Human-Waste: Recycling in Social Contexts

A Thesis Examining the Transformative Potential for Society of Haptic, Local, and Immediate Plastic Recycling Practices and Their Cultural Implications

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Abstract

With reference to existing waste management systems, alternative concepts for collaborative participation in recycling processes will be developed. By examining the historical and material contexts of plastics, this thesis explores the role of making and hacking as transformative practices in waste revaluation. Methods for the investigation of human-waste relationships will be applied, drawing on theories such as Rubbish Theory and Material studies, which highlight the shifting perception of objects between value and non-value. Additionally, practical investigations, including workshop-based experiments with polymer identification and machine-based interventions, will provide hands-on insights into the material properties of discarded plastics. Novel archiving practices will be introduced, together creating a novel methodology for artistic research and practice. Through these approaches, this research aims to foster a socially transformative relationship to waste, emphasizing participation, design, and speculative approaches to material reuse. The findings will be evaluated based on participant feedback and workshop outcomes, contributing to a broader discussion on waste as both a challenge and an opportunity for sustainable futures and a material reality of the human experience.

Keywords: waste management, recycling practices, object-value, transformative interaction, maker-education, hacking, archival practices,

Contents

Introduction

Why Plastics?

Plastics have become both a cornerstone of modern innovation and a symbol of environmental degradation. After the Success of the term “Anthropocene”, People already made convincing arguments for the “Plastocene” (Preston, 2017), marking the invention and industrial usage of plastics and the fact that it will be discernible on a geological level when humanity started that process since plastics residue can and will remain as fossil layer. Plastics transformed the story of industrialism and can be shown to be closely interwoven with modern capitalism. It revolutionized packaging, enabling completely new scales of food storage and transportation, Much like the story of the fossil fuels at large (Malm, 2016) The cultural image of plastic was not too bad at its inception: one could say the positive image remained even with Life in plastic, it’s fantastic[1] the Song by Aqua

connect

As someone immersed in 3D printing, I frequently confront sustainability challenges. Most 3D-printed parts are never recycled; instead, they contribute to the growing global waste problem. The 3D printer itself is indifferent to what it prints, concerned only with material purity and dimensional accuracy, yet the materials it uses often demand virgin plastic, perpetuating a cycle of consumption and waste. Germany, as one of the leading producers and consumers of plastics, exemplifies the systemic reliance on virgin materials. Although some recycled filaments are available on the market, they are typically costlier and of lower quality, discouraging widespread adoption. This disparity highlights a fundamental issue: the economic infeasibility of a robust, scalable recycling process for plastics. The core challenge lies in identifying and separating materials efficiently—a technological and logistical hurdle not yet overcome. Despite these challenges, the

[1] https://genius.com/1613295/Aqua-barbie-girl/Life-in-plastic-its-fantastic

willingness of individuals to engage in recycling is evident. However, existing systems fall short of empowering individuals to recycle effectively. This disconnect raises the question: how can we reimagine the lifecycle of plastic, fostering both ecological sustainability and human agency? This thesis explores potential answers to this question through theoretical insights and practical experimentation. By examining the intersections of human behavior, waste systems, and design innovation, it aims to uncover opportunities for a socially transformative relationship with plastic. The goal is to shift perspectives, treating plastic not as waste, but as a resource capable of enduring value.

With the backdrop of plastic waste as a global challenge, a collaborative workshop format is born, which tries to change perspectives on plastic objects surrounding us and playfully explore whether a co-creative learning process can contribute to a change in behavior towards waste. To support the Workshop, a novel archival practice is outlined and tested. The Archive is a semi-permanent knowledge structure, used both for teaching and documentation purposes.

leave for last.

Do i actually want to talk about social perception of plastic? takes too much room right now.

Want to focus more on workshopping and archiving as material-insensitive scientific practices.

Related work?

The research hypothesis

reformulate

Hypothesis: working communally, touching and transforming a material generates novel insights and shifts in percieved agency, not available through other forms of learning.

Capturing the knowledge generated in a communal setting such as a workshop and knowledge transfer to a usable, persistent state is hard and usually

relies on individual coping strategies, resulting in an imbalance between the learning efficiency of interactive formats like workshops and their contribution to knowledge-generating processes like for example present in scientific communities. An automated archival process is expected to lower the hurdles of participation of laypersons in artistic research. A similar effect is expected for shared knowledge generation in general, even “hard-scientific” ones.

In this work.

outline provide written outline of everthing happening in the following chapters.

Context / Theoretical framework

History of Plastics

Bakelite Example

Bakelite was the first plastic to be dicscovered and quickly took to productive and consumptive processes. it was immediately recognized as the wonder-material it truly is. (Montoya, 2024)

Reference back to plastocene

History of Trash

Waste in capitalism

Trash in pre-capitalist societies

English alternative source for waste histories (Strasser, 2000)

In the Book “Müll: eine Schmutzige Geschichte der Menschheit” by“ Köster (2024), Trash is shown to be closely intertwined with capitalism and the resulting overproduction. Pre-capitalist societies did often not even have a concept of waste, as it was simply not a necessary concept. Waste was either not produced in the first place or it took a form that simply reintegrated into either a productive cycle or a natural process. (Köster, 2024, p. 15)

Köster also observes that Trash is from its inception a valued category. It always comes with the association of “dirtiness”, devaluation and general repulsiveness. (Köster, 2024, pp. 11ff)

Scavenging as expert knowledge: (Köster, 2024, pp. 298ff)

Plastics transformed scavenging industries and also the following handiworks. Craft workers previously primarily working with scavenged metals quickly switched and retrained working materials towards plastics, since it is in many regards more convenient, easier to scavenge and easier to form and also less resistant to DIY-Forms of recycling. (Köster, 2024, pp. 298ff)

Whether or not recycling happens, is historically strongly aligned with the available infrastructure for it. The fact that glass has one of the highest recycling

rates worldwide is not only due to material properties, but also because it has a long history of politics establishing infrastructures for collection and recirculation.

With Plastics, this infrastructure took particularly long to establish, because of the sheer variety and lack of regulation at point of production. A prominent german example is the “Grüner Punkt”, which got established in 1990 and had an especially hard time growing the support necessary from a larger population in order to be effective.

> Einmal etablierte Infrastrukturen entfalteten vielmehr eine Performativität, die Recycling überhaupt erst zu einem Massenverhalten machte: Der Glascontainer brachte die Möglichkeit der Wiederverwertung jeden Tag in Erinnerung. Ähnlich war es später mit den verschiedenen Tonnen, welche den Bürgern zur Verfügung gestellt wurden. Nicht zuletzt diese Alltäglichkeit machte Recycling mehr und mehr unverzichtbar. (Köster, 2024, p. 293)

translate?

(Köster, 2024, pp. 293ff)

My own analysis:. The workshop is infrastructure. It will provide performative transformation simply through providing a space for exploration. Just the guided and playful contact with the material is enough to change perceptions and create appreciation on a matzerial level.

Making and Hacking as transformative Practice

Show that Making, hacking and playful learning is just science and thats whats being done in the workshop.

How is hacking a form of science?

how is explorative learning / playful learning hacking and what

Reference to Junge TüftlerInnen?

Haecksen?

CCC?

Better Makerspace references?

Introduce Playful learning?

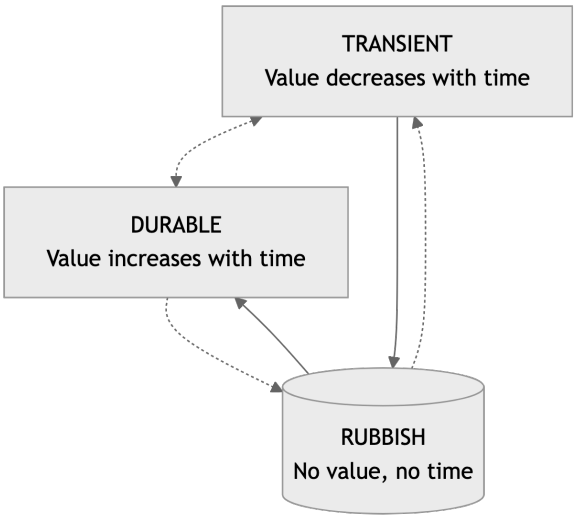
Dumpsterdiving as an example of hacking with focus on the revaluation aspects (Lehtonen & Pyyhtinen, 2020)

Rubbish Theory

In the Book “Rubbish Theory” by Thompson (2017) the author argues that the value of an object is not inherent to the object itself, but rather a social construct. This is especially true for waste, which is often considered valueless and disposable. However, Thompson contends that waste can be transformed into value through social, cultural, and economic processes. By reevaluating our perceptions of waste and its potential, we can create new systems of value that promote sustainability and resourcefulness. This aims to go beyond teaching the participants how to recycle, but to fundamentally change their relationship to waste and the materials around them.

Figure 1

(Thompson, 2017)



Note.

The Book establishes 3 fundamental value classes, transient, durable and rubbish. The Categories *transient* and *durable* are no surprise here, they have been around in design theories for quite a while.

A transient object is simply an object expected to decrease in value over time, while a durable object is expected to increase in value over time. The third category, rubbish, is the novel thing introduced here.

Knowing Waste. Hird can bring feminist Epistemoplogy to the table, helping to dissect the “twilight category” of waste as something that is intentionally ill defined. as such we need Theories like haraways Cyborg and Barads Onto-epistemology

Hird: Waste is not technologically containable. It fails to be determined, to be predicted, to be categorized. The only way waste seems to be feasibly contained is through human norms and social practices. Knowing waste is therefore a necessity for survival. (Hird, 2012)

(Barad, 2007)

(Haraway, 1990)

A Bauhaus Example: Materialstudien

As visible here, (Institute, n.d.) already the 1920s Bauhaus movement pioneered the idea that it might be a pedagogiaclly useful exercise to restrict oneself to a certain set of materials, in order to explore the very base attributes of it. The Bauhaus tradition differentiates between “Materiestudien” and “Materialstudien”, the former instigating students to look at the base properties of a material, to facilitate choosing the right material for specific tasks, while in the “Materialstudien” the students got consciously restricted to a single material to bring about novel and unexpected applications of it

The Bauhaus Vorkurs is an especially valuable reference, because it is an early example of how the Bauhaus movement sought to instigate students to explore the very base attributes of materials. The Vorkurs is a foundational course that introduces students to the fundamental principles of design and aesthetics, including the study of materials. Plastic, a material arguably very far from the intuitive artistic

choices when choosing a material for a specific project, is thereby given a renewed focus and is encouraged to be explored through the lens of both aesthetics and functionality. It is given a

Fig. 49.

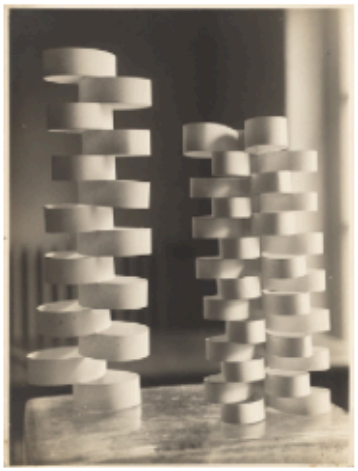


Fig. 50.

Fig. 51.

Materialübung (Material study). Artwork: artist unknown, n.d. Paper. Photo: Alfred Ehrhardt, ca. 1928–1929. Gelatin silver print. 23.1 x 15 cm. Bauhaus Student Work, 1919–1933. The Getty Research Institute, 850514. © Alfred Ehrhardt Stiftung

(*Albers Paper Exercises*, 2019)

The present workshop adopts this approach by focusing on the material properties of plastic, encouraging unconventional uses and applications that challenge conventional perceptions of plastic. Here, exploration of techniques is fostered through a specific selection of tools presented to participants. Effectively, a Material study is conducted, where we focus on recycled plastic waste as the sole material but leave personal autonomy in workflow design and choice of method.

A continuation. (Lerner, 2005)

describe modern application and use

A modern Example.

In this studio, we will focus on the unique gestures dictated by a particular material and the specialisms of working that material in what we call 'material gesture.' We will explore the making in relation to a material in

order to produce an architecture that is solely focused on the relationship between the two. Our interest in the material will be related to its properties, how it is mined, its use in industry, its effect on craftsmanship, specialised fabrication techniques, its cultural significance, and innovations in the field of architecture.The research that is carried out in the studio will be largely developed through a practice-based approach, and applied throughout the intrinsic developments of the projects in the design studio. Each semester, a subtopic within material gesture will be explored ranging from an in-depth focus on one specific source material - gypsum, to the geological interest of a site, and the man-made materials from our current geological age, the Anthropocene.The results will be collected in a growing physical database of materials, and its performance through its applications in the form of large architectural models, made in the actual researched materials and techniques. Anne Holtrop

(*Material Gesture*, 2024)

The Liminal object

What is a liminal object?

expand

"The dissolution of order during liminality creates a fluid, malleable situation that enables new institutions and customs to become established" . ("Liminality," 2025)

Introduce the liminal object as an additional object category.

(Żyniewicz, 2023)

take definition from Żyniewicz_2023

The liminal object is a similar category as the Rubbish by (Thompson, 2017), but it encompasses not only necessarily trash and thereby opens up the opportunity for a material as such to already undergo the desired transfer from transient to durable. The liminal object can be understood as an intermediary state between

waste and art, where the material itself is not necessarily discarded but rather transformed into something new.

Questions: is the term necessary? Why is the rubbish category insufficient?

answer

Material Ecocriticism. serves to give us the concept of “storied Bodies” Humans are storied bodies, and objects are too. we are Material beings in a material world. Storytelling can thereby reframe and reinfluence everything. (Phillips & Sullivan, 2012)

> Nevertheless, our capacity for storytelling and tool-making serves to extend our material bodies and the material processes in which they are enmeshed, not to sever us from them. We extend our material lives and bodies, and thereby we also extend and increase our material impact—which is to say we have never been immaterial since we first appeared on Earth, and will always be material so long as we remain here (Phillips & Sullivan, 2012, p.447)

The Workshop

It was clear pretty early in the conceptualization phase of the Thesis research that a workshop format and methodology is the desired outcome

Reasoning behind the Workshop

Plastics pollution is one of the most pressing environmental challenges of our time, yet recycling processes are often monopolized by industrial systems that prioritize economic efficiency over ecological sustainability. The ReShaping Plastics workshop aims to empower participants with hands-on experience in recycling and reimagining plastic waste as a valuable resource, fostering a sense of agency against an otherwise overwhelming global issue. This workshop is open to participants from all disciplines, requiring no prior experience. Over the course of two sessions, participants will learn to construct a DIY plastic sheet press and explore innovative methods for recycling plastic waste into durable and functional objects. The small group size (maximum 6 participants) ensures an intimate, collaborative environment tailored to the capabilities of the tools provided. The workshop encourages a shift in perspective, treating plastic not as disposable waste but as a versatile material capable of new forms and functions. By engaging directly with the processes of sorting, shredding, heating, and molding plastic waste, participants will gain practical skills and insights into sustainable design practices and circular economies. The workshop balances technical instruction with creative exploration, culminating in the production of personalized objects such as engraved cutting boards, modular clamps, or experimental prototypes. Participants will leave with a deeper understanding of plastics' lifecycle and the tools to advocate for and contribute to ecological innovation in their communities. This is not just a recycling workshop—it's an opportunity to rethink waste, create tangible solutions, and spark a broader dialogue on sustainability and material culture.

Workshop Intent

Concisely repeat the intent of the workshop

What are expected outcomes? What is to be proven?

Setup and Machines

The workshop concept hinges on the quick availability of machines that can be easily transported and set up at various locations. A central constraint is portability, as the workshop should be able to adapt to different spaces and contexts without requiring extensive infrastructure or setup time. As a consequence, everything was built on wheels. The workshop's core components include:

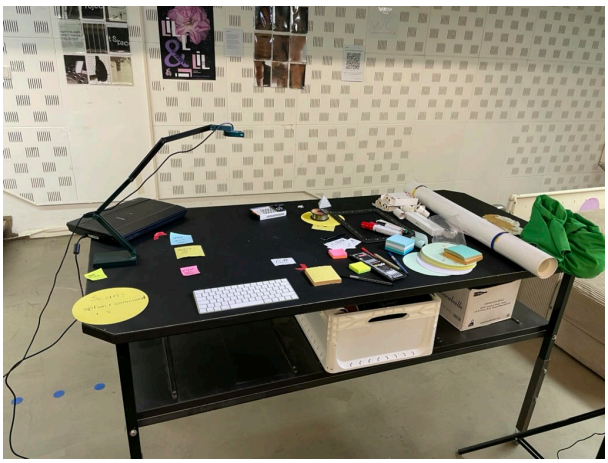
- The Shredder (Section 3.2.2.1)
- The Material Station (Section 3.2.1.2)
- Heat Area (Section 3.2.2.2)
- CNC Station (Section 3.2.2.3)
- Post-Processing Area (Section 3.2.2.4)
- Upload Station (Section 3.2.1.1)

Areas and Stations

The UploadStation. This is where documentation happens. It is a designated table, slightly removed from the working area, yet close enough to cause as little obstructions to its use as possible.

Figure 2

The UploadStation



The uploadStation denotes only the physical area of interaction with the participants. All of the software-backend taking place here are discussed in Section 3.3.

The MaterialStation. For all of the shredded material, there needs to be a way to store them, keep them sorted and clean, yet portable.

Herein lies a delicate balance, since it will become infeasible very quickly having several colors from every type of material on hand. The material station, made from an ikea serving kart and several restaurant grade steel containers on aluminium rails, attempts to solve the storage issue in a compact, versatile and portable form factor.

One moot point here is the labelling. For later iterations it would b e convenient to have material type and color on a given container labeled in a reusable fashion. In the current, more prototypical fashion, it was nevertheless quite usable and comfortably fits more color variations than really needed for initial experimentation.

Arguably, the overall objective of flexible and efficient storage is met in this iteration and it hopefully serves in many more upcoming formats.

Figure 3

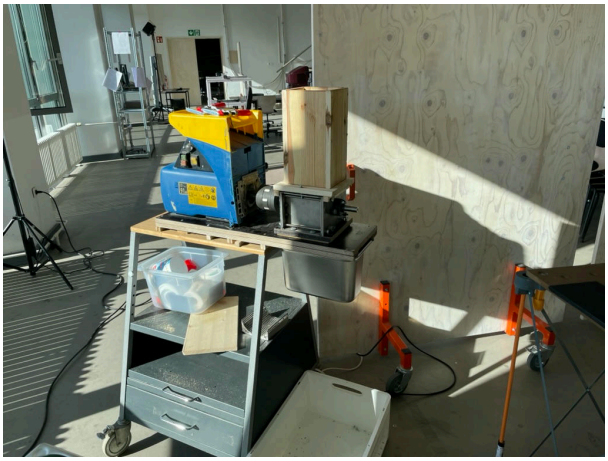
The MaterialStation

Machines

Shredder. The Precious Plastic Shredder is a versatile tool designed to efficiently break down plastic waste into small, manageable flakes, making it easier to process and recycle into new materials. Its robust design accommodates a wide variety of plastic types, enabling the creation of sustainable, high-quality outputs from discarded items. By offering an accessible and affordable solution, the shredder empowers individuals and communities to actively engage in local recycling initiatives and foster circular economies.

Figure 4

The Homebuilt Shredder



It combines the motor and controls of a standard garden variety wood chipper (motor is strong and geared for high torque) with a robust cutting mechanism that can handle tough materials like PET bottles, PVC pipes, and more. The shredder's design allows it to be easily disassembled for cleaning and maintenance, ensuring its continued performance over time. The shredderbox is manufactured according to specs from Plastic (n.d.)

Shredding plastic is not a trivial process, on a hobbyist level, people often try to repurpose paper shredders with mixed results. I built this shredder in 2019, already with a research project in mind. THe primary focus there was to achieve a granulate uniform enough to work in conjunction with the Filastruder (n.d.). The thinking was to attach some kind of microcontroller to get the sensitive extrusion

process under automated control, which requires an enourmous level of accurary and consistency. The filastruder wrote history for being the first commercially available filament extruder achieving a pricepoint under 1000 Euro. It's winding process is laser-based, so it is, in addition to being sensitive to wind and temperature changes, also sensitive to changes in light. This proved top be a hard challenge without a dedicated workspace setup that could be light controlled. While Recycling-to-Filament poses an interesting and often-tackled research problem, for the purposes of a participatory workshop, i decided for plate fabrication in the end. A shredder, in this configuration is a welcome aesthetic tool, in such that it gives us control over the particle size used as inputs for the plate-pressing process, enabling greater color precision, but it is more or less optional, since most of the plastic pieces a 2kw shredder can manage are able to be melted whole in the heat-presses.

Having a shredder for the process nevertheless enables far better storage options, since storing granulate is far easier than storing filament or failed prints.

Hot Press. In order to create sheet goods, some kind of flattening heat source is needed. After a bit of research into cost-effecticve solutions, a ribless sandwich maker was used. It is limited to sheets the size of A4 paper. Some modification might be necessary to ensure level sheets, since the pressure is only applied along the center axis, but for the first tests, this is sufficient. It is comfortably reaching 200°C, which is enough for all plastics used in the context of the thesis. Some optimization could be achieved here by adding some form of Oven to keep plastic warm and enable larger batch sizes.

Figure 5

The Heat Press Area

CNC Station. Thanks to the support of InKüLe, there are two Shaper origins available. These are quite specialized CNC machines, in that they allow for handheld operation, making them more-than-digital fabrication tools. They require a Vector Image to work, which can be created from multiple Sources. One of particular interest here is via Shaper Trace, a workflow where it is possible to digitize any object or sketch via taking a photo of it with a specially marked reference frame.

Figure 6

The CNC Cutting Station

The Postprocessing Area. For the purposes of the workshop, any process happening up until this point was structurally constrained on a unified scaffolding for all participants. Design and Research decisions could be taken, but it was generally suggested to take the provided material in granulate form, press it into plates and carve some form out of the plate either using hand-tools or the CNC (Section 3.2.2.3)

This station then provides an explosion of opportunities, where one is forced structurally to already have some preconception of a final object in mind.

Postprocessing then denotes any work done to an object after it has been pressed into a plate and carved. I will now lay out some prominent options for postprocessing. It would not serve the thesis purpose to make the list exhaustive here, but instead the postprocessing is to be understood as an open category, inviting research not only on a design- and material level, but also inviting to gather new processual knowledge.

One example for that is a research group in the workshop examining whether melted plastic can be treated using a glass-blowing process. The result of that can be seen in Figure 15.

Figure 7

The Post-Processing Area

Welding Iron. For some portable soldering irons I already had, I found additional tips in knife form. This made them work effectively like a hot-knife, enabling small scale hot-plate welding and efficient plastic cutting. THey also serve well for cleaning up edges of parts.

Hot Air Gun. The hot air guns proved incredibly useful and versatile as they provided fine-grained control and selective heat application onto parts.

The AutomatedArchive

write about AA functionality

In modern waste centers, a notebook is still the main instrument of classification. This on the one hand, shows again how technologically infeasible recycling as an industrial endeavour is, and on the other, also shows how documenting and tracing is among the most effective tools to preserve and create value in objects. (Laser, 2020) I claim the AutomatedArchive is delivering a value-creation process.

Figure 8

The UploadStation in use during the workshop, showcasing the automated archive system.

Archive Location

Note. An illustration of the Upload process. As camera, a modified document camera was used, which allowed for the capture of high-quality images and videos directly from hotkey on the prepared keyboard. The UploadStation was used to upload these media files into the archive system. Everything after pressing the hotkey was done automatically by the system.

Software used

(*Logseq*, n.d.; *Mermaid-Js/mermaid*, n.d.; Mädje et al., n.d.; Rossum, 1991)

complete list

The Exposé

move to appendix?

This hands-on workshop invites participants to actively address plastic pollution by transforming waste into durable, meaningful objects. Unlike traditional industrial recycling, which often prioritizes economic over ecological concerns, this workshop empowers individuals to reclaim and repurpose plastic in a way that fosters creativity, sustainability, and personal agency. The workshop unfolds in two sessions. In the first, participants will sort, wash, and shred plastic waste using a Precious Plastic Shredder, creating small flakes. These flakes will then be heated in a panini press, transforming them into a malleable plastic mass, which will be molded using a DIY plastic sheet press. The resulting sheets will be finished with woodworking tools,

and participants can add personal engravings with a CNC machine, allowing for unique, patterned designs. The final products, shaped through a combination of heat, pressure, and craftsmanship, will reflect the individual designs and creativity of each participant. Whether through engraving or coloring, participants will gain hands-on experience with the potential of upcycling plastic waste into functional, aesthetic objects. This workshop offers a tangible way to engage with the global issue of plastic pollution, encouraging participants to reconsider the life cycle of everyday materials. It is a way of reformulating transient objects into durable/lasting objects, an alchemical formula for design. InKüLe Immaterialities Reshaping Plastic Call

Workshop Contents

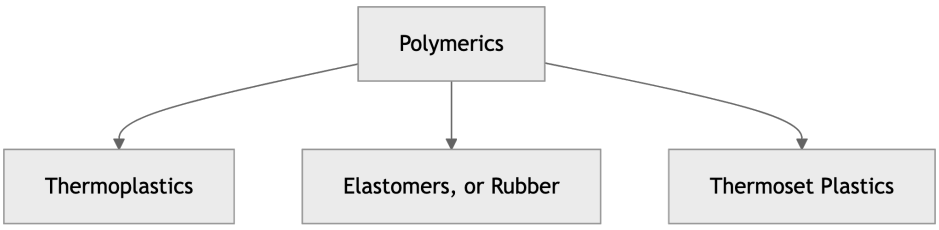
Although the workshop was structured primarily on the practical research questions surrounding the materiality of plastics, it included the minimum viable knowledge on the plastics classes and labelling. THrough this, no prior knowledge was necessary and the format opens up to anybody. The materials presented are taken mostly from other public information campaigns on sorting plastics, but the Precious Plastic Melbourne materials (*Precious Plastic Downloadable Resources*, n.d.) stand out as being prepared quite aptly specifically for laypersons in a sorting-plastic-as-workshop format.

Polymer Identification

Polymer Subclasses.

Figure 9

*(*Academy - Precious Plastic*, n.d.; Katz, 1998)*

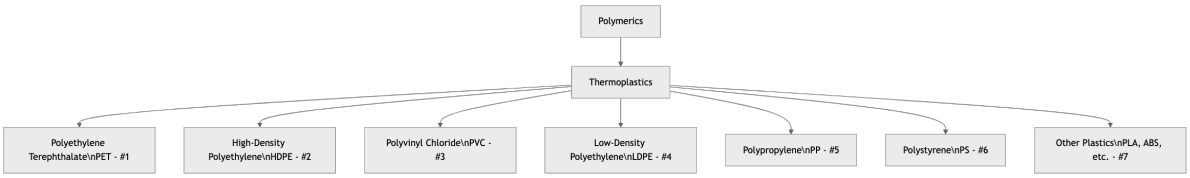


Note.

Thermoplastics Subclasses.

Figure 10

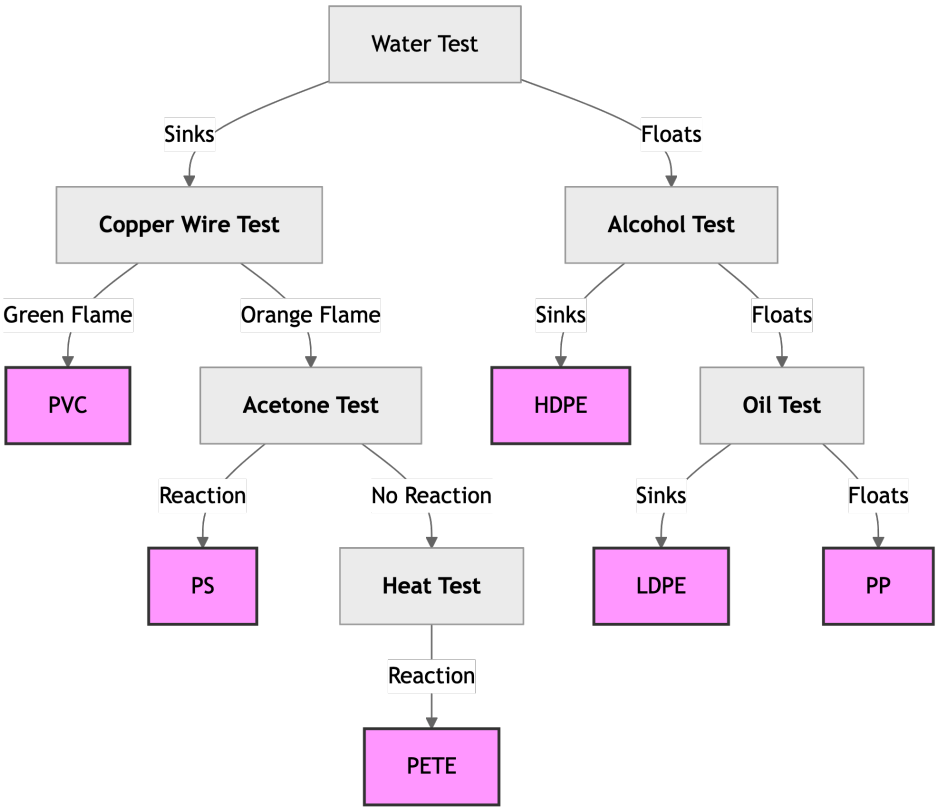
(Academy - Precious Plastic, *n.d.; Katz, 1998)*



Note.

Figure 11

A standard decision tree for identifying common polymer classes. (Katz, 1998)



Note. Polymers Identification is generally a hard problem. On a surface level, for artistic purposes, a few simple density tests are enough. This is a decision tree that found its way into many basic chemistry classrooms.

For the purposes of the workshop, i had prepared only density tests; with water, alcohol and

Floats on	Alcohol	Vegetable Oil	Water	Glycerin
PET	No	No	No	No
HDPE	No	No	Yes	Yes
PVC	No	No	No	No
LDPE	Yes	No	Yes	Yes
PP	Yes	Yes	Yes	Yes
PS	No	No	No	Yes

Visual properties.

Type & Name	Properties	Common Use	Burning
PET (Polyethylene Terephthalate)	Clear, tough, solvent-resistant, barrier to gas and moisture, softens at 80˚C	Soft drink, water bottles, salad domes, biscuit trays, food containers	Yellow flame, little smoke
HDPE (High-Density Polyethylene)	Hard to semi-flexible, resistant to chemicals and moisture, waxy surface, softens at 75˚C	Shopping bags, freezer bags, milk bottles, juice bottles, ice cream containers, shampoo bottles, crates	Difficult to ignite, smells like candle
PVC (Polyvinyl Chloride)	Strong, tough, can be clear and solvent-resistant, softens at 60˚C	Cosmetic containers, electrical conduit, plumbing pipes, blister packs, roof sheeting, garden hose	Yellow flame, green spurts
LDPE (Low-Density Polyethylene)	Soft, flexible, waxy surface, scratches	Cling wrap, garbage bags, squeeze bottles,	Difficult to ignite, smells like candle

Type & Name	Properties	Common Use	Burning
	easily, softens at 70°C	refuse bags, mulch film	
PP (Polypropylene)	Hard but still flexible, waxy surface, translucent, withstands solvents, softens at 140°C	Bottles, ice cream tubes, straws, flower pots, dishes, garden furniture, food containers	Blue yellow tipped flame
PS (Polystyrene)	Clear, glassy, opaque, semi-tough, softens at 95°C	CD cases, plastic cutlery, imitation glass, foamed meat trays, brittle toys	Dense smoke
OTHER (All Other Plastics)	Properties depend on the type of plastic	Automotive, electronics, packaging	All other plastics

Description

The Participants

the workshop was advertised by InKüLe and through that reached students all over the UdK. I did not know the Majority of the participants beforehand. 12 People booked the Workshop and 9 showed up for it, along with Members of InKüle joining.

Workshop Timeline

Workshop Overview. A two-day hands-on exploration of plastics, their properties, and transformation techniques. Participants engaged in material studies, documentation, and reflection.

Summary of Events. On the first day, the workshop began with introductions, where participants shared their backgrounds and expectations. A theoretical session followed, covering types of plastics, their identification, and

recycling. Participants were then introduced to the machines used for material processing and documentation through the digital archive. Hands-on activities included creating ID markers, experimenting with material properties, and initial explorations of plastic manipulation techniques. The day concluded with a reflection session where participants shared their findings and outlined their plans for further experimentation.

The second day started with a recap and discussion of the previous day's activities. Participants engaged in extended free work time, allowing for deeper material studies. An interim check-in facilitated knowledge sharing before continuing explorations. The final phase of the workshop included group reflections, gallery walks showcasing work, and a plenary discussion on insights gained. The event concluded with participant feedback and an evaluation of the workshop's impact.

Program Day 1.

Program Day 1	**Duration (180 Min)**
Who are we?	20 min
Theory Block	20 min
Machine Introduction	20 min
The Archive	10 min
— BREAK —	
Making your first ID Marker	20 min
Uploading first Post with ID Marker	10 min
The Infrastructure: what can we explore?	20 min
First Material Explorations	30 min
Reflection: what are Findings and Plans?	30 min
Clean Up	10 min

Program Day 2.

Program Day 2	**Duration (180 Min)**
Recap, Questions	20 min
Free Work time on Material Study	60 min
Interim Check-In	15 min

Program Day 2	**Duration (180 Min)**
— BREAK —	
Free Work time on Material Study	60 min
Group Reflections: Final uploads	15 min
Gallery Walk	20 min
Plenary reflection with archive	20 min
Feedback on Workshop	

The Research Groups

- **Color Patterns**
- **Connections and Welding**
- **Thermoforming**
- **Surfaces**

Color Patterns.

Can we influence the color mixing? How to mix them? How to layer them? Twist them? Fold them? Can we mix materials? What influence does temperature have on color? Can we overcook, undercook? Transparency, translucency?

Connections and Welding.

Welding: What creates the strongest welds? Can they be reinforced? Can they be invisible? Can we create pin connectors? Other, non-welded joint techniques? How could we do hinges? Can we sew plastic?

Thermoforming.

Could we do slumping? (Melting into a specific shape) Can we imprint or emboss details while hot? How can we bend the material? Are there material differences? What can be done with elongation? Can we make it melt until liquid?

Surfaces.

What are ways to create regular or irregular patterns? Can we stamp patterns? How about inlays? Plastic into other materials? Other into plastic? Inscriptions or engravings?

Findings of the Participants

What did the participants find?

Expand with examples and start to find temporal progressions

Figure 12

Some Results from the experiments

Evaluation

Reiteration Research Questions

what does the

What are the need to show?

workshop evaluation

Criteria?

How do we measure them?

Criteria

The evaluation criteria for this thesis and workshop are structured to assess the effectiveness and impact of the proposed solutions.

The following points outline the key criteria for evaluation:

Participant Engagement and Transformation Evaluate whether participants demonstrate a shift in perception towards plastic waste, viewing it as a valuable resource rather than disposable material.

Technical Feasibility and Usability Assess the functionality and accessibility of the developed tools and processes, ensuring they are user-friendly and replicable in diverse settings.

Creative Outcomes and Innovation Measure the diversity, functionality, and creativity of the objects produced by participants, reflecting the potential of recycled materials.

Sustainability and Impact Examine the workshop's contribution to sustainable practices and its alignment with circular economy principles, including long-term usability and reduction of waste.

Knowledge Transfer and Skill Development Analyze the participants' acquisition of new skills, understanding of material lifecycles, and ability to apply the workshop's methods independently.

Community and Collaborative Impact Consider how the workshop fosters collaboration and builds networks among participants, encouraging collective action in recycling and sustainability. These criteria will form the foundation for a comprehensive evaluation of the project's success and its potential for broader application.

1. Participant Engagement

Number of participants and their backgrounds. Level of engagement in discussions and activities. Participation in hands-on material explorations.

2. Learning Outcomes

Understanding of plastic types and properties. Ability to use identification and processing techniques. Effectiveness of the theoretical and practical balance.

3. Practical Application

Success in using workshop tools and machines. Quality and creativity of material explorations. Use of the digital archive for documentation.

4. Group Dynamics and Collaboration

Effectiveness of group work and research teams. Knowledge sharing and peer-to-peer learning. Supportiveness of the workshop environment.

5. Challenges and Areas for Improvement

Technical difficulties or limitations of materials/machines. Issues in documentation and archival process. Time constraints or workshop pacing concerns.

6. Participant Feedback

Highlights from participant reflections. Suggestions for future improvements. Overall satisfaction with the workshop structure and content.

7. Future Recommendations

Possible improvements for future iterations. Additional topics or activities to include. Enhancements for the documentation and archive system.

Workshop 1

Evaluating Participants Feedback

The End of the workshop featured a 20 minute feedback round, serving to evaluate the didactic aspects of the workshop as a format and potentially collecting evidence on a perspectival shift that occurred during the workshop. The Participants were asked to share a few insights and their views, especially regarding:

1. The open, explorative format,
2. the Utility of the UploadStation,
3. their perspective on the role of plastics in society.

Changes in Perception of Plastic as a Material. Participants expressed a shift in their view of plastic, recognizing its potential for creative reuse. Initially, some saw plastic as waste, but the workshop demonstrated its malleability and potential for transformation. One participant noted, “It was really nice to experiment with everything, even though there was not like this one final product in the end.” .

The ability to create new objects from discarded plastic was seen as an eye-opening experience. “We could easily see that new things can be made out of old things, and its like a very nice thing.” . Some participants now appreciate plastic in a new way, even stating, “I love plastic now after the workshop.” .

Impact of the Hands-On Format. The exploratory, research-based approach allowed participants to focus on process over final products. “I was thinking beforehand which product to make, but it was nice that we were not focusing on the final product, but more on the process and on finding out something.” . Many found it liberating to experiment without pressure to create a finished item. “It was more for the sake of finding new things out and experimenting with something new instead of just trying to achieve something.” . The hands-on nature encouraged playful engagement and deepened understanding of recycling possibilities. Participants valued collaboration, learning new techniques from each other, and overcoming technical challenges together. “So many people helped me along the way, explaining how to use the drill, the printer, and stick it together—it was a real group effort.” .

Techniques and Experimentation. The workshop introduced various plastic manipulation techniques, such as using a soldering iron for fusing, molding, layering, and bubble-forming. Experiments included making beams for furniture,

translucent effects, and exploring different types of plastic. “I tried molding a strip of plastic onto a bottle, but it just stuck down on both sides — it was just nice to play around and try out different things.” .

Documentation moments helped participants reflect on their process and material interactions. “Sometimes you get so deep into the making process, you forget that this is, you know, material, and then the documentation process gives you a little time to reflect.” .

Ethical and Environmental Considerations. Some participants grappled with the ethical implications of repurposing plastic: “Are we going to just produce more plastic in the end? Because we didn’t solve the problem yet.” .

Concerns were raised about the energy and material loss involved in recycling plastic into new objects. “Making new things also costs—it costs energy, it costs money, you lose material.” . Despite these concerns, the consensus was that working with existing plastic is better than letting it go to waste. “The plastic is there, its not shrinking; might as well use it.” .

Reflections on the Workshop Structure. Participants appreciated the open-ended nature, allowing for personal exploration. “I like that the workshop was two days because yesterday we explored things, and today we had an idea of what we wanted to make.” . Some felt that rather than finding one essential product to make, the focus should remain on experimentation and material understanding. “Maybe we have so many products already, its not about finding one new product to make.” . The two-day format allowed for both exploration and more structured making on the second day.

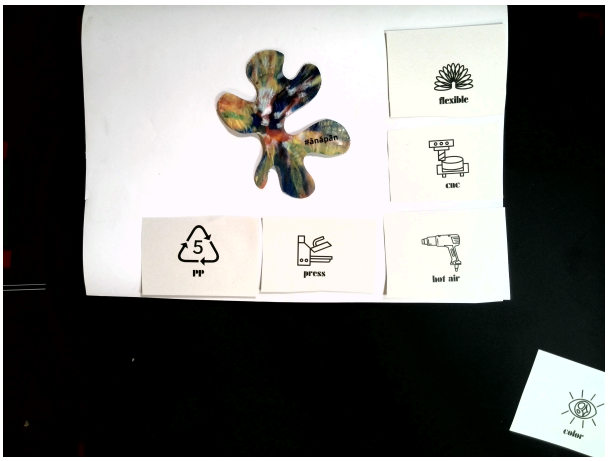
The collaborative nature of the workshop was highlighted as a strength, with individuals supporting each other’s learning.

Future Directions and Next Steps. Some participants expressed interest in continuing to explore plastic manipulation, potentially visiting other community workshops.

Conclusion. The workshop successfully changed perceptions of plastic, offering a hands-on, experimental space for creative recycling. While some ethical meta-questions remain, the experience encouraged deeper engagement with the material and collaborative learning. Future iterations will refine the approach and explore applications in different settings.

Figure 13

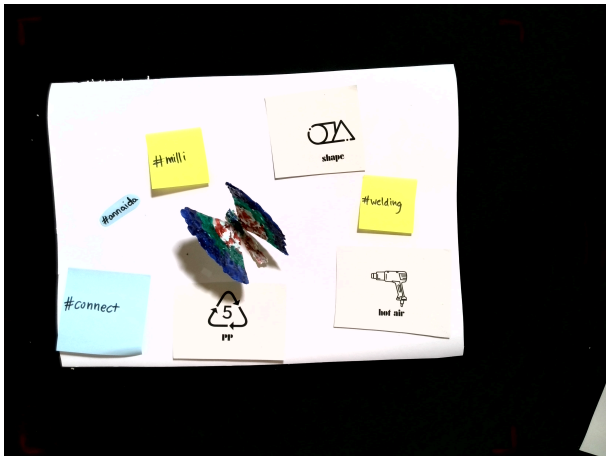
An ID Marker example after upload. *Archive Location*



Note. Here, the general structure for the archival uploads is already present: the created object, in this case an ID MArker made from a pressed PP sheet. Around it the different qualifiers, either realized as pictograms or written out notes. The image is linked to the archive page where it can be accessed and further explored.

Figure 14

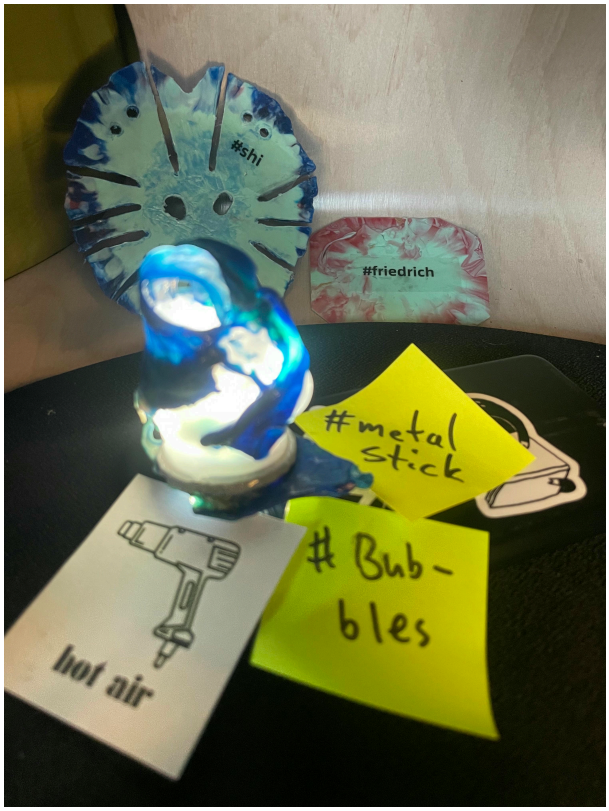
A research Upload conveying knowledge gathered on welding plates. *Archive Location*



Note. Another example from the first research results. Utilization of the hashtag function can be seen, creating novel categories in the knowledge graph, removing the initial constraint on limited classes.

Figure 15

A mobile Upload realized with shortcuts and continuum camera Archive Location



Note. An example showing the adaptability of the archival process. Initially, the rigidity provided by forcing participants to adhere to the prepared camera perspective from overhead provided a stable training ground for getting to know the

system. Later on, the hashtag function was introduced to allow for more flexible categorization of the data. On top of that, the camera became mobile, enabling novel perspectives and a less disrupted research process.

Workshop 2

Add content here after workshop

=Discussion

Is the feedback conclusive?

is there Knowledge progress evident ofer the course of the uploads?

How are participants utilizing the archive afterwards?

Outlook

What are the next steps? What could be done further? Workshop format in schools the Archive could be expanded Skill Trees for all kinds of material transformations could be invented. One idea is to explore expanding the wonderfully gamified Levelling system of Steph Piper (Piper, 2024) into a more expansive, multi-material framework that includes plastic recycling as one aspect. The playful learning approach to making is something that we will explore further in our work with studio einszwovier. There is also some potential in combining the physical skillpoints with the kind of digital backbone the automated archive could provide.

Speculation

What might a future application look like? In future workshops, participants will continue to engage in hands-on activities that transform waste materials into functional objects. An area of deeper investigation will be the integration of digital fabrication tools and techniques alongside traditional methods How do I expect the Format to scale? Is that something desirable? What will happen to the archive? Are there ways to attach permanency?

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Appendix A. List of Figures

Appendix B. List of Tables