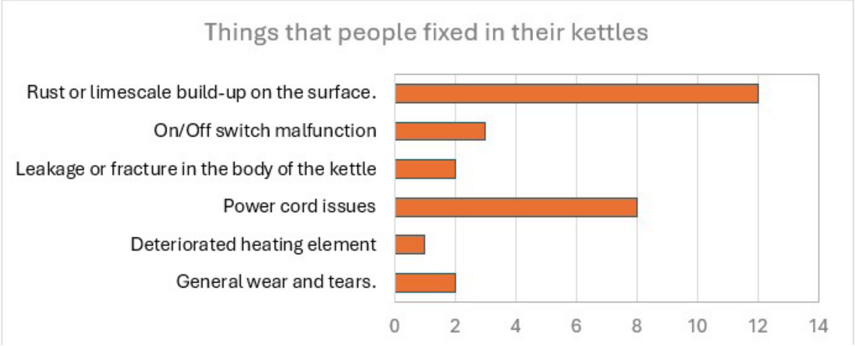
7. Limescale accumulation on the bottom surface.
8. Switch malfunction or damage.
9. General wear and tear.
10. Leakage or fracture in the body of the kettle.
11. Power cord issues.
12. Deteriorated heating element.

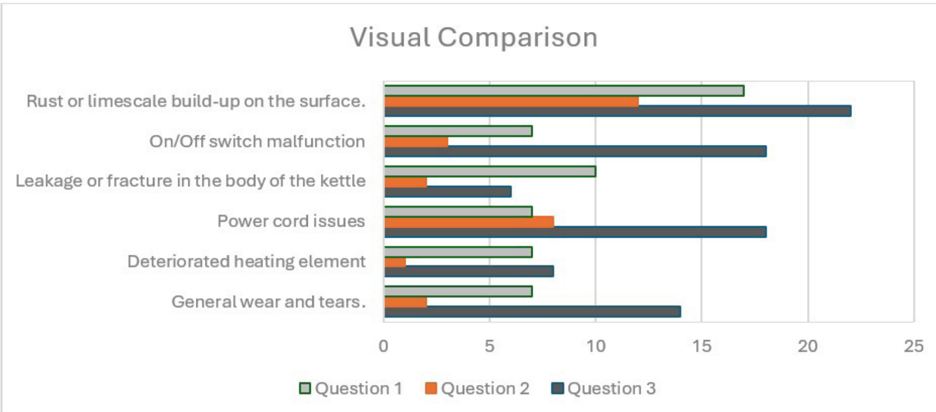
General wear and tear include that when the kettle is old, dirty, or damaged due to misuse, people usually throw it away, even if it's still functional. In this case, there might not be a way to work around getting rid of the kettle, especially since kettles are relatively affordable. In the case of power cord issues, some people opt to change the power cord instead of throwing the whole thing away, especially if they have spare cords from old devices that could be used to replace the faulty one. This practice, even though not common, could be used with a malfunctioning switch. An average person with simple hand tools should be able to change the switch of the kettle if provided with guiding steps. This leaves three issues: limescale build-up, leakage, and heating element problems. Each of those issues could be fixed if the kettle were designed in a different way, but since it is designed so that all the respective components are fixed together, it makes it much easier to just buy a new kettle.

The process of reverse engineering prompted me to do a quick survey and collect data on users' behavior when using, fixing, and throwing away kitchen appliances. The following data were collected from a sample of people aged 20 – 30 from various backgrounds. The results were as follows:

The first question, about why people get rid of their appliances, showed that the majority will do that because of the limescale build-up on the surface. The next most common reason is a fracture or leakage, while other reasons are less common and relatively close to each other. Some other answers that people added included electricity issues and odors, which might fall under general wear and tear, but other answers also mentioned that the reason is simply to buy a new, better one. However, when asked if they fixed any issues, we see that the most fixed issues are the limescale buildup and the power cord issues. As for limescale, fixing it by cleaning the kettle might work to extend the usage of the kettle, but with time, it becomes harder to clean, and would need replacing. But power cords are usually fixed and are not seen as a common reason to throw away the kettle. And the reason power cords are usually repaired might be the fact that they are more accessible; you don't need to open the body of the appliance to change the cord, rather you can cut it and attach a new one. Moreover, it is relatively easy to change it, and is considered common knowledge, and most importantly, it is easy to find a replacement for the power cord, whether it is a new cord, or a cord salvaged from another broken appliance. The last question shows that people are interested in fixing their appliances if they feel enabled to do so.



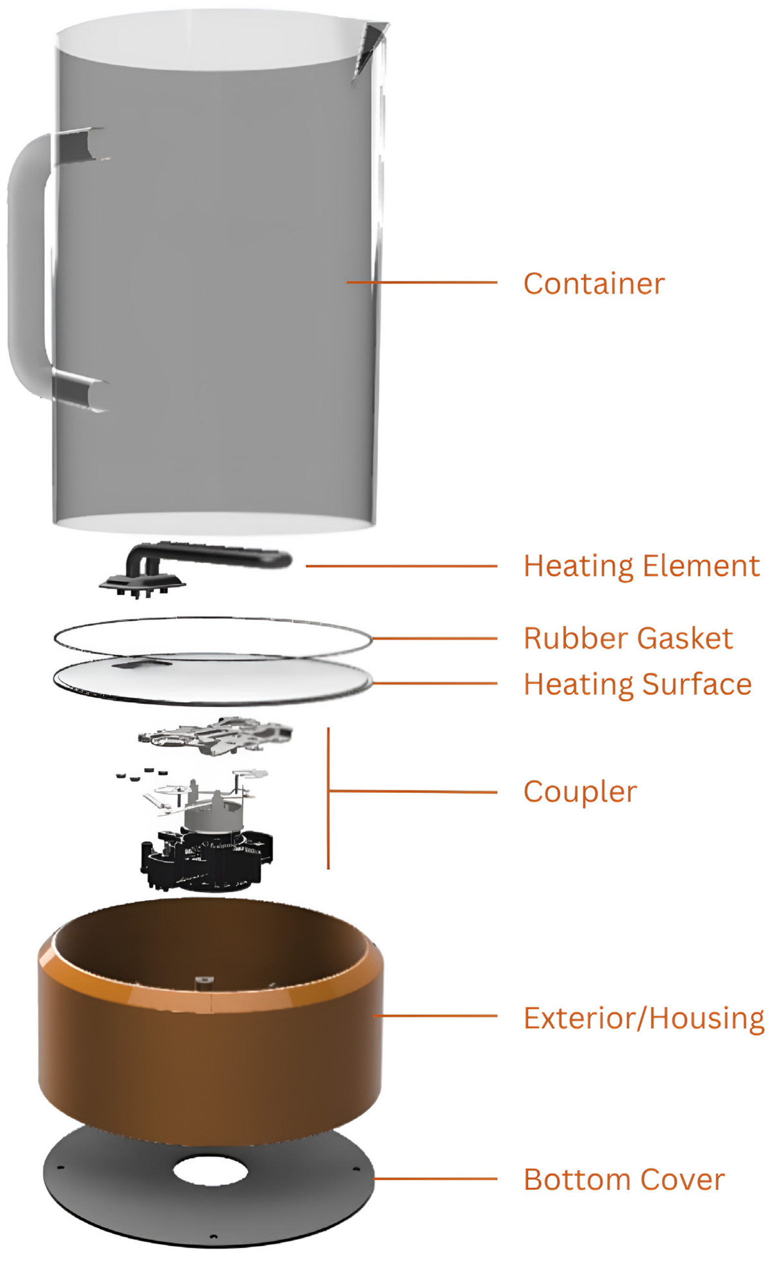




3.2 The Shape of Circularity

I designed an electric kettle that has a uniform circular shape and is designed in a way where all components could be disassembled and separated as individual materials. The most significant part of this design in comparison to the heating kettle I deconstructed is that in this one, I am using an exposed heating element. Although an internal heating element might provide better user experience as it is easier to clean, the compromise was made as the exposed element is more efficient in energy consumption and affords the innovative idea about the design, “disassembly”; with a simple screwdriver, the user easily remove the heating element and replace it with a new one, or reuse it with a different device.

Picture 17: The Last Version of the Kettle, With Exposed Heating Element



Picture 18: Exploded View of The Kettle

The exposed heating element opened a discussion when I presented my design to my peers. Having the component that makes the whole device function the way it does, along with the exploded image of the kettle with all its components explained triggered a sense of curiosity and also confidence that changed their energy to wanting to try and deconstruct and rebuild a kettle and hoping to get the opportunity to fix one soon. From an aesthetic point of view, before explaining the intention of exposing it, they did not like how it looked. The shift happened after the explanation, and highlighted an opportunity here, which is looking at the exposed element as an aesthetic identity of circular devices, and embracing exposing how kitchen appliances work, could push users to think of repair and reuse differently. Similar to the Toyota Prius car, which had a rather unattractive shape, when it was released, people embraced it as the shape of sustainable vehicles. It is important to note that most of the technology involved in essential kitchen appliances is common knowledge to people in the field of design and making. Extending this knowledge to the normal user should not be an issue or a challenge, but an opportunity to bridge the gap between the designer and the user.

Epilogue: Synthesis

This project started with a simple question: what does it take to make kitchen appliances easier to fix and recycle? Through the process of deconstructing appliances, gathering insights from users, and designing a new kettle, it became clear that the way things are built plays a huge role in how people use, maintain, and eventually get rid of them. Most appliances, even very basic ones like kettles, are made with multiple materials bonded together in a way that makes repair and recycling hard without specialized tools or knowledge.

The survey and conversations with users showed that the willingness to fix things is there. People are open to the idea of repair if they feel enabled and if the process seems doable. The problem is that most products aren’t designed to give users that chance. Instead, they push toward replacement.

In designing a new kettle, I tried to answer this gap by creating a product that could be taken apart completely using a screwdriver. I found that embracing design decisions like exposing the heating element, even if it challenges traditional aesthetics, can create new opportunities. It can spark curiosity, give users confidence, and make the function and repairability of the device part of its identity, not something hidden away. Design choices that once might have been seen as purely technical or purely visual can actually shift mindsets toward repair and reuse.

One of the most powerful tools in guiding this shift is the visual identity of a circular product. While internal mechanics and material choices are crucial, how a product looks, feels, and communicates its purpose plays a significant role in whether people engage with it differently. A kettle with an exposed heating element, for instance, is not just a functional decision but a deliberate visual cue to its repairability. It challenges users to rethink what "good design" is — not just about sleekness or minimalism, but about transparency, sustainability, and the ease of disassembly. When users see components that are meant to be handled, they begin to internalize the idea that these products can be cared for, not just disposed of. Design becomes a bridge between the technical and the emotional, inviting people into a conversation about repair, sustainability, and consumer responsibility. Just like how the Toyota Prius became associated with sustainable transportation despite its initial design critiques, a circular product can shift its visual identity to symbolize innovation in sustainability. Over time, products like this can push consumers to reconsider what they expect from their daily objects, viewing them not as single-use items but as things that can be maintained, fixed, or reimagined.

Reflecting on my participation with the team at Al Zaatari camp, I am reminded that even small interventions, even when they don't lead to a full redesign of an object, can have a meaningful impact on people's experiences. Sharing the basic technology behind a simple appliance like a kettle, making it common knowledge, can open up possibilities that seemed distant before. In contexts where resources are limited, empowering people with the ability to understand, fix, or creatively reuse what they have can change their relationship to objects, and by extension, to systems that often feel closed off or predetermined. The act of demystifying a product is itself a design intervention, not through materials or form, but through access to knowledge.

Throughout this process, a bigger question kept surfacing: What is the role of the individual in a system that is intertwined with many factors? While the structures of mass production, cheap materials, and built-in obsolescence are massive and complex, individual decisions, whether as designers, consumers, or makers, do matter. They might not overturn the system overnight, but they can create friction against it. They can offer alternatives, however small, that make people pause, notice, and act differently.

As a designer, I realized that the choices I make at the material, form, and assembly levels can either close or open doors for the user. Design can either continue to hide how things are made or invite people in. It can either reinforce a passive relationship with objects or create an active, empowering one. By making repairability visible, by making disassembly easy, and by making material honesty part of the aesthetic language, a small object like a kettle can carry a different set of values into daily life.

This work is not a solution to the larger problem, but it is a step toward imagining a different way of making and using things, one where circularity, repair, and user empowerment are not afterthoughts, but starting points. Changing the system starts by changing the assumptions we build into the products around us, and by trusting that users are capable and curious.

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Appendix

Circularity of Electric Kettles

1 minutes Survey to collect data on why and when people get rid of their electric kettles.

* Indicates required question

1. If you used an electric heating kettle in the past and you got rid of it, what was the reason you threw it away? *

Check all that apply.

- [ ] Rust or limescale build-up on the surface.
- [ ] On/Off switch malfunction
- [ ] Leakage or fracture in the body of the kettle
- [ ] Power cord issues
- [ ] Deteriorated heating element
- [ ] General wear and tears.
- [ ] Other: ____________________

2. Have any of the mentioned issues happen to your kettle and you got it fixed instead of getting a new kettle? (select all that applies)

Check all that apply.

- [ ] Limescale build-up on the surface.
- [ ] On/Off switch malfunction
- [ ] Leakage or fracture in the body of the kettle
- [ ] Power cord issues
- [ ] Deteriorated heating element
- [ ] General wear and tears.

3. Do you think you would be able to fix any of the issues by yourself if given the right tools and instructions?(select all that applies)

Check all that apply.

- [ ] Limescale build-up on the surface.
- [ ] On/Off switch malfunction
- [ ] Leakage or fracture in the body of the kettle
- [ ] Power cord issues
- [ ] Deteriorated heating element
- [ ] General wear and tears.

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Hello, My name is Ahmad and I designed an electric kettle that could be fully disassembled using only a screwdriver - an exploration of how everyday appliances can be reimagined for repair, reuse, and circularity.

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