MATERIALS RESEARCH KITCHEN

Vol. One: Report

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Making Food Together as Material Method and Metaphor

PhD by Practice: The Report

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I, Elise K F Doney, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Materials have no rights; in our time of mass extraction and consumption we waste and mistreat them. But we too are stuff, we human beings are a mixed meat composite, an *Ouroboros Sausage,* sharing materials and microbes in dynamic transformation with our surroundings, to which our fate is ecologically linked. The sausage is eater and eaten, subject and object.

Through the establishment of the *Materials Research Kitchen (MRK)*, I co-investigate perspectives on the properties, qualities, cultural, and emotional meanings and uses of edible materials through cooking and eating together, listening to materials as they transform, with an aesthetic curiosity.

Materials are inherently transdisciplinary, but our research disciplines are increasingly narrow. This thesis identifies an applied knowledge practice of making food together through which new materials research can be facilitated across contexts. Using foodstuffs, utensils and cooking as art research materials, methods and metaphors, I show how materials become embodied, not only in our physical but also in our cognitive being, situating knowledge production within the material framework of a cognitive biome. It is an ethical approach that stimulates curiosity and care for past and future incarnations of materials and reveals how much is at stake in their exploitation.

The collaborative research takes place in three contexts: with research groups at UCL's Slade School of Fine Art and Institute of Making, with home appliance manufacturer Beko Plc's R&D team, and with various urban community growing projects in London.

The methodological and physical tools resulting from this PhD-practice exemplify its thesis: revealing likeness in human-material ecologies, towards self and environment care. This thesis shows that the use of these tools - the *MRK*, the *Activated Works* (a collection of generative sculptures), and the *Sensicle* (a prototype tool for sensing transformations in foods, soils, and bodies) - further expands our cognitive biome.

Impact Statement

The impact of this work is in the development of a thoughtful practice of cooking and eating together that helps understand human-material ecologies personally, encouraging curiosity and care for past and future incarnations of materials. Renewed awareness of our own vital connectedness to materials is increasingly important in an era of rapid ecological, social, and technological change, and an escalating climate crisis.

The Materials Research Kitchen methodology that I developed has identified ways in which materials research can be facilitated across disciplines and domains through making, towards transdisciplinary outcomes. These methods broaden materials epistemologies by valuing amateur, technical, working class, indigenous and specific cultural knowledge practices, which are not adequately included in the white patriarchal canon of Higher Education's hierarchies of value. The MRK workshops foreground individual sensory experience, enabling understanding of cross-cultural and cross-disciplinary perspectives.

The benefits to academia include the facilitation of transdisciplinary materials research, towards the use and development of the Institute of Making Stratford's Experimental Kitchen at UCL East. Its design has been directly influenced by this thesis and will create new materials knowledge through connections between students, academics, professional staff and underrepresented communities via food practices.

The pedagogical methods I have demonstrated have impacted the curriculum by influencing active and connected teaching and learning methods, and cross-disciplinary cross-pollination within applied disciplines like art and technology studies, engineering, and medicine (Appendix A p. 116)

The benefits to industry and public sector, include directly influencing methodological R&D processes, improving user research at an early stage, and providing in-depth research on specific appliance capabilities with my research partner Beko Plc. The concept of the *Sensicle* developed with Beko – a sensory tool for tracking transformation in pH, salinity and temperature in food, soils, and bodies, demonstrates potential impact for clinical use, public health, wellbeing and quality of life, and the quality and wellbeing of the environment. (p. 212)

This work has the potential to impact on other professional practices, providing insights into the benefits of creative partnerships, specifically the contribution artistic thinking can make in industrial innovation strategies. Wider impact has been brought about through exhibitions, writing, talks and other engagement activities, such as:

- International public communication of work through radio and podcast broadcasting.
- National and local impact through public lectures, exhibitions, festivals, and masterclasses, commissioned arts events, artworks, and residencies.
- Academic research publishing through journals and conference proceedings.
- Invited research workshops in Higher Education.
- Funded self-organised research workshops.
- Teaching based on research.
- Technical and methodological demonstration, consultancy, and advisory roles.
- Commercial research and creative methods facilitation in the public and private sector. (Details in Appendix B p.8)

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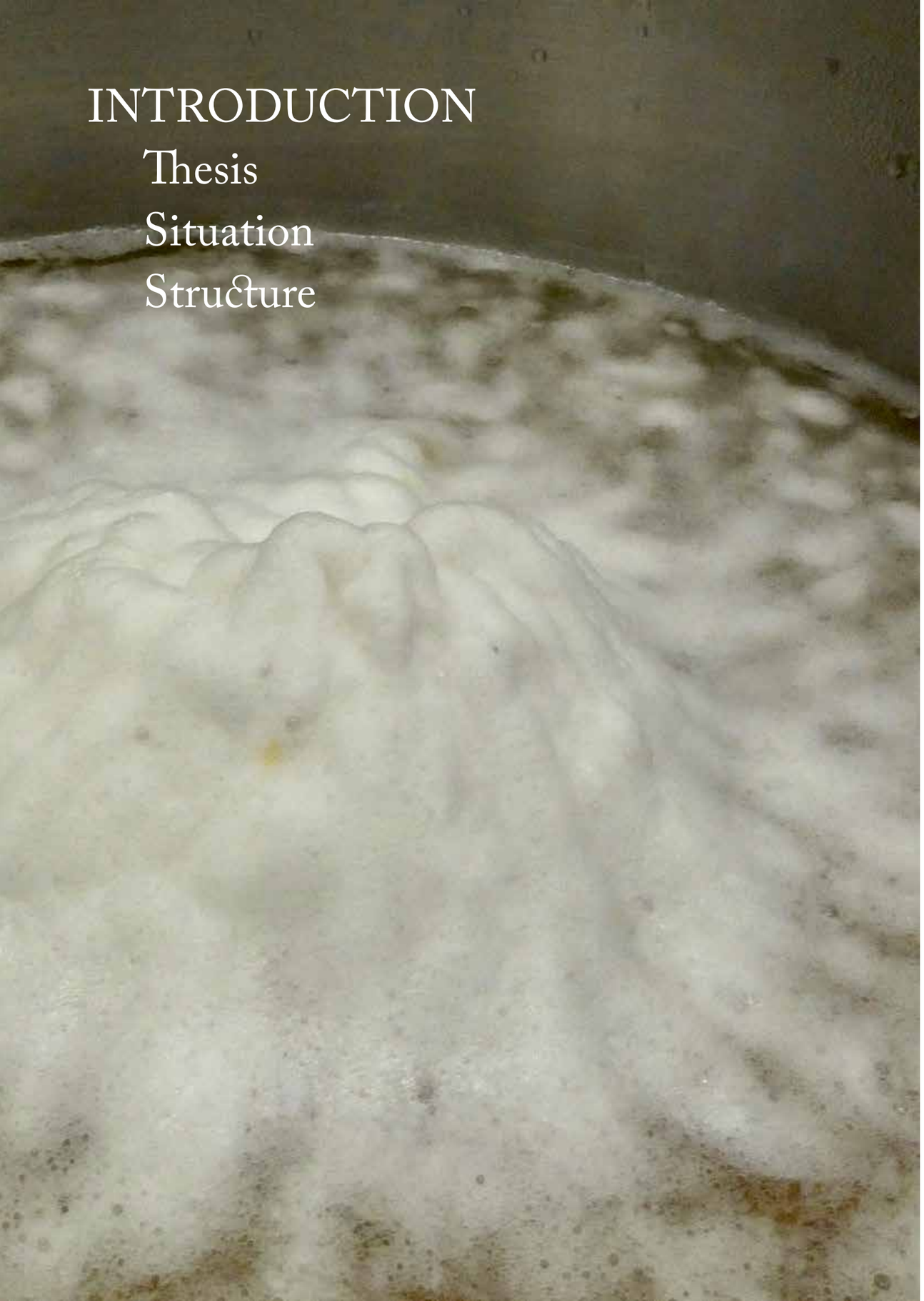


Thesis

> …discovery requires aesthetically motivated curiosity, not logic, for new things can acquire validity only in an environment that has yet to be.[1]

This thesis of practice offers art as an enquiry, a process. I approach the experience of cooking and eating with others as research, grounded in aesthetic curiosity for material transformation.

Materials are constantly on the move, and this project stems from my joy in exploring the entangled and changing relationships between materials and people through making. Rather than closed entities, we are resting points for materials in flux. I find this exciting; in my imagination materials shapeshift through different scales in time and space, part of a wider body of matter in the changing life of stuff, with a past and a future. They neither are born nor die, yet they endlessly combine, recombine, and are activated as essential parts of life systems with their own agencies, tendencies, and behaviours.[2]

Practicing common acts of food transformation, consumption and metabolisation as a methodology, I physically relate materials to our bodies and our everyday lives, as well as using food, and food tools as cognitive metaphors, through an intimate and daily form of boundary-crossing and becoming.

This knowledge practice allows an expanded view of selfhood to include our material and microbial ecologies, revealing likeness between our material selves and the environment, and the links between self and environmental care.

Taking artistic thinking into academia and industry metabolises knowledge within these institutional bodies, as materials do through our bodies – carrying the methodology of metaphor through the work.

1. Metallurgist and historian of science Prof Cyril Stanley Smith
Cyril Stanley Smith, 11 – On Art, Invention and Technology, in A Search for Structure: Selected Essays on Science, Art, and History (Cambridge: MIT Pr, 1981). 325
2. I use the word material to denote "The matter or substance from which a thing is or may be made" as opposed to the form or formal aspect of things, or even more slippery stuff like photons or dark matter. The word can specify human-made or prepared materials, but in outlining the topic for this thesis, I include substances from which things can be made, from the microscopic to the tectonic – the physical materials of our world.
Material, Adj., n., and Adv.', in OED Online (Oxford University Press, December 2021), https://www.oed.com/view/Entry/114923

Parasitical Mushroom Broth, part of Recipes for Speculative Sentiences, tastings made for the event Not I, Jerwood Staging Series 2018.
Appendix A p.78

Introduction: Thesis

HYPOTHESIS

Materials not only have physical properties and qualities but layers of cultural, emotional, and historical meanings and affordances, depending on your viewpoint. They are complex.

However, materials are still understood to be at the 'lowest' end of our outdated hierarchical metaphors of matter. They have no rights; in our time of mass extraction and consumption we waste and mistreat them.

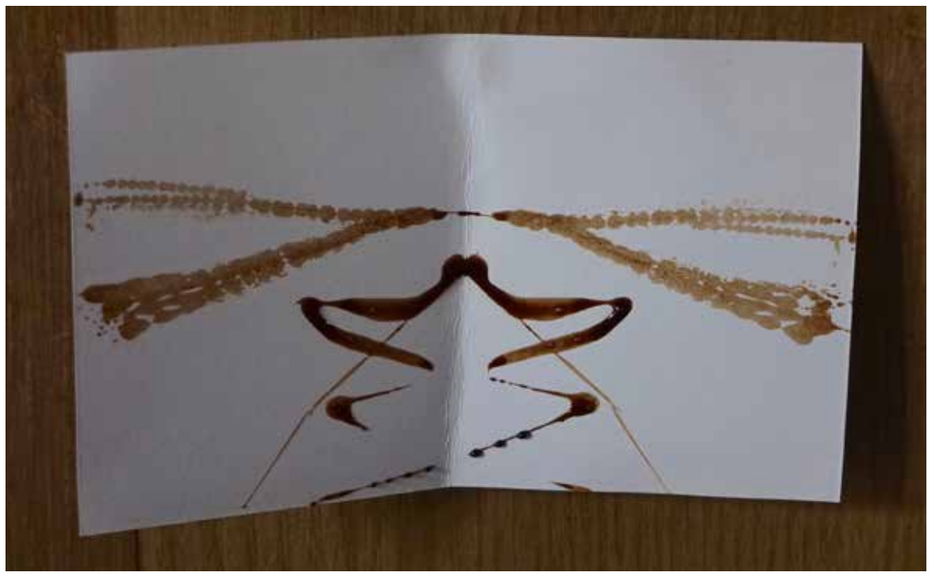
In fact, we ourselves are materials, and our fate is ecologically linked to theirs – not linear but connected, mediated, and reciprocally made by our symbiotic microbial inhabitants.

If we showed more curiosity, with greater understanding of the complex ecosystems that connect our physical bodies and even our cognitive processes to other materials, we might treat them with renewed care.

Food is something we all have in common. It is a way for people to understand what materials are, intimately in our bodies. My methodology of making knowledge with food at a shared table aims to involve material experts, technicians and practitioners who are often the holders of material understanding, but are not explicitly included in existing research ecosystems. This diversifies research perspectives and ensures we are asking appropriate, inclusive, and necessary questions using methods which include the people who could benefit from the findings. It is a method born of a pragmatic epistemology of practice, embracing embodied and devalued knowledge forms, rejecting universalised knowledge, and situating the knower within an expanded notion of social environments, to include our animal, vegetable, material, and microbial ecologies.

Different disciplines understand materials deeply, but each has their own language and jargon, and often find it hard to relate to other material experts. We need to work together to address this in education and research. Understanding can be shared by showing people just how much they already know about materials through food.

While this project is not *about* food as a subject, bringing people together to think, *through* food, about the ethics around human-material relationships is now critical; the accelerating ecological crisis means research disciplines, industry and community need to work together to find creative solutions to global issues. Collaborative practice aggregates and extends thought processes to produce knowledge that is usable in different contexts: transdisciplinary knowledge. (p. 177 for definition)



Index card and treacle drawing made by a participant at Sugar Metamorphosis workshop, 2017.
Appendix A p.54

Introduction: Thesis

The Institute of Making, a uniquely hands-on materials research institute based at UCL in London where I work, has established the concept of Senseoaesthetics as the sensory qualities by which we know about material properties – and thus their affordances – and how we experience them as we interact. (pp. 21, 131)

We each perceive material properties differently, due to our inner 'structure', comprised of learned knowledge systems and associations made by our individual experiences, which shapes our perception and behaviour. Materials too develop behaviours, properties, and tendencies from their experience, which become embedded in their structure. Considering food can help us to understand the different cultural dimensions to materials. By acts of cooking and eating edible materials together, an extended and shared cognitive process, we can further understand the way we all experience differences and similarities in the qualities, affordances, and value of materials.

If we can shapeshift through this extended thinking process, then using tools for cooking and eating together as research can increase embodied understanding of human-material-microbial ecologies, and engender a real curiosity and care for materials, a realisation of our material kinships, affinities, and connectedness, leading to mutual transformation, and more sensitive treatment of materials in research. The methods of this thesis of practice reveal likeness in materials and us, and the links between self and environment care.

Ellie Doney at a 'sugar play day' at the Institute of Making in preparation for FEAST: Sugar project, 2018.
Appendix A p.104

Situation

PRACTICE

I practice experimental materials and making processes, having studied 3D material techniques in an applied art, craft, and design context at art school, becoming fascinated by materials that change state – metals, plastics, ceramics, and glasses, and how their emotional and sensory qualities change with their processes of transformation. My work explores the aesthetics of materials' qualities and associations, which I find are intrinsically linked to their past and future incarnations.

This led to an interest in materials that you can smell, taste, and feel in the mouth and gastro-enteric system, thereby sensing their transformations in the body, and a desire to further explore this physical knowledge-making process in a time of increasingly screen-based interactions.

I found it satisfying and thrilling working with technicians and other materials specialists to extend and inform each other's skills and stretch the possibilities of materials. I lost interest in being involved in the commercial art and craft market and wanted to investigate materials with others in ways which were responsive, generative, and useful across disciplines.

Through mixing socially engaged practices of group art sessions based on my own work, with collaborative and public making activities at UCL's Institute of Making, I have developed a practice of doing research through workshops. I take a utilitarian approach to research, looking for areas to apply my skills and perspective that are usable in relation to real-world issues.

For clarity, throughout this report I refer to my ongoing activity as an artist as my *practice*, and the specific activity that forms this doctoral research as my *PhD-practice* (alongside more general references to e.g., making, cultural, or knowledge practices).

As part of the PhD-practice, I employ the figure of the communard, or cook's cook – in the traditional French kitchen hierarchy, the communard takes a supportive role, cooking for the kitchen team. My role as researchers' researcher is an original way of contextualising the artist research facilitator.

I have increasingly used edible materials and their transformation as a rich medium for communication, translation, and thinking together. Food's multifaceted role as fundamental need, ritual substance, source of pleasure and disgust, connector, point of difference, and emotionally and culturally charged material has become an exciting way to reveal many perspectives on our material relationships.

Copper, gold, silver, tin, zinc, chrome and stainless steel spoons by Dr Zoe Laughlin, 2012.

Flyer for Slade PhD studio group breakfast club which used furniture and tools that were part of Dr. Nir Segal's practice, 2017

UCL

The seeds of these ideas sprouted during research for my MA dissertation in 2009.[3] My idea to construct a *Periodic Table of Emotion* led me to the Materials Library, then at Kings College London:

> …a collection of some of the most wondrous materials on earth, gathered from sheds, labs, grottoes, and repositories around the world. It is a resource, laboratory, studio, and playground for the curious and material-minded to conduct hands-on research through truly interdisciplinary inquiry and innovation.[4]

Exploring the collection, I was interested in their taxonomic strategy and focus on qualities as well as properties in materials. Library founder Dr Zoe Laughlin, an artist and then doctoral student, had made library swatches such as spoons, tuning forks, or cubes which 'perform' their own properties through their sensory qualities. Her thesis [5] became the basis for the methodological approaches of the nascent Institute of Making [6] and some of its original research.[6] The team went on to develop the concept of *Senseoaesthetics*: "the application of scientific methodology to the aesthetic, sensual and emotional side" of materials. Their work on the *Taste of Materials* provoked my interest in new embodied ways of knowing materials, and how that knowledge could be used to understand more about materials generally.

When the Institute found a purpose-built home at UCL I was lucky enough to join them as manager of their new MakeSpace, with a mission to facilitate and promote hands-on materials-led research across disciplines, through the provision of a multi-tool space hosted by experienced makers. Creating community and building a welcoming space with this ethos felt like a vocation and a privilege. It was exciting to learn from staff and members about diverse disciplinary subjects, approaches, and ways of knowing about materials and making, expanding their meaning to include natural processes, non-human, domestic and amateur processes as areas of importance for hands-on research.

As a team, we often use food as an analogy to help describe a technical or specific technique or quality in materials. Although the terminologies used in disciplines, language and culture may differ, food and cooking facilitate experiential common ground. When asked to contribute to a BBC World Service podcast on food packaging and food tools, I was able to talk about how we feel about these intimate materials and their Senseoaesthetics properties, the link between the newsprint texture on the lip, or fumes from of vinegary chip paper, and differences in memory and identity, appetite, pleasure, and disgust. (Appendix B p.8)

3. Elise Doney, *Liquid Quiddity: The Essence of Matter* (Unpublished MA thesis, Royal College of Art, 2009.)
4. https://www.instituteofmaking.org.uk/materials-library
5. Zoe Laughlin, Beyond the Swatch: How Can the Science of Materials Be Represented by the Materials Themselves in a Materials Library?, 2010.
6. Conceived in 2010 and now at UCL, directed by Dr Zoe Laughlin, Prof Mark Miodownik and Martin Conreen. How materials affect the taste of food:
Betina Piqueras-Fiszman et al., 'Tasting Spoons: Assessing How the Material of a Spoon Affects the Taste of the Food', Food Quality and Preference 24, no. 1 (April 2012): 24–29.

Composting Worms shared by Shrublands Community Garden, to start my wormery, 2018.

This started me thinking about how we might identify with materials and food, how ingestion extends to non-food, and the ecosystem of materials around food and bodies. In the case of the 'seasoned' surface of the cooking pot, or chai-cup terracotta dust, our preferences both become literally part of us, and part of our cultural identity. This set me off on the journey of curiosity about our likeness to materials and knowing their interior worlds of qualities and properties through food, which led to this thesis.

The research is sited at the Slade School of Fine Art, the home of practice-led fine art doctoral research at UCL. The programme was studio-based and very much a community endeavour for the first half of the project, until the COVID-19 pandemic, and various studio and personal interruptions took the activity online.

BEKO

I approached a partner to fund and collaborate on this mutually beneficial doctoral project: Beko Plc,[7] a home appliances brand, part of multinational parent company Arçelik A.S..[8] I worked with Beko's UK Research & Development (R&D) team to develop novel research methods, creative thinking and product development around food and transformation. Beko's strapline is *Official Partner of the Everyday*, and they were interested in creativity in industrial R&D, and in our working together to develop useful products.

The methods I developed during the project address my questions and aims in tandem with those of the Beko team. We ended up working closely in the development of the Materials Research Kitchen's methods, and the journey we went on to develop new kitchen tools together. *PicklePal* project during lockdown contributed to a practical framework within which to site this research, and the eventual prototyping of a sensory tool that embodies this thesis: *The Sensicle*. In applying my hypothesis to this context, my own motivation was to investigate how kitchen appliances and the materials they are made of extend our senses and cognitive processes, enriching our relationships with the materials they process, helping us see how connected we are to other materials.

COMMUNITY GROWING PROJECTS

Alongside work at UCL and at Beko, the research was also carried forward in collaboration with long and short-term projects taking place on sites of urban food-growing activity in London. The methods began to develop on residency at Bethnal Green Nature Reserve,[9] at Calthorpe Community Garden,[10] and various other local community growing projects. (Appendix A pp. 8, 68, 86,92)

It was important to ground and contextualise parts of the research in food-growing projects and nature reserves where food ecologies were more tangible. I wanted to diversify what research can be and who holds knowledge, and to move away from solely institutional turf.

7. Pronounced BEH-koh.
8. Pronounced Ar-CHE-lik.
9. "A cultural institute focused on ecological research and community learning in the heart of East London": https://bethnalgreennaturereserve.org/
10. "The Calthorpe inner city community garden and centre exists to improve the physical and emotional wellbeing of those who live, work or study in Camden and surrounding areas through sport, education, environment and diversity" https://www.calthorpecommunitygarden.org.uk/

Supermarket Chorizo Monoprint - a Slade Small Press project using a hydraulic press, 2018.
Appendix A p.42

THEORIES FOR PRACTICE

I use various theories, and prioritise applying them in my PhD-practice rather than trying to make them all agree in the theoretical realm. I don't think all the people referenced here would necessarily see eye to eye, but this eclectic approach to gathering ideas and ways of seeing from different disciplines fuels my research and characterises my understanding of the importance of including multiple perspectives in knowledge-making practices. (p. 245)

EPISTEMOLOGY OF PRACTICE

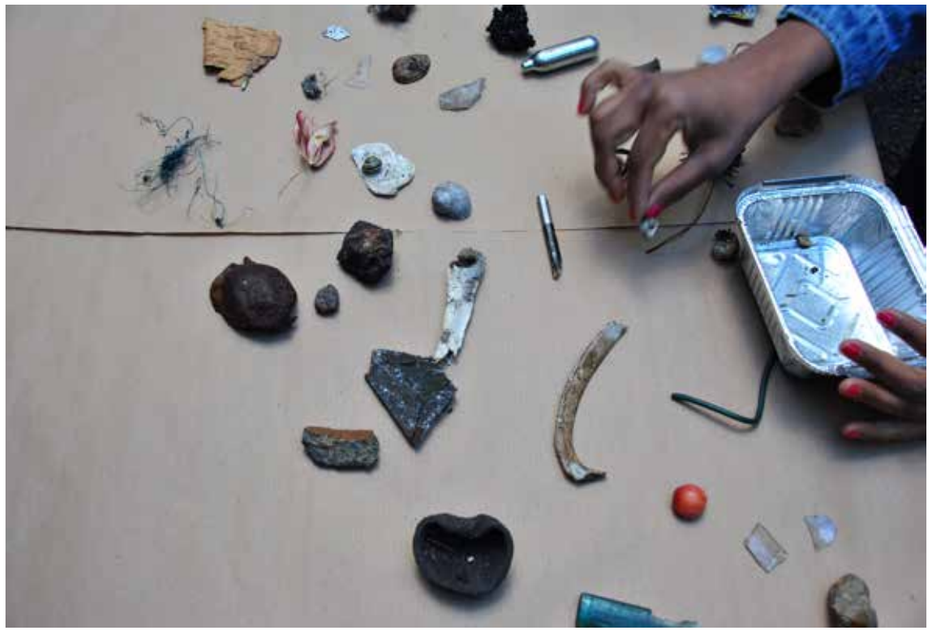
The work detailed in this report is influenced by feminist and pragmatic artists, practitioners and thinkers, contributing to an epistemology of practice that considers everyday activities and individual, bodily experiences, embracing devalued forms of knowledge. I cite the work of two contemporary multidisciplinary philosophers' methods: Prof Annemarie Mol's *metabolic engagement* with the world, and Prof Lisa Heldke's *thoughtful practice*, which draws on pragmatist philosopher and education reformer Dr John Dewey's approach to learning by doing, and *art as experience*. In this respect their methods eschew the traditional divisions drawn between theoretical and practical activity. I also draw upon principles demonstrated in anthropologist Dr Anna Harris' resource, a *Sensory Education* which demonstrates how sensing is constructed through social and material relations.

4E COGNITION, THE 'COGNITIVE BIOME'

I am also guided by various writers on embodied, extended, embedded, and enacted (4E) cognition, and cognitive metaphor theory, referred to as the *cognitive biome* by cognitive scientist Dr David Kirsh. This is the study of the active role of environment and other organisms in cognition, as well as our use of metaphor to construct models of how we think and understand ourselves in relation to the world.

INDIVIDUATION AND TRANS-INDIVIDUATION

In philosophy, the notion of individuation is how a person develops an idea of the self. The psychoanalyst Dr Carl Jung's interpretation of individuation involved bringing some of the unconscious parts of the self to the surface of the mind, to become a full version of an individual. My thesis of practice explores the notion of the self as not individual but situated and connected to our environment, physically, and cognitively. I draw on philosopher Dr Gilbert Simendon's further conceptualisation of trans-individuation in contextualising the Materials Research Kitchen as a collaborative research method that works towards trans-individuation of our extended selves, and transdisciplinary outcomes.



Urban Mudlarking - collecting and close looking at objects and materials - Of Lost and Found, Bethnal Green Nature Reserve, 2017-19.
Appendix A p.8

SYMBIOTIC TRANSFORMATION

Anthropologist Dr Anna Tsing's ethical ecological perspective, that organisms come into being in relation to each other, echoes earlier influences on my work such as process philosophers, for whom matter is in a state of continuous transformation towards equilibrium, as well as biologist Dr Lynn Margulis' *Symbiotic Theory* inventor Dr James Lovelock's *Gaia Hypothesis*, and feminist theorist Dr Karan Barad's writing on quantum entanglements of matter and meaning, Dr Donna Haraway's concept of *natureculture* which decentres the human, and the use of fermentation as political feminist subject, method and metaphor in social researcher Dr Maya Hey's research. These worldviews underpin my concept of likeness; we are all the same matter.

AESTHETIC CURIOSITY AND CARE

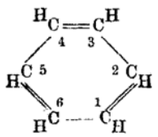
I identify with art practitioners who use their skills and ways of working as tools to generate useful or utilitarian outcomes or ways of understanding the world, including the *Arte Útil* movement. In considering the usefulness of my PhD-practice, I cite Dr Cyril Stanley Smith's plea for *aesthetic curiosity*. Renewed material awareness is increasingly important in an era of rapid ecological, social, and technological change, and growing climate crisis. Knowing the ethical and political dimensions of a material's past and future changes its aesthetic qualities. I follow Dr Anna Tsing's teaching that if we are to make work in these conditions of precarity, our first step is to *bring back curiosity*.

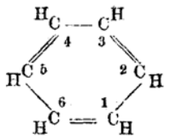
LISTENING TO MATERIALS

I look to anthropologist Dr Tim Ingold and artist Annie Albers who urge us to listen to the *materials themselves* and partake, hands-on, in their process of change.

Above: The Ouroboros Sausage I made and used from the beginning of the PhD.

Left: One of the Alchemic symbols for the element gold.





Left: German chemist August Kekule (1829-1896) dreamed of a snake with its tail in its mouth while researching the molecular structure of benzene. After waking, he interpreted the dream to mean the structure was a closed carbon ring. Original drawings of Benzene by Friedrich August Kekulé von Stradonitz (1829-1896).

This creature is from the Chrysopoeia (gold-making document), among other circular symbols for material transformation, and diagrams of alchemical instruments of Cleopatra the Alchemist. A Greek/Egyption alchemist, author, and philosopher. she worked with practical alchemy but is also credited alongside Mary the Jewess as one of the four female alchemists who could produce the philosopher's stone. Some writers consider her to be the inventor of the alembic, a distillation apparatus.

From El Daly, Okasha (January 2013). Egyptology: The Missing Millennium, Ancient Egypt in Medieval Arabic Writings. London: University College London Press.

THE OUROBOROS SAUSAGE

Early on, I set out with this cannibalistic sausage as a metaphorical medium to explore the temper and terroir, the flavour and consistency of the person, to physically think through the making and consumption of the sausage, aspiring to use ingestion, digestion and metabolisation as part of the research process.

The Ouroboros is an ancient Egyptian symbol, which has evolved in use over time and context, including becoming an alchemical sign for the unity of all things, the cyclical nature of birth and death that the alchemists tried to transcend through transformation of matter. In alchemy, it represents the spirit of mercury - the substance that Alchemists believe permeates all matter - a continuous liquidity, and an emblem also of the quest for gold, the aim being a unison of matter and spirit.

It is a closed loop, in mathematical terms it is a torus, a trivial knot, an unknot – a continuous connected topological space, not unlike the body which is basically a continuous tube with inner and outer surfaces (discounting the nose and the division of the oesophagus).

Sausages are found almost worldwide and have a huge range of national and regional varieties, preservation and cooking styles, skins, contents, texture, and flavour. They are the archetypal made food, an early tool, a sophisticated food technology, the creature fed into its own guts, both mould and cast. Once transformed by heat, salt, desiccation, or fermentation, they are a portable, and long-lasting nourishment. They were a frugal practice, and truly nose-to-tail, using up all the unidentifiable bits of the animal that weren't eaten, and were known in Victorian England as Bags O' Mystery. But a supermarket sausage today is a very different animal, and its examination raises questions about our own meat.

In this PhD-practice, the sausage is a device, a method of thinking and doing. It is a joker, a comic archetype that tickles many people's imaginations, a metaphor that allows in the absurd and playful. It also unites and liquidises opposites: mind and matter, subject and object, eater and eaten, and incorporates the body, food, and the act of eating. As the sausage eats itself, the animal inhabits its own gut. It is a reminder of the ridiculousness of our self-appointed place at the top of the 'food chain'. The animal and its environment are mediated, connected by inner and outer skin – the vanguard of sensory perception and an inhabited microbial landscape.

Martin Conreen, Institute of Making Director, seeing the world through cheese-rimmed spectacles.

Focus

The development of these ideas through an experimental PhD-practice has primed me to focus on key problems in applying the above theory to my situation in London with my collaborators. These challenges take the form of questions - to be returned to in the conclusion, and solutions, in the form of the aims I have pursued:

QUESTIONS

Through the four chapters of this report, I address these questions:

- Does using foodstuffs as research method and metaphor show how materials become embodied, in not only our physical but also in our cognitive being?
- Can embodied and extended knowledge practices of cooking and eating together stimulate curiosity and care for past and future incarnations of materials, and reveal how much is at stake in their exploitation?
- How can this art research practice be a generative tool for exploring human-material relationships through making and facilitating usable, transdisciplinary knowledge together?
- How does my work with Beko drive and exemplify this thesis of practice, revealing likeness in human-material ecologies, towards self and environment care?

AIMS

- *Develop a physical methodology of materials research and learning* that enables creativity and stimulates novel ideas and outcomes across disciplines.
- *Make new knowledge based on the ethics of human-material ecologies,* and in the links between art, food, materials and making - specifically sited within the domains of academic and industrial research and development.
- *Build a network of lasting relationships between materials specialists* from outside and inside universities, including technical and amateur practitioners, through food.

Collaborative aims with Beko Plc:

- Stimulate ideas for new kitchen appliances or technologies.
- Develop new approaches to creating the conditions for innovation in the team.
- Develop new approaches to user experience research early in the R&D process.
- Add value through their home Internet of Things (IoT) ecosystem, integrating emerging technologies, user interfaces and materials into existing products.
- Address their current brand priorities: healthy eating, minimising food waste, living sustainably, low buying and running costs of appliances.

Custom Whisks for beating egg-whites, made by three artists and a chef (right), at my request in preparation for my first meeting with Beko Plc, 2017. Appendix A p.134

CONTRIBUTION TO KNOWLEDGE

My PhD-practice - the Materials Research Kitchen (MRK), uses cooking and eating food together as method and metaphor to understand human-material ecologies, an original methodological approach to transdisciplinary research. There are other art research practices which explore this territory, (p. 153) but the defining feature of the MRK is its situation in R&D, in Higher Education, Industry and urban public food growing projects.

The thesis extends the work of theorists and practitioners across disciplines in the arts and sciences, in recognising and valuing home cooking practices as material expertise, and the kitchen as site of formal research where knowledge can be made. It uses food to extend Senseoaesthetic theory in practice, allowing us to use the materials of food and cooking as interdisciplinary research tools, in the context of the Institute of Making. (p. 131)

The role I employ as the communard, a researchers' researcher, is an original way of contextualising the artist research facilitator. (pp. 49, 151)

Bringing the MRK to an industrial R&D context and encouraging Beko engineers to cook with their own tools early in their product research process has enabled new ways for my collaborative research partner to look at user research, and to value the role of creative thinking in engineering. (Appendix B pp. 72-218)

The use of my concept the Ouroboros Sausage - the sausage eating its own tail - as unique research device, piques the curiosity of people across disciplines and allows an embodied metaphorical understanding of the research territory covered here. I used this comic sausage idea from the very beginning to spark curiosity and fun in research sessions and to engage people with the main questions, and themes of the thesis. It is a method and a muse – a way of discussing the body, food, ethics, the circularity of systems, and the intersections of animal, vegetable, and mineral. (p. 65)

My research is further exemplified by the development of the Sensicle at the end of the research period. This is an original idea for an open-source tool that senses transformation, connecting food, soils, and our bodies to encourage curiosity, empathy and empower us by extending our senses and enabling greater self-care, linked to care for materials and our past and future incarnations. (p. 212)

Iridescence caused by diffraction and thin-film interference in cured meat. Image: Kirill Ignatyev CC BY-NC 2.0.

SCOPE

This thesis, an epistemology of practice, is not about food or cooking as subjects, but uses them as method and metaphor for transdisciplinary research into materials and making.

Using a charged medium such as food means that important matters of politics, ethics, and culture often arise during workshops. This thesis focuses on ways of knowing, rather than what is known about specific subjects. It is an ethical proposition that focuses on the journey, or the ongoing transformations, rather than the destination, or object. It does not explicitly study the politics, ethics or mechanics of food systems, gastronomy, or food science for example, but aims to provide a way of facilitating the exploration of these themes across disciplines. I use the sausage as a metaphor, not to confer any ideal about what people should or shouldn't be eating.[11]

The site of this doctoral research was limited to London UK, at UCL and other research universities, local community gardens, and Beko Plc's R&D team, in the context of an artistic PhD-practice.

11. In 2020 the IPCC's report Climate Change and Land recommended that humans need to move towards a plant-based diet as our current food system of intensive animal farming is attributable to up to 37% of greenhouse gas emissions. This does not consider indigenous and traditional foodways with sustainable practices.
The symbolism of categorising (some) animal flesh as food runs deep, and there are many perspectives on its politics, ethics and future viability, notable recent books include:
Amber Husain, Meat Love: An Ideology of the Flesh, First edition, Discourse 010 (London: MACK, 2023).
Alicia Kennedy, No Meat Required: The Cultural History and Culinary Future of Plant-Based Eating (Boston: Beacon Press, 2023).
Rob Percival, The Meat Paradox (Little Brown Book Group, 2023).
George Monbiot, Regenesis: Feeding the World without Devouring the Planet (London: Penguin Books, 2023).

Spiral clay mixing technique which aligns the microscopic internal flat particles of clay so that when that clay is thrown on the wheel - also a spiral motion - the resulting object is less likely to warp or crack when it shrinks as it dries and is fired in the kiln. Potter: Darren Ellis.

Structure

This thesis of practice is evidenced in two volumes, which cross-reference each other:

Vol. One:	Report: PhD by Practice
Vol. Two:	Appendix A: Documentation
	Appendix B: Supplements

This volume, The Report, is comprised of four chapters which address each of my four research questions and contextualise the practice-based research which is fully documented in appendices A and B.

The first two chapters set out the theoretical basis of the Materials Research Kitchen, and the second two focus on the PhD-practice. All chapters return to the same topics: epistemology of practice, embodied, extended, embedded, and enacted (4E) cognition, metaphor, likeness, individuation and transindividuation, transformation, curiosity, and care. I borrow terms from key thinkers, including Stanley Smith's aesthetic curiosity, Mol's metabolic engagement, Heldke's thoughtful practice, and Kirsh's cognitive biome.

I approach these topics from different angles according to the four main aspects of my research: food, cooking, art practice, and the appliance of tools, as demonstrated by documentation from the MRK, the Activated Works, and my R&D process with Beko:

Cochineal red food colouring on milk –
studio experiments 2017.

Chapter One: Foodstuff
Establishes how food can help us understand the physical and cognitive embodiment of materials. I show how we become materials though eating them and become like materials via our use of metaphor. I discuss whether making and eating food together enables the development of empathy, curiosity, and care for materials.

Chapter Two: Cooking and Knowing
Considers how food-making practices can create embodied knowledge about transformation in material and in us. It argues that as these daily experiential ways of knowing are often under-valued in knowledge hierarchies, they deserve to be taken seriously in academic and industry research, as embodied, extended, and enacted 'thoughtful practice'. Through use of the kitchen as research site, I show how listening to materials through close sensory engagement can stimulate ecological curiosity and care about their past and future incarnations, revealing how much is at stake in their exploitation.

Chapter Three: Practice as Utensil
Contextualises the MRK as a collaborative art research practice which uses cooking and eating together as both method and metaphor. A part of this I have produced various Activated Works which I have made or collected to be used as generative thinking tools in workshops. I show how this thoughtful, embodied practice can be used to learn more about human-material relationships through working together towards usable transdisciplinary knowledge.

Chapter Four: Tools for Transformation
Introduces the application of disciplines, technologies, methodologies and thinking in this project. It then tells the story of the foundational research collaboration with Beko Plc, entitled Food & Transformation, reflecting on the workshopping of methods, and how I used them to develop the PicklePal, a home fermentation appliance idea.

It then documents the project's subsequent change of direction which led to my development of the Sensicle: a prototype tool for tracking transformation and revealing likeness. It concludes by demonstrating how this concept exemplifies my thesis as a way of knowing that extends our understanding, connecting the materials of food, soils, and bodies as they transform.

METHODS

- Methodologies
- Materials Research Kitchen
- Beko Collaboration

How Do You Like Your Eggs? A workshop on personalisation in the kitchen, 2018.
Appendix A p.136

Previous page: Sausage Stuff - public event at Institute of Making 2023.
Appendix A p.131

Methodologies

This PhD explores acts of making, cooking, and eating together as part of an art-based action research methodology, a qualitative inquiry using artistic processes to understand and articulate the subjectivity of our human experience in relation to our changing environments and ecologies. I position myself as an artist researcher and facilitator, to draw from other methodologies used across disciplines in industrial design and the social and physical sciences, to investigate my questions alongside various researchers, learners and public.

The term together includes the people, place, materials - edible or otherwise - involved in the activities, and the micro-organisms that inhabit them. These activities I have termed the Materials Research Kitchen (MRK), also the title of the thesis, which is a methodological proposition.

MAKING TOGETHER

The MRK proposes a direct engagement with materials and materiality, and a direct transmission of knowledge about (edible) materials and making techniques between the participants of the MRK sessions. The argument for reviving the importance of acquiring and practicing embodied knowledge about materials and their transformation is being made visible in cultural trends: the rise of the maker and repair movements, reality TV craft competitions, the popularity of giving skills classes as gifts, and the resurgence of craft languages in fine art and design.[12] The popularity of home baking with sourdough, fermented food making and sewing machine purchases all surged in the UK during the COVID-19 pandemic lockdowns.

The Colombia University Making and Knowing project, which explores the intersections between artistic or craft making and scientific knowing, notes that these realms are today regarded as separate:

> …yet in the earliest phases of the Scientific Revolution, nature was investigated primarily by skilled artisans by means of continuous and methodical experimentation in the making of objects – the time when "making" was "knowing".[13]

Knowledge is distributed in the act of making through the body, materials, and tools. Cultural geographers Wilbur and Gibbs' study on embodied research methods involving food, proposes that:

> Embodied methods enable a different sort of attentiveness to nonhuman entities and more-than-human processes than is possible through traditional social science research methods alone. [14]

12. Crafts Council: Market for Craft Report 2020, accessed 13 May 2022 https://www.craftscouncil.org.uk/documents/880/Market_for_craft_full_report_2020.pdf
13. 'The Making and Knowing Project', accessed 13 May 2022, https://www.makingandknowing.org/about-the-project/.
14. Andrew Wilbur and Leah Gibbs, "'Try It, It's like Chocolate": Embodied Methods Reveal Food Politics', Social & Cultural Geography 21, no. 2 (12 February 2020): 265–84.
More-than-human is a term in post-humanist and ecofeminist circles for example, referring to the way that non-human beings, forces, materials, and objects make up the assemblage that is a person.

Close Encounters with Materials
and Microbes, a Roving Microscope
workshop 2019.
Appendix A p.98

PARTICIPATORY ARTS-BASED ACTION RESEARCH

Action research is a term more commonly applied to education and social sciences but has been used in art and design research contexts in the process of making or doing as research, towards change. It is a rejection of the possibility that the researcher can be neutral, accepting that the observer necessarily influences the observed, and thus is an active participant. Its goals, according to The SAGE Encyclopaedia of Action Research:

> …stress participatory engagement and collaborative partnerships in the research process, empowerment, co-learning, capacity building, and community-based action towards social transformation.[15]

With arts-based action research, this is achieved through art practice. My practice is experiential, spatial, sculptural, and collaborative, and focuses on the relationships forming between the body, the material as it transforms, and the (research) community who are working together at the time. These include materials, microbes, and other more-than-human entities in this sense of community, towards transformation in curiosity and care for material ecosystems.

This process of action research represents alternative modes of knowledge, gained through doing – bodily experience through sensory information. Layers of meaning and connection are also constructed through a noticing of affect, resemblance, sensory connections and metaphor, an interpretation of subjective cultural experience through food, which can be shared through visual, verbal, or written means.

This methodology is integral to using food as a transformative way to do research together and can have effects in our conceptualisation of ourselves and our material ecologies, which influence our daily actions. It goes beyond individual tools, documentation, or accounts to encompass a broader research assemblage which takes transformation as form and function, to investigate changing relationships.

Leading workshops in a teaching context, I emphasise the importance of connectedness of practice, research and learning, and their relevance to connectedness of disciplines, each other, society, and environment.[16] I have used active and experiential approaches to learning through self-directed research and inquiry, based on students' accounts of their own interests, ideas, and prior knowledge, building in self-care and group solidarity.

The Activated Works which emerged from this activity are a material thinking process, in the form of made or collected tools. They become a way of doing research when activated - they are meant to be generative, to be transformed and be transformative; to be used. They are a way to channel material qualities and affordances into a relationship of embodied and enacted knowledge-making about human-material ecological exchange, which allies with recent experiential 'turns' in art practice. (p. 161)

15. 'Arts-Based Action Research', in The SAGE Encyclopedia of Action Research, by David Coghlan and Mary Brydon-Miller (2455 Teller Road, Thousand Oaks, California 91320: SAGE Publications Ltd, 2014) 0.
16. Dilly Fung, A Connected Curriculum for Higher Education (London: UCL Press, 2017).

Cupboard Love: the modern pantry, a workshop on living with your food, 2018.
Appendix A p.140

MAKING FOOD TOGETHER

In working with others across disciplines, I have found the setting of the kitchen to be more relatable and broadly accessible than a studio, workshop, theatre, or lab. It enables us all to 'cook up' new ways to create embodied knowledge about materials and people. While I don't want to declare everyday things as art or research, I realise the potential power of quotidian materials and acts to engage people in and with artistic, scientific, and interdisciplinary research. Cooking and eating food together as a research tool can upend the conventions of what is deemed legitimate knowledge creation in the patriarchal hierarchy of the university.[17]

Unlike research into restaurant food which foregrounds food's science, and the aesthetics of taste, home cooking has been less studied. Feminist anthropologist Dr Lisa Heldke in her 1988 paper Recipes for Theory Making, shows how western philosophers have belittled food and food practices, but argues that thinking through food:

> …successfully merges the theoretical and the practical, and that promotes a self-reflective and interactive model of an inquiry relationship.[17b]

To me, this "inquiry relationship" suggests a two-way process with the materials and processes of food: by asking what food can do for us, I am encouraging reflection on what I can do for food. And by asking what food is like, I am reflecting on what I am like. By divorcing study from practice there is a risk of reinforcing the body mind dualisms of the past – food is a special substance that we can know from the inside.

I am embracing a feminist epistemology of practice in the use of the kitchen as formal research forum in both Higher Education and Industrial research contexts. By presenting the MRK as a formal research method to be developed further, I hope to contribute to the value that is and should be placed on the labour and knowledge of women, and domestic and manual expertise globally. (p.123)

I want to draw out the meanings and possibilities that arise when people demonstrate how they make food. Food is a common vocabulary and bodily experience. We all have opinions and knowledge of food – we are all experts on how we like it prepared. Its legitimacy as knowledge medium is continued in everyday use, rather than tucked away in libraries or behind paywalls. It allows the diverse perspectives needed to shift power away from the existing canon of what knowledge about the world is.

17 . Anthropologists first used food-making as a research method, as part of their commitment to the practice and the analysis of the everyday, although the generational knowledge about people that it entails was not written about in detail, its importance discounted as womens' work. Food studies has since become an established area of research.

17b. Lisa Heldke, 'Recipes for Theory Making', Hypatia 3, no. 2 (1988): 15–29.

Transformative Technologies Festival
UCL, FOAM Event, 2017
Appendix A p.56

Materials Research Kitchen (MRK)

This has become the collective term I use for the art-based action research and experiential material investigations that form my practice. In the studio I amassed kitchen tools and appliances for making food, but soon realised that it was more appropriate to create not a kitchen as object, but a flexible and responsive set of physical and methodological tools.[18]

I assembled a portable research 'kit' which could be used to stage larger research workshop activities of different kinds in different places. This also evolved because of the practical drawbacks of carting a kitchen around a campus, but also to allow for cultural, physical, and disciplinary differences – I didn't want to assume a universal version of what a 'kitchen' could be, but to let the appropriate tools emerge during research.

I began to call this arrangement the Materials Research Kitchen (MRK), which encompassed both the flexible kit, and the material themes I aimed to co-investigate using it. This kit was built up in the Slade Research Centre Woburn Square.

COMMUNARD

As a researcher I didn't claim to take a detached ethnographic position to action research, as I created the conditions for it, but wanted to co-create the work as much as possible. As a result, I chose to position myself not as an artist researcher but as a communard. In the military-style system of the French classical kitchen, the communard cooks for the kitchen team.[19] I began to understand my research role as a communard of art research; a researcher for researchers, aiming to take a tangential position on hierarchies to question what research can be, and who gets to drive it. It is a host, facilitator, and co-worker position, taking a utilitarian, familial approach to research methods.

18. My initial PhD supervisor, artist Gary Woodley and artist Dr. Alaena Turner had created a beautiful Mobile Kitchen Workstation to work with art and food, partly inspired by Italian industrial designer Joe Colombo's all-in-one trolleys, dressers, and cabinets on wheels. We used it together as part of our workshop on FOAM. I didn't want to replicate what that could do. (see Appendix A page 56-7).
19. The Professional Chef, 9th ed (Hoboken, N.J.: John Wiley & Sons, 2011).9-10

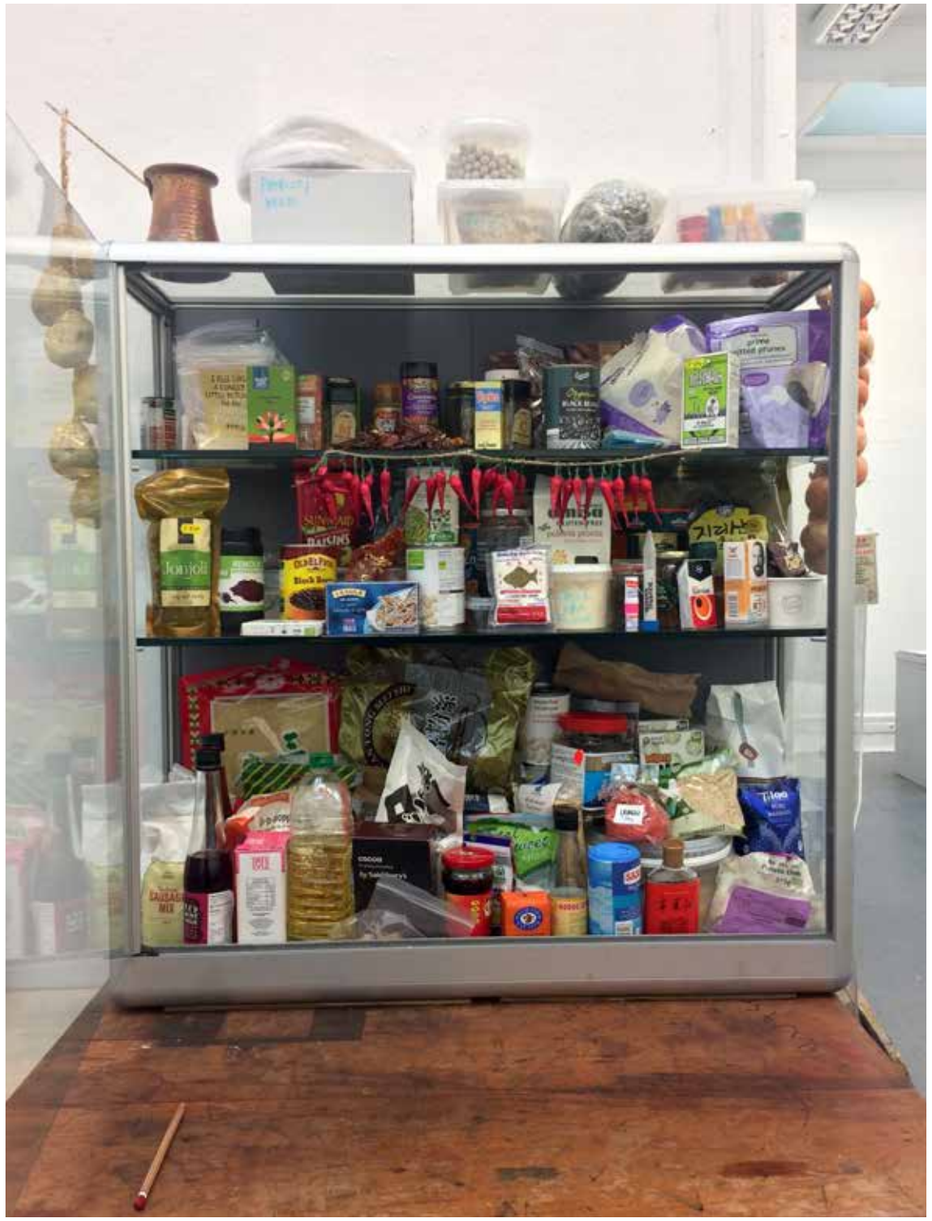
Artist and Slade lecturer the late Klaas Hoek's big tabletop used for Slade "Breakfast Meetings" which invited guests and any students who were up at 8am would join, cook breakfast, eat and talk together. Boris Johnson famously attended when in his role as London Mayor, causing some Slade staff to refuse to sit around it again.

TABLE

The table is a studio, a practice research method, a forum, and a stage. It is a space and platform for experimentation, for communion, for trust, and for the kind of talk that goes with shared making and eating food. In Spanish, the sobremesa is not directly translatable, but could be translated as 'over the tabletop'. This period of digestion or after-dinner activities period is where you set the world to rights. At the table there is a sharing of matter that happens, physically and through discussion.[20]

My then PhD supervisor, artist Gary Woodley had told me about the Slade's Breakfast Meetings: cooked breakfasts and discussion at 8am, held around a tabletop on Slade's Rotunda, and I was keen to continue this discursive art and food activity around the Studio table at the Slade.

20. I am aim not to reinforce the assumed western nuclear family myth of the dining table as universal ideal, but see the round table, in the context of the university, as a less hierarchical forum (than the boardroom or classroom table) for doing research through making, arranging materials upon and as a foundation for eating off. There is no real consensus on eating round a table and family s that stay together this is a myth. Most people around the world do not use tables to eat. The table features in this research project as a metaphorical forum, but there are as many ways to eat and feed together as there are social and familial groups, with no real consensus on this, through geographical or generational location.
See Mary Douglas, "Deciphering a Meal." Daedalus 101, no. 1 (1972): 61–81. http://www.jstor.org/stable/20024058.



First iteration of our studio pantry,
Slade Research Centre, Woburn Square.
Appendix A p.30

PANTRY

I collected a usable pantry of 'active', ingestible ingredients including herbs, medicines, condiments, raw materials, compounds, and essences, and included books and reading materials.

This became a part of the work; as others were invited to add to and use materials from this collection, the pantry morphed and changed, restocked with every workshop. It functioned as a medicine, kitchen or curiosity cabinet of materials, a record of stuff that affects us physically, psychologically, and culturally, allowing me to explore what different people conceive of as an 'active' material. The everyday use of the pantry was important – a living object, it needed to be kept alive through the adding and subtraction of items for cooking and eating together. It needed to be in constant transformation to exist, needing us all to cook and contribute, paying attention to the lifespan of materials.

The pantry helped open out discussion in workshops with a rich vocabulary of substances to hand, its taxonomy continually changing. Its conception drew on Dr Tim Ingold's idea of an Environment Without Objects (EWO):

> EWO is not a material world but a world of materials, of matter in flux. To follow these materials is to enter into a world that is, so to speak, continually on the boil. Indeed, rather than comparing it to a giant museum or department store, in which objects are arrayed according to their attributes or provenance, it might be more helpful to imagine the world as a huge kitchen, well stocked with ingredients of all sorts.[21]

Seeing the world as ingredients, as parts that have the potential to be mixed to make new things, allows me to imagine more. The pantry suggests agency: you can be the cook not just the consumer.

21. Tim Ingold and Arthur Lewis Building, 'Bringing Things to Life: Creative Entanglements in a World of Materials', 2010. 8

CARDS

In a similar way to a mixed pantry of active ingredients, using index cards to record parts of the action allows for a more subjective, generative documentation of what went on, with each card able to spark new meanings in combination with others. In an early sensory session on sugar metamorphosis, I asked people to record impressions, drawings, feelings, and phrases on standard white index cards, which we stuck up on the walls to form a kind of mind-map. (Appendix A pp. 60-70, 108, 140, 150)

This became a device I used in every session, to document and identify themes and threads from people taking part in the research. They are re-configurable – we often moved the cards around at the end of sessions to find affinities and connections. In other sessions people used the cards to write or draw recipes or responses.

This system of group 'brainstorming' and documenting discursive thinking is similar in form to post-it notes methods used in design thinking and ideation, a non-linear way to think around problem-solving in a group. However, the index cards differ to the more disposable post it notes in their connotations.

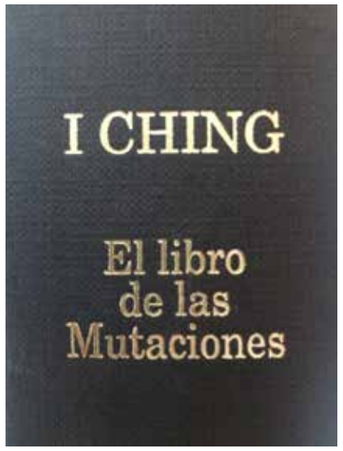
The card-index as an information system was first introduced by botanist and physician Dr Carl Linnaeus, who developed them to capture discrete pieces of information about plants, animals, and materials, which could be categorised and filed in hierarchies, according to his ideas about taxonomy. However, as observed by Michel Foucault, "…the appearance of the card-index and the constitution of the human sciences are another invention that historians have taken little note of."[22]

By which I understand he means that these hierarchies of data that separated, categorised and ranked human and more-than-human, far from being an apolitical recording system, fundamentally reconfigure power relationships with lasting effects – still echoing today in scientific racism and Eugenics.
(p. 95)

I have tried to subvert the hierarchical use of the index cards by liberating them from their index and creating reconfigurable mind-maps together with the workshop participants as a tool for co-enquiry, as an externalised thinking process making unexpected connections, resemblances, and affinities.

The growing collection became interesting as it became a pack of cards, usable to form new connections within the research, as a spur to experiment or analysis, or to stimulate new ideas; drawing cards to generate new combinations of thought.

22. Michel Foucault, Discipline and Punish: The Birth of the Prison, 2nd Vintage Books ed (New York: Vintage Books, 1995). 281



Assorted cards and resources from different decks: I Ching (the book of changes), by Richard Wilhelm Castilian version, Osho Zen Tarot, Thoth Tarot by Lady Frieda Harris and Aleister Crowley, Oblique Strategies by Brian Eno and Peter Schmidt, Struggle For Existence - John Player & Sons cigarette cards, Flower Power - "Ancient Herbal Remedy Cards", Merrimack Corp N, and found cards.

Games of chance or divination have a long history. Tarot cards, and the I Ching developed from games, as ways to make decisions, divine the future or frame thinking. They can act as a mirror to see what you want (or don't want) to do – it is easier to know your own mind when things are reflected to you. I also use elements of interpretation: in the barometers I made: *Luminal Organs,* or through the *Listening to Incense* workshop, divining meaning in matter. (see Appendix A pp. 32, 58)

Interpretation has links with the methodologies of surrealism, defined by artist Andre Breton as "psychic automatism in its pure state, by which one proposes to express - verbally, by means of the written word, or in any other manner - the actual functioning of thought." [23] The cards create structure, tap into undercurrents of barely conscious ideas which are starting to coalesce, through interpretation of senses and emotion.[24]

During the development of the form of the workshops I developed some key ways of working:

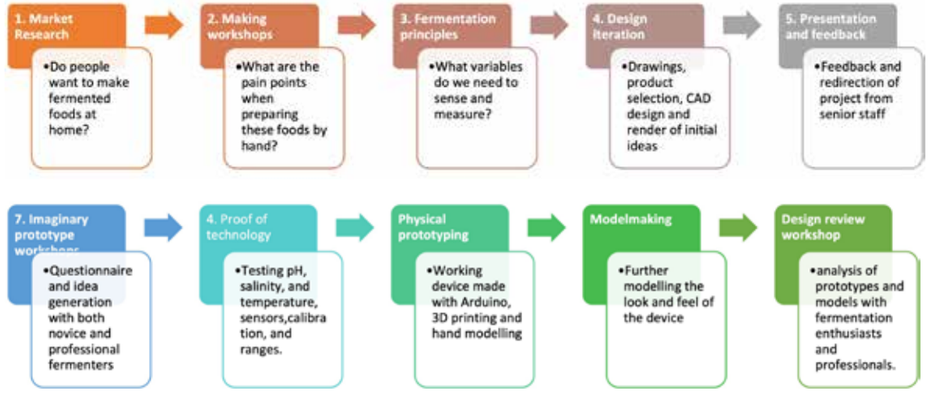
- Set the scene: communal table, pantry, reading materials, index cards and pens, a wall or surface to arrange the cards on.
- Start with tea-making and snack-sharing – introducing the subject and communing in the act of ingestion (also to discuss allergies or restrictions, likes or dislikes).
- I ask people to bring something with them to introduce themselves or respond to the theme of the workshop. This allows everyone to speak and introduce their perspectives through a material or thing (rather than focusing on labelling themselves with their profession for example). We pass each item around to get the senses and fingers going.
- Introduce what we are investigating – this could be a demo or co-exploration of a material or reading out some provocations.

At the end of a workshop, we review and re-order the index cards with any new relationships or themes.

The cards from the various research sessions will appear peppered throughout this report.

23. André Breton, Manifestoes of Surrealism (University of Michigan Press, 1969). 26. See also the Abramovic method: https://www.dailyartmagazine.com/marina-abramovic-method/

24. In their use, I have been influenced by 'Oblique Strategies', a pack of cards developed by Brian Eno and Peter Schmidt, to jog creative block, or take a new tack with thought process: "Stop thinking about art works as objects, and start thinking about them as triggers for experiences (Roy Ascott's phrase)": Brian Eno, A Year with Swollen Appendices (London: Faber and Faber, 1996). 368-99
Two other card systems I have come across have been helpful, New Metaphors - a creative toolkit for generating ideas and reframing problems, by imagining entities and phenomena as others, by interaction designer Dan Lockton at Imaginaries Lab: Dan Lockton et al., 'New Metaphors: A Workshop Method for Generating Ideas and Reframing Problems in Design and Beyond', in Proceedings of the 2019 on Creativity and Cognition (C&C '19: Creativity and Cognition, San Diego CA USA: ACM, 2019), 319–32.
The other is IDK - by Strategy Professor Dr Vaughan Tan, who says he creates tools to help people, teams, and organisations flourish in uncertainty. This deck suggests actions to place yourself outside your comfortable boundaries and see things differently: Vaughn Tan, 'Idk', Productive Discomfort (blog), 15 May 2022, https://productivediscomfort.org/about.



Sprouts in Small Spaces I workshop on home growing appliances, 2019.
Appendix A p.142

Methods flow diagram for the Beko fermenter projects: PicklePal and the Sensicle,
Report pp 203, 121

Beko Collaboration

MRK BEKO

I developed the MRK as an experimental method over the first two years focusing on themes in my work and the priorities of Beko R&D alternately. The project's activities later diverged as their aims became more specific. I wanted to focus on getting embodied knowledge about materials and tools into the hands of engineers who are designing for them – encouraging them to use their own branded appliances as well as the food that their customers will be processing. I tried to set up a Materials Research Kitchen in their Cambridge Lab.

I staged 11 in-person participatory research workshops and public events specifically towards our collaborative research aims. I also staged a specific product research workshop, and an online fermentalong with Beko R&D and marketing team staff and their families, during the UK's Covid-19 lockdown, All the subsequent participatory product research and development workshops were held online too.

MARKET RESEARCH

Once we had embarked on the *PicklePal* fermentation product design, I proposed the flow of methods detailed here. By this time all our work was online because of the COVID-19 Pandemic, so communication was limited. I used the language of their internal communications at times, presenting ideas using Microsoft Powerpoint graphics, so as not to go outside of the team's comfort zone too much, to focus on the content. At other times I had fun with the presentation style.
(Appendix B p.72)

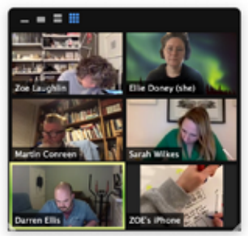
My first step (just before UK lockdown) was to aggregate data from consumer reports and user questionnaires: analysis of trends in attitudes to fermented foods taken from Global Data and Mintel Reports at the British Library. I read all the current reports and future forecasts on fermentation gathered relevant insights from each.

I used online questionnaires and WhatsApp groups to gauge responses to workshops from user groups over time, which became even more useful in lockdown.

TECHNICAL RESEARCH

This stage included researching current approaches to home fermentation, and collating measurements and ratios for making fermented foods via books, blogs, and online fermentation classes.

'Proof of technology' involved repeatedly testing several methods of reading variables, sensor calibration, and ranges, to identify how a device would work, and what kind of sensors or technologies were most suitable for the job. (Appendix B p. 204)



Documentation from research for the Sensicle, 2020-2022.
Report pp 121

TECHNICAL DEVELOPMENT

I used drawing and modelmaking to imagine what form a home fermenter might take, and once we had branched out into ideas for the Sensicle multitool, the methods could expand to involve sensor testing and proof of technology.

The idea for the 'imaginary prototype' came from a conversation with roboticist Richard Sewell,[25] who described a process that he had explored, whereby - instead of going straight into designing something - you workshop ideas with whatever materials come to hand, role-playing, and imagining yourself into the process. My experiments with t his had to be adapted for these now-online workshops due to the pandemic restrictions in meeting face-to-face. (see Appendix B p. 206)

Physical prototyping used robust food-safe sensors controlled by an Arduino processor with a small OLED screen powered by a solar panel and rechargeable battery. I prototyped the design of the multi-tool in plasticene and sticks, moving on to mouldable thermo-soft plastic, and then silicone putty. Beko R&D staff interpreted CAD models and 3D printed components from my drawings. (see Appendix B p.152)

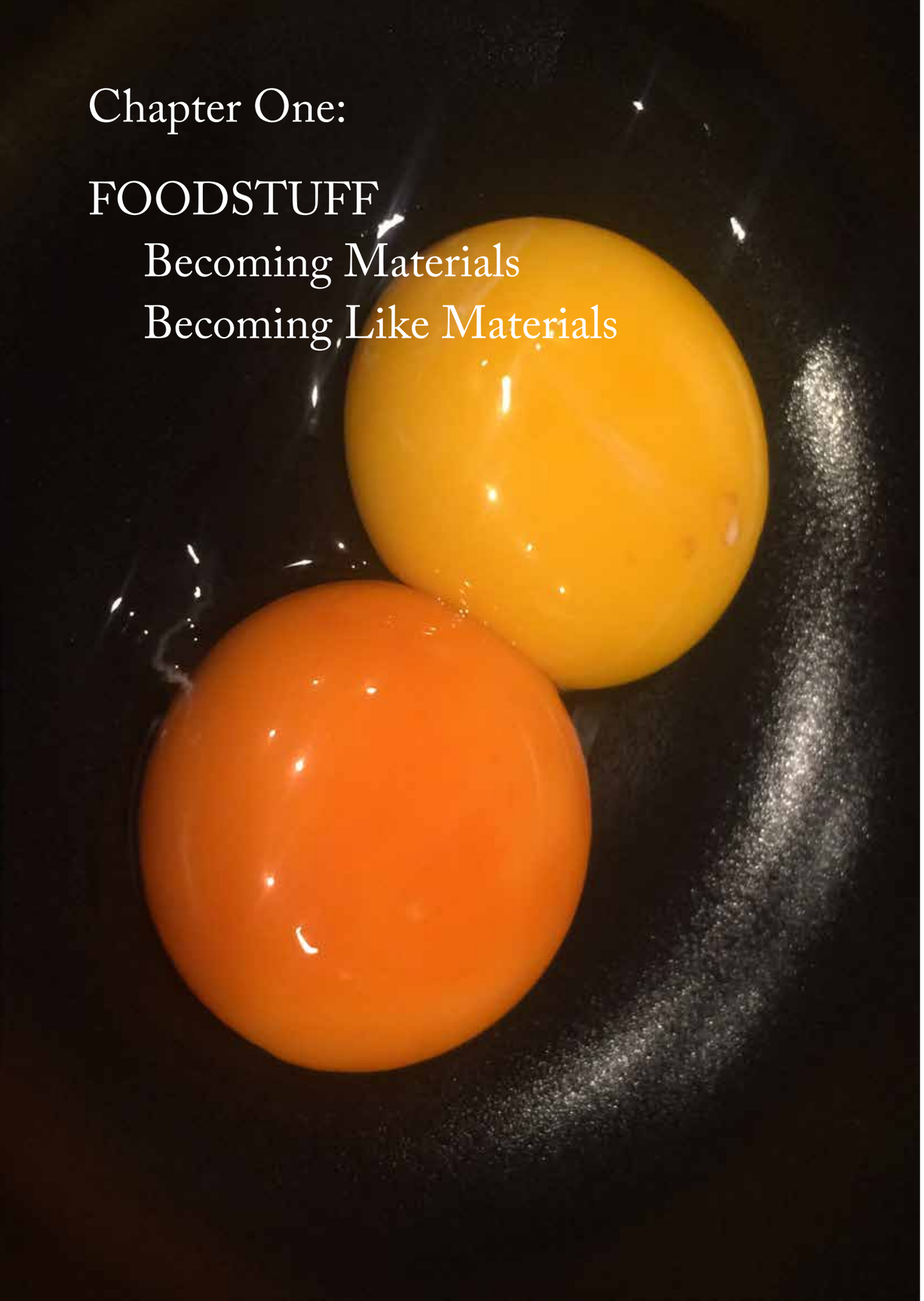
ANALYSIS

With one working prototype and three models of the Sensicle, industry professionals gave feedback on post-it notes in four sections: Likes, Problems, Questions, and Ideas. They all brought and presented a favourite, or most annoying tool, which helped us to start thinking and talking about how they feel about kitchen tools – the expert users allowed us to gauge reactions from people who could really imagine using these tools day-to-day. (see Appendix B p.210)

Working with targeted feedback on post-it notes at this point allowed us to keep feedback relevant, and to see patterns within it, without needing to use the more interpretable and generative medium of the index cards.

The theory and influences that support my research methods found a practical application in the project with Beko R&D. In the first two chapters that follow, I introduce these ideas further, and discuss how they underpin the practice research in chapters three and four.

25. Richard Sewell, "Maker. Software engineer. Contraptor." https://jarkman.co.uk/



Chapter One:

FOODSTUFF

Becoming Materials

Becoming Like Materials

Chapter One establishes how food can help us understand the physical and cognitive embodiment of materials. I show how we become materials though eating them and become like materials via our use of cognitive metaphor.

I discuss whether making and eating food together enables the development of empathy, curiosity, and care for materials.

Hog intestine and deer meat (venison)
from Ashab Martin, The Ethical Hunter -
for the Sausage Sessions, 2017.
Appendix A p.60

Becoming Materials

> What if we were to stop celebrating 'the human's' cognitive reflections about the world, and take our cues instead from human metabolic engagements with the world? [26]

THE OUROBOROS SAUSAGE

This report begins and ends with the image of the Ouroboros. The sausage eating its own end is a comic emblem of the ridiculousness of our perceived place at the top of the food chain, and the idea that there is something in our substance that makes us superior to the rest of stuff. We too are stuff, and foodstuff at that; we are mixed meat. We are inhabited and transformed by the materials traversing our bodies, being catalysed, and absorbed, changing us daily. Most of these materials we get from food, through the inner skin of our enteric system, but we also absorb materials through our outer skins, orifices, and lungs. Self and environment are mediated and connected by this skin: the vanguard of sensory perception and an inhabited microbial landscape. The borders of the body are porous; we are in a state of constantly transforming, becoming, a blur of both self and other, through the living and non-living matter that traverses us. The microbes and materials there redraw what it means to be a person.

The Ouroboros Sausage incorporates opposites: mind and matter, subject and object, eater and eaten, beginnings and ends. As the sausage eats itself, the animal inhabits its own gut, taking on the form of the intestine it's encased in. It extrudes itself, as the daily internal part of us that becomes other, the first object we ever make - the poo we are extremely proud of as kids - to become the soil that we need to sustain life as part of the planet.

The first research workshops I held used the sausage literally as well as figuratively, where through an exploration of sausage anatomy: skin, substance, and spice, we were able to talk about diverse issues to do with materials, the boundaries of the body and identity through the medium of sausage making. The questions I posed at the beginning of each session, early iterations of my research questions, were about likeness: How are materials like us? How do we become like the materials we spend time with?
These early sessions led to further sausage-based events and workshops in relation to key concepts in this thesis. (Appendix A pp. 60-70)

26. Annemarie Mol, Eating in Theory, Experimental Futures (Durham ; London: Duke University Press, 2021).

Mouldy Sausage in sausage 'cave', contributed by chef and artisan food production specialist Shebah Kingsford Smith.

DYNAMIC TRANSFORMATION

As well as via gestation and eating, the daily materials that make us come from our ancient exchange system with microbes, the mediators between materials and people. Microbes power life and our earthly transformations, converting materials into food and kickstarting living ecologies.

We are not individuals but a multitudinous community in constant transformation comprising complex chemicals, minerals, and micro-organisms intra-acting and transforming, being built, and rebuilt in micro-structure. Some traditional and ancient ontologies (Buddhism, for example), encompass ideas of a dynamic expanded and connected self but – despite evidence to the contrary – in our increasingly individualistic and industrialised societies we have lost this general awareness.[27]

We are holobionts;[28] a community of fungus, bacteria, and viruses, as part of a living system of cells in constant ecological transformation and exchange, symbionts that we rely on for life processes including eating, reproduction, and the formation of an immune system. This complicates taxonomies and creates connections.

Symbiotic micro-organisms inhabit our gut in utero[29] and on throughout our lives, inside and out; sixty percent of our immune system is concentrated in the gut. Listening to our gut is not just about our conscience, or our unconscious mind, it is about becoming tuned in to what 'we' need, which includes our wider microbial and material ecosystems.

The many-faceted role of these microbes is important to this metabolic enquiry into human-material ecologies, through fermentation and growing. We cultivate their mass reproduction by growing grains and fruits and animal products for them to ferment and transform, and for us to cook and eat. Materials make and transform us, and we, increasingly, make and transform materials in concert with microbes. We and our microbial symbionts have moved from being a biological agent to a geological agent, changing the fabric of the world.

27. Dr Donna Haraway notes that in English language, what "…westerners call individuals… Melanesians, perhaps more presciently, call dividuals.": Donna Jeanne Haraway, The Haraway Reader (New York: Routledge, 2004).
See also: Scott F. Gilbert, Jan Sapp, and Alfred I. Tauber, 'A Symbiotic View of Life: We Have Never Been Individuals', The Quarterly Review of Biology 87, no. 4 (December 2012): 325–41. This paper was discussed by Sociologist Dr David Griffiths who concluded that the multiplicity of ways that life reproduces itself is far from heteronormative, and that paying attention to the symbiotic view of life can have positive biomedical consequences for non-normative bodies, practices and communities: David Griffiths, 'Queer Theory for Lichens', UnderCurrents: Journal of Critical Environmental Studies 19 (13 October 2015): 36–45.
28. The holobiont concept, coined by biologist Lynn Margulis 1991 (but with antecedents e.g., in Kropotkin Mutual Aid 1902), extends an organism's boundaries whether a human, a coral or a mosquito to include the essential microorganisms in, on and around it. This concept troubles linear evolution and allows us to appreciate how the branches of life intersect and support each other's existence.
29. Noelle Younge et al., 'Fetal Exposure to the Maternal Microbiota in Humans and Mice', JCI Insight 4, no. 19 (3 October 2019).

Distillates, liqueurs and artisan spirits from the local environment: Ars Natura Liquida. Made by Bernat Guixer Daniel Martínez and Joan Carbó at El Celler de Can Roca in Girona, Catalunya (photographed on a research trip there in 2019).

Over the past few decades, new ways of thinking about materials have emerged. New work in quantum physics, biology and genetics reveal a vision of materials formerly seen as passive, helplessly subject to the laws of Newtonian physics, as intricately interconnected, and dynamically self-organising. According to the Gaia hypothesis,[30] the planet is a "superorganism", a living, self-regulating system that seeks to create a balanced physical and chemical environment, ideal for life as we know it.

Rooted in process philosophy, Open (or General) Systems Theory[31] reimagines matter as part of an active network, with properties that arise in streams of material with its own tendencies and capacities. Systems theory understands complex systems – be they a cell, a body, a building, a company, or a country – by focusing on their interactions with the matter, information, and energy of their environment.
These principles include the idea that systems exhibit emergent properties, meaning that the whole system has characteristics and behaviours that cannot be reduced to the sum of its parts. In a functional system the porous boundaries are selective, maintaining equilibrium. This theory has been influential across disciplines as a usable model, allowing for a dynamic view on problems and realities. As technology develops, we are blurring boundaries even more, creating animate matter, responsive architecture, bespoke living systems, and bionic bodies. [32]

Nothing exists in isolation but is in constant ecological transformation through the media of gases and liquids. Objects, bodies, are a resting point for materials in flux.

30. Proposed by scientist and inventor James Lovelock and developed with microbiologist Lynn Margulis: James E. Lovelock and Lynn Margulis, 'Atmospheric Homeostasis by and for the Biosphere: The Gaia Hypothesis', Tellus 26, no. 1–2 (January 1974): 2–10, https://doi.org/10.3402/tellusa.v26i1-2.9731.
31. Introduced by Mid 20th century biologist Ludwig Von Bertalanffy, in: Ludwig von Bertalanffy, General System Theory: Foundations, Development, Applications, Revised edition (New York: George Braziller, Inc, 2015). 1930s Phenomenologists Schelling and Heidegger's slogan was "To the things themselves!", which accords with Anni Albers' exhortation to "go back to the material itself, to its original state, and from there on partake in its stages of change." (see Chapter 1 page x)
32. Psychologist, Professor Lisa Blackman sees 'the human subject (as) both one and many', exploding what we are, way beyond the physical, describing: '…bodies as assemblages of human and non-human processes… These bodies may not conform to our expectations of clearly defined boundaries between the psychological, social, biological, ideological, economic, and technical, and may not even resemble the molar body': Lisa Blackman, Immaterial Bodies: Affect, Embodiment, Mediation (SAGE Publications Ltd, 2012).1-2

Nutritional Sculpture: iron cooking ingredients/tools, part of my Activated Works, 2018
Appendix A p.36

Physicist and systems theorist Dr Fritjof Capra proposes a fundamental change of metaphors, unifying conception of mind, matter, and life:

> …from seeing the world as a machine to understanding it as a network… that sees not only the brain, but also the immune system, the bodily organs, and even each cell as part of a living, cognitive system. Evolution is no longer seen as a competitive struggle for existence, but rather as a cooperative dance in which creativity and the constant emergence of novelty are the driving forces. And with the new emphasis on complexity, nonlinearity, and patterns of organization, a new science of qualities is slowly emerging.[33]

This mention of qualities as emergent moments in the flow of matter adds to previous conception of qualities as subjective attributes, and together they form my understanding of materials, disciplines, and bodies, not only with physical measurable properties, but with multi-layered bio, emotional and cultural qualities of materials that arise and change depending on our point of view and moment in history.

I have used food to explore this. Edible materials are a form of complex matter familiar (and attractive) to people, and ingestion is the obvious way we become other materials and they become us.

INGESTION

In response to the Materials Library's collection of elements that are found in the human body, Researcher Phillip Howes wrote:

> Although there are around sixty chemical elements present in the body, only twenty-seven have known biological functions…
> We grow from nothing, being assembled by complex chemical reactions in the womb. We take in the chemical building blocks of life, firstly from our mothers and then from our food. Our bodies are built from the chemical elements of the Earth, and these are constantly replenished throughout our lifetime as we use them and dispose of them. The very elements that we are composed of have been on one hell of a journey to get into our bodies, first through space and then through the history of Earth. When we die, we will become part of the Earth again, and the atoms that once made your body will go on to be many other things. [33b]

33. Fritjof Capra, 'The Systems View of Life a Unifying Conception of Mind, Matter, and Life', Cosmos and History: The Journal of Natural and Social Philosophy 11, no. 2 (July 2015) 242. Capra's critics accuse him of reductionism, confusing detailed understanding with metaphor in his use of the big visual ideas like fractal geometries and other pattern phenomena, but I don't discount the value of his observations in building my ideas, as metaphors themselves are so important to our cognitive process. These modern perspectives echo traditional Chinese medicine understandings of the body and the flow of Qi.

33b. 'Phils Findings: Elements of Life', n.d., http://www.instituteofmaking.org.uk/blog/2011/11/phils-findings-18-pencil-lead-and-water.

The Material Body anatomy class with UCL medical students - constructing a body map through object handling and discussion of prosthetics, fillings, jewellery, and surgical and cosmetic implants, makeup and skincare, 2020. Appendix A p.72

Foodstuffs act upon the body once ingested, whether by the effects of macro or micronutrients, or by other biologically active compounds. Food contains metals, stones, and salts which plants and animals themselves have ingested. These materials, in the wrong place, find their way into our bodies through biocides, fertilisers, forever chemicals and antibiotics in plants animals and soils, as microplastics, chemical pollutants and non-food additives deliberately added for flavour, texture, and longevity. It is now recognised that these substances act upon us, change our bodies, and drive our behaviour by their effects on our hormones and those of our descendants, by means which are still mysterious.[34]

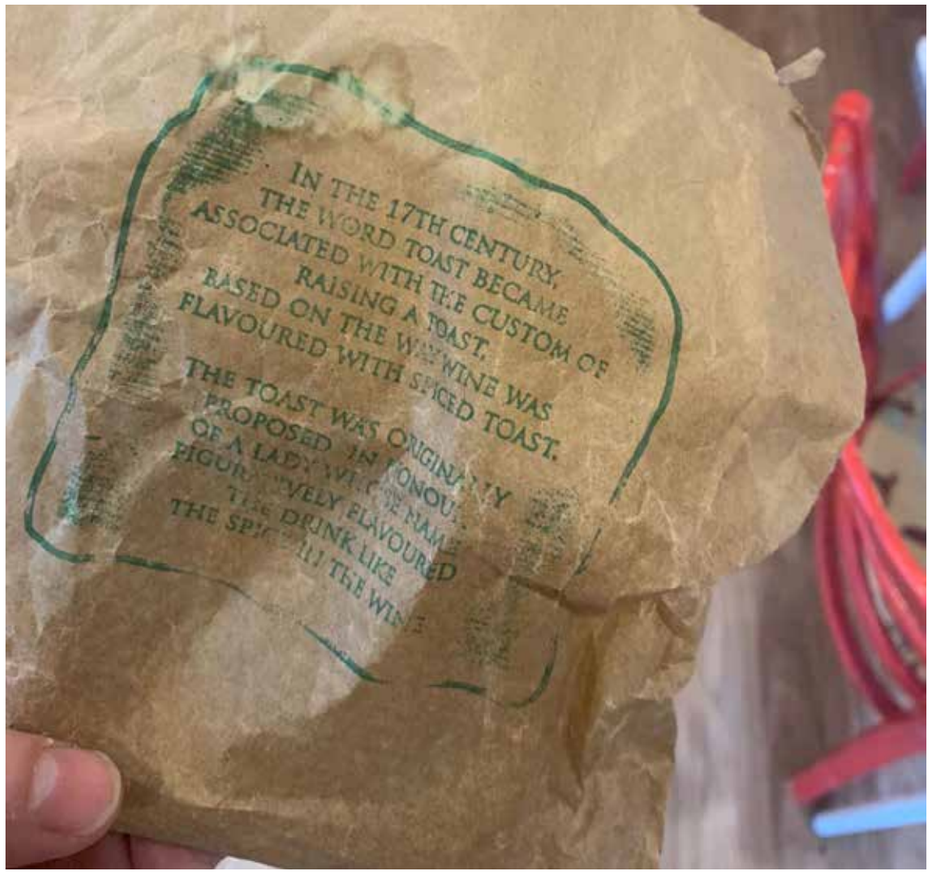
The material history of a person's life is recorded in their bones and teeth; isotope ratio analysis shows how much we are altered by what we ingest, reflecting variations in temperature, soil, microbial and human action. Whether we were breastfed, lived in the city or country, what we eat and breathe: a material index of a life, and even ancestral lives are detectable though epigenetics. Materials are at work across the world and our bodies past and future, connecting and reflecting the far reaches of the universe.

The act of ingestion means that foodstuff is a category we impose onto various materials because of their physical but also cultural edibility – whether something is deemed food might be based on nutritional, moral, societal, or religious taboo. It can be layered and charged with many feelings and significances. These can be related to power: for a toddler, or a hunger striker, it can often be one of the only ways we can exert control over our lives, through what we allow in.
Ingestion of materials is too often not a choice and is highly political. Industrialisation and cheaper ingredients and additives, contamination and food fraud, pollution of the air, water and earth finds its way into food. And exposure to harmful industrial materials means the people with least ability to choose what they eat, where they live and work, and with higher likelihood of exploitation ingest more of the materials they shouldn't have to.[35] These conditions create racist ecologies, inequalities of environment for the most vulnerable, controlled by corporate interest and power.[36]

34. "Exposure to plastics (BPA and phthalates) are linked with behavioral deficits, changes in DNA methylation, and changes in gene expression. There is a well-established link between metabolic disease and BPA exposure, including transmission of metabolic disorder through transgenerational epigenetic inheritance."
Jennifer L M Thorson et al., 'Ancestral Plastics Exposure Induces Transgenerational Disease-Specific Sperm Epigenome-Wide Association Biomarkers', ed. Metz Gerlinde, Environmental Epigenetics 7, no. 1 (28 February 2021).
"While it becomes increasingly important to establish causal links between chemical exposures and their impacts on public health, this is no easy task"
Shana J. Sturla and Yinsheng Wang, 'Chemical Exposures and Impact on Health', Chemical Research in Toxicology 36, no. 1 (16 January 2023): 1–2.

35. For more on coloniality, power, and queer and racial politics in extractive human-material ecologies see:
Mel Y. Chen, Animacies: Biopolitics, Racial Mattering, and Queer Affect, Perverse Modernities (Durham, NC: Duke University Press, 2012).
Elizabeth A. Povinelli, Geontologies: A Requiem to Late Liberalism (Durham: Duke University Press, 2016).
Ros Gray & Shela Sheikh (2018) The Wretched Earth, Third Text, 32:2-3, 163-175
Kathryn Yusoff, A Billion Black Anthropocenes or None, Forerunners: Ideas First from the University of Minnesota Press 53 (Minneapolis: University of Minnesota Press, 2018).

36. Global agreements regulating materials use can work, see the Montreal Protocol on Substances that Deplete the Ozone Layer, which has phased down their consumption and production since 1987, allowing the 'hole' in the ozone layer to repair: https://www.unep.org/ozonaction/who-we-are/ about-montreal-protocol



Raise A Toast, performance tasting with artist Nir Segal as part of The Spirit of Slade Ladies Past with artist Tai Shani, UCL Art Museum, 2018.
Appendix A p.72

ENACTING EMBODIMENT

Embodiment is the incorporation of ideas, qualities, or feelings into physical form, connecting the physical and the metaphorical. When materials are ingested, we are also taking in the cultural and emotional properties embodied in that substance.[37]
These qualities and dimensions contribute to how we feel, value, or behave towards them, making sense of who we are, in relation to them. The human experience is different for every person, and the intersections of power and inequality, environmental and material situation and the privilege of choice mean that our material experiences differ wildly. Conceptions of the body are diverse across cultures and traditions, and meanings and metaphors of materials are even more varied. Materials and bodies are run through with combinations of identity and culture, emotion, character, personality, flavour. These charged materials reflect us, as part of the way in which we enact our bodies through practice.

There are various ways of understanding how embodiment might happen as a process, which all feed into my practical work. Dr Annemarie Mol, a philosopher, who studies the anthropology of the body says: "… as part of our daily practices, we also do (our) bodies. In practice we enact them." [38]

Enacted embodiment is a process of intra-action. As feminist theorist and physicist Dr Karen Barad explains: "Existence is not an individual affair. Individuals do not pre-exist their interactions; rather individuals emerge through and as part of their entangled intra-relating."[39]

People and materials are entangled, not joined, or intertwined, but intra-related. We become made by our encounters – not once and for all, but through a continuous making process, a highly contingent one that preserves difference. This is an important distinction from earlier phenomenologists' universal, anonymous concept of the body. We are not a melting pot, or a tossed salad, but as feminist pragmatist Dr Sharon Sulllivan puts it, a stew:

> …as they are in the pot together, stew ingredients intermingle in such a way that each helps constitute what the others are… the flavors of the carrot and onion in a stew impact each other such that the carrot is no longer a carrot, but an onion-y carrot, and the onion is a carrot-y onion…. When a stew is finished cooking, each vegetable in the stew has helped make the other vegetables in the pot what they have become. In this way, the vegetables are co-constitutive of each other, but they also remain vegetables with their own distinct, but trans-formed and thus not isolated identity.[40]

In this way, we are enacted by what we eat.

37. For more on materiality and embodiment see for example: Lavis, Anna, and Karin Eli. "Corporeal: Exploring the Material Dynamics of Embodiment." M/C journal 19, no. 1 (2016).
38. Annemarie Mol and John Law, 'Embodied Action, Enacted Bodies: The Example of Hypoglycaemia', Body & Society 10, no. 2–3 (June 2004): 43–62.
39. Karen Michelle Barad, Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning (Durham: Duke University Press, 2007).ix
40. Shannon Sullivan, Living across and through Skins: Transactional Bodies, Pragmatism, and Feminism (Bloomington: Indiana University Press, 2001).15. Sullivan cites other constitutive notions like John Dewey's *Habit* and *Transaction*, Judith Butler's *Performativity.*

Theriac, a public medicine compounding - an Activated Work, made as part of SUGAR: Transformation workshop, 2018.
Appendix A p.110

ACTIVE INGREDIENTS

I am drawn to the term active ingredients, as the part of a substance or compound that produces its chemical or biological effect. By the active qualities and properties of everyday materials – their physical effect entangled with emotional affect – I understand how materials manipulate us as we manipulate them; our food systems act upon us and the environment whether the food is directly ingested or not.[42] We could say the same about microbes, in the huge amounts of land we give over to feeding them to help make our bread and beer, soy sauce, coffee, tea, wine cheese and chocolate.

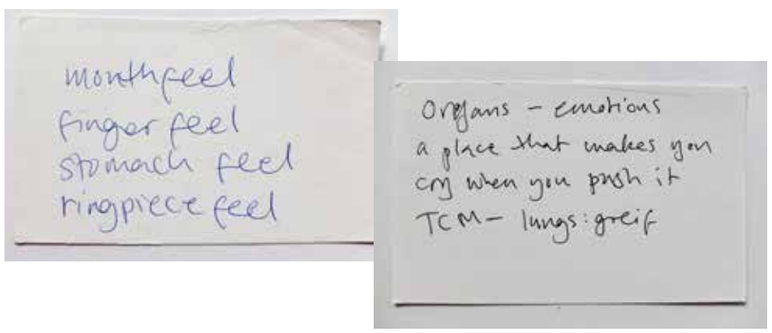
Proponents of Vital Materialism, part of New Materialist anthro-decentric streams of thought – who take seriously the lively interactions and transformations of matter as of ethical and political importance[43] – reject 'environment' as anthropocentric, centring instead ecologies with their own streams of agency which confound taxonomy. Dr Jane Bennet highlights:

> …the capacity of things–edible, commodities, storms, metals—not only to block the will and designs of humans but also to act as quasi agents of forces with trajectories, propensities, or tendencies of their own. [44]

Take sugar, for example. This is a megamaterial - a potent substance which continues to transform our world. Anthropologist Dr Sidney W. Mintz wrote of the powerful effects of desire and corruption wrapped up in the production of sugar and its role in the unequal and racialised structures of the modern world in *Sweetness and Power*.[45] He implicates in this the rapid rise of sugar consumption and national and private wealth, on the backs of people who are enslaved and exploited.

41. 'Active Ingredient Definition and Meaning | Collins English Dictionary', accessed 5 February 2019, https://www.collinsdictionary.com/dictionary/english/active-ingredient.
Active ingredients is a pharmaceutical term. Food and medicine are closely linked through the history of cultivation and ingestion, and the links live on particularly in Traditional Chinese Medicine and Ayurvedic traditions. However, we should be wary of seeing food as medicine, the proponents of special diets that cure cancer, superfoods or ultraprocessed food replacement at the expense of making a habit of eating varied fresh food, might be taken with a pinch of salt.
42. Michael Pollan, in the Botany of Desire, discusses how the tulip, the apple, cannabis and the potato have domesticated us, rather than the other way round: Michael Pollan, The Botany of Desire : A Plant's Eye View of the World (Random House, 2001).
43. Several streams of recent thought in critical anthropology, sociology, aesthetic, political and cultural theory place the question of the multifaceted and active nature of matter at their centre. Ideas of relational materiality and complexes of the human/non-human/other, investigate the material nature of thought, and the entanglement of stuff of all kinds, mostly focusing on human-made or assumed technologies, objects and materials which we use to live, and to extend our capacities, arising from Bruno Latour's Actor-Network Theory, Deleuze and Guattari's Rhizomes, and Jane Bennet's Thing Power and Graham Harman's Object Oriented Ontology amongst others.
44. Jane Bennett, Vibrant Matter: A Political Ecology of Things (Durham: Duke University Press, 2010). Viiii
45. Sidney W. (Sidney Wilfred) Mintz, Sweetness and Power : The Place of Sugar in Modern History (Viking, 1985).

Salt dough sausage stuffing workshop: Bags O Mystery, at CRASSH Conference, Foodmaking and Gender in Early Modern History, with charcutier Adrienne Eiser Treeby, 2022.
Appendix A p.70



He tracks the advance of the capitalist system through social and economic factors and the "desocialization" of cooking and eating – an instant energy source that enables longer hours at work and shorter hours making and sharing food. The ripple effects of cheap sugar on our bodies show up in the way we live now.

This thesis proposes a way of knowledge-making about our material relationships through food and its active qualities., asks us to imagine how paying attention to our active bodily engagement with the world's materials would change our mentality. As Mol proposes:

> What if we were to stop celebrating 'the human's' cognitive reflections about the world, and take our cues instead from human metabolic engagements with the world?[46]

I see this as an important ethical proposition that decentres dominant narratives about what's important to pay attention to, valuing individual lived bodily experience.

SENSORY BORDER CROSSING

Our skins are our sensory boundaries, the dynamic border where world and body mingle and are perceived, where we find out how we feel about materials. Metabolism is not just a matter of mechanical processing, but perception too.

Our tastebuds are electrochemical sensors – neurons and organoleptic taste receptors line our inner surface, our internal organs, even including lungs, intestines, testicles, and anus, in a complex balance of sense and response. They help control the manufacture and release of chemicals and hormones that drive our perception of sensory information, as well of course, as telling us whether something is good to eat. Knowing through tasting,[47] through putting stuff in our mouths is fundamental, one of the first actions we ever do as babies. We investigate, understand, and accept or reject the world through flavour - a combination of tasting, smelling and mouthfeel which bypasses our conscious sensory processors (the thalamus) and goes straight to the limbic system (amygdala and hippocampus), affecting emotion and memory.

The borders of the body think and know, and hormones secreted by the gut, which are inhabited and governed in part by a whole host of microbes, drive our desires. They, in concert with all the other social and environmental factors, tell our conscious mind what we want, and alter our behaviour.

46. Annemarie Mol, Eating in Theory.(Duke University Press, 2021), 2
47. InformedHealth.org Cologne, Germany: Institute for Quality and Efficiency in Health Care (IQWiG); 2006-. How does our sense of taste work? Dec 20 2011 [Updated Aug 17 2016]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK279408/

Brown sugar making table at
Bittersweet: Sugar Creation event at
Manchester Museum, part of research
for FEAST Journal: Sugar Issue, 2019.
Appendix A p.108

Our senses play a crucial role in determining whether we want to eat something, allowing it to enter and become our bodies. Our sense-based knowledge about plant, mineral, and animal materials has been passed down through the ages. Contemporary food practices remove the necessity for some of these embodied knowledges in the detection, selection and preparation needed to make our surroundings edible, often deliberately manipulating our sensory logic about edibility in pursuit of profit.
The phenomenologists studied experience, arguing that knowledge must be constituted of practical, lived, and active bodily exposure to the world,[48] and is therefore subjective. Sensual phenomenologist Michel Serres goes further, critiquing their observations as:

> …austere and meagre …tragically stripped of any tangible experience… no sensation - everything via language…
> …in the skin, through the skin, the world and body touch, defining their common border… I do not like to speak of the place where my body exists as a milieu, preferring rather to say that things mingle among themselves and that I am no exception to this, that I mingle with the world which mingles itself in me.[49]

He recognises that knowing about the world must involve being among it, as a multi-modal participant - subject and object combined, not observing it as an outsider.

My concept of the body as matter in flux is contingent on its active sensing of its surroundings – the body is constantly happening and being made in response to an ecological community.

EATING TOGETHER

Eating food together in commensality[50] is key to understanding our family connection and affinities with other matter. When we eat the same food together, along with our microbial symbionts, household pets and pests, we are literally and symbolically becoming a shared substance, making relations, companions.

48. See for example the work of phenomenologists Husserl, Heiddeger Sartre and Merleau-Ponty, David Woodruff Smith, "Phenomenology", The Stanford Encyclopedia of Philosophy (Summer 2018 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/archives/sum2018/entries/phenomenology/
49. Steven Connor, 'Michel Serres' Five Senses', accessed 20 February 2019, http://stevenconnor.com/5senses.html.
Michel Serres, The Five Senses: A Philosophy of Mingled Bodies, trans. Margaret Sankey and Peter Cowley, 978-1-4742-9964-0 (London New York Oxford New Delhi Sydney: Bloomsbury Academic, 2016).
50. Commensal state; the habit of eating at the same table. "Commensality, n." OED Online, Oxford University Press, March 2023, www.oed.com/view/Entry/37039. Accessed 3 July 2023

Documentation of comfort food discussion, part of Arte Útil (Useful Art): A Working Group - day 3, The Material Body, research event at Calthorpe Community Garden.
Live drawing by Josh Knowles, 2018
Appendix A p.88

Donna Haraway, in her discussion of inter-species and inter-material kinship, calls it:

> …(a) chimera of materials, languages, histories. Terrapolis is for companion species, cum panis, with bread at table together – not post-human but com-post.
>
> We are those who are at risk to each other, who are each other's flesh, who eat and are eaten, and who get indigestion…[51]

Our different senses of human identity are multitudinous, and determined partly through what and how we eat. Our experience of the same food will also be perceived in diverse ways through our different senses, cultural and social economic situations, beliefs, experiences, and ethics.

Eating together is not an instant connector, but it can begin the process of dialogue, to find understanding through difference. There isn't a right way to eat, there are many ways. Sharing or feeding each other, with fingers, forks, or chopsticks, located on the sofa, floor, table or in the carpark, the importance of common food and the act of ingestion in the company of others is important to cultural or national identity. It reinforces belonging and engagement in community and may have evolved as a mechanism for facilitating social bonding. [52]

There is a vulnerability and a necessary trust in eating together, a time when you let your guard down. The customs and taboos around eating reveal a great deal about a person's history, psychology, and cultural background, but it also has a levelling effect on hierarchies – we may eat differently but we all eat and are implicated in the cycles of life as a co-eater and metaboliser. [53]

Eating together is not always this ideal. Many face barriers to the pleasures and bonds of commensality by the politics of food supply, distribution, and sovereignty, resulting in food insecurity. Shortages or famine due to war, political instability, corporate corruption, and climate change can produce social breakdown such that eating together in this way is a precious thing.

Consubstantiation: becoming a shared substance, is a word used in studies of religions and anthropology, a process deeply enshrined in various spiritual practices. The concept of consubstantiation in Roman Catholic Christianity, for example, refers to a belief that consecrated food and God's spirit become the same substance, having, or developing common properties. Bodies are continually fabricated through food sharing and the exchange of substances creates a kind of consubstantiality. [54]

51. Donna Jeanne Haraway, Staying with the Trouble: Making Kin in the Chthulucene, Experimental Futures: Technological Lives, Scientific Arts, Anthropological Voices (Durham: Duke University Press, 2016). 22
52. See: R. I. M. Dunbar, 'Breaking Bread: The Functions of Social Eating', Adaptive Human Behavior and Physiology 3, no. 3 (September 2017): 198–211.
53. See: Claude Levi-Strauss, 'The Culinary Triangle' in Carol Counihan and Penny Van Esterik, eds. Food and Culture: A Reader.(London: Routledge 1997), 28
54. Consubstantiation stands in contrast to the process of Transubstantiation (where bread and wine is believed to transform into Jesus' real body and blood). This process is codified in ritual, alongside the more metaphorical swallowing of ideas and beliefs – remembering Him every time you eat and drink those foods.

Fat and quartz, for meat and rocks drawing sessions, part of The Material Body anatomy sessions with UCL Medical School and Slade students - body as landscape, 2020.
Appendix A p.118

Becoming Like Materials

Foundational and archetypal imagery and symbolism from a range of cultures embed the importance of food's transformational qualities, across our worlds, and those of gods, spirits and ancestors through religious and cultural practice, myths, and archetypal folk tales. Bread, alcohol, maize, rice, fish, oil, ghee, entrails, pomegranate seed, apples, sweets herbs and spices take on deeply embedded shared qualities or properties between edible materials and people. Food's role as catalyst for transformation makes it a rich medium for exploring relationships across cultures.

METAPHOR AND COGNITION

Metaphor can be understood as grasping the concept of one thing by the transference of properties and qualities of a known other. I have found philosophy Professor David Hills's definition useful:

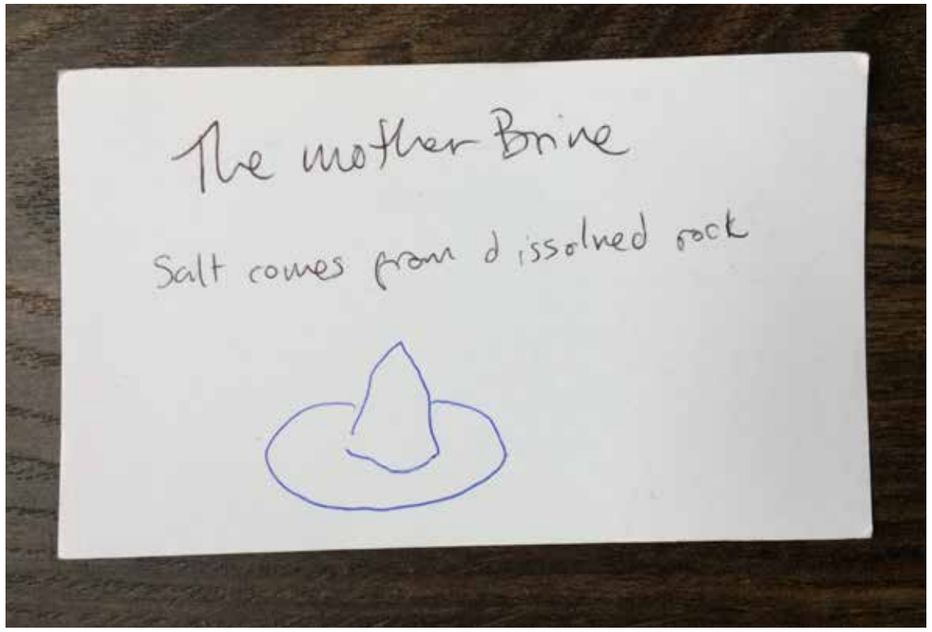
> When we resort to metaphor, we contrive to talk about two things at once; two different and disparate subject matters are mingled to rich and unpredictable effect.[55]

To me, this conveys the magical way that metaphors layer remembered imagery and sensation with practical description, and how differently they can be summoned by, or act upon us, depending on our own experience and imagination. However, Hills's definition describes *resorting* to metaphors as secondary to description, but they are not merely stylistic, or explanatory (although these are vital for communication), but they are important to cognition. They make thinking possible, and art possible. Each metaphor opens a window onto a different world, enabling us to use a safe and known entity (like food), to imagine and understand quite complex things through their qualities, often bypassing words entirely to connect senses and emotions with meaning.

If metaphor is an imaginative transference of properties and qualities, it is made plausible by a feeling of likeness,[56] based on shared relationships or connections, sensory attributes, behaviour, or a feeling of kinship. As we realise how connected we are to materials through food as research medium, likeness is revealed, and materials can become embodied.

I am interested in meaning within materials – how experience of edible materials can act as metaphors to help us understand ourselves in relation to our environment. When we begin to think about materials' likeness to ourselves, we are sensing the world differently, opening a new mode of thinking.

55. David Hills, 'Metaphor', in The Stanford Encyclopedia of Philosophy, ed. Edward N. Zalta, Fall 2022 (Metaphysics Research Lab, Stanford University, 2022), https://plato.stanford.edu/archives/fall2022/entries/metaphor/.
56. The fact or quality of being alike; resemblance, similarity. Oxford English Dictionary, '"likeness, n.".', n.d., https://www.oed.com/view/Entry/108318



In their book Metaphors We Live By, linguists and philosophers George Lakoff and Mark Johnson show that our conceptual system defines our experience, and that some conceptual systems are stored and passed on as metaphor embedded in our language and culture, often using, or understanding cognitive metaphor unconsciously. So, cognition itself relies on metaphor, and we act accordingly, implicating bodily response in metaphor.

Take *ideas* as an example. When we use metaphorical language to describe an abstract concept like this, we imagine it materially – an idea *comes out of the container* of our minds, ideas can be *swallowed, digested or nourishing*:

> …it is as though the ability to comprehend experience through metaphor were a sense, like seeing or touching or hearing, with metaphors providing the only way to perceive and experience much of the world. Metaphor is as much a part of our functioning as our sense of touch, and as precious.[57]

In this way, our senses aid the richness of our thinking. The more physical intelligence, the greater our theoretical understanding. In his book Sensitive Matter, materials physicist Dr Michel Mitov explores the nature of shapeshifting materials and how we can better understand our interactions with them in relation to metaphor and cultural phenomena, by their reaction and relation to our bodies, food, drink, and beliefs.

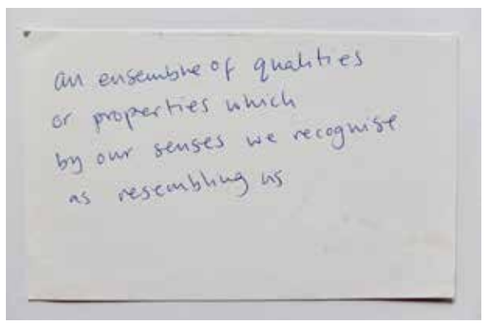
> What if some of our ideas are liquid and others soluble or foamlike? What if our deepest-seated convictions are in reality nothing but mesomorphic states, that is, transitory, intermediary? … What if traditions were obese and philosophical thought a complex fluid? What if our faith were to melt at times?[58]

Metaphors allow us to understand, to assemble ideas into shapes we recognise, and can re-think with. We ingest and embody these metaphorical ideas about materials, which have placebo-like effects on our bodies and emotions. In the definition of materials in my introduction ‘matter’ contrasts ‘mind’ as well as ‘form’, but the three can intra-act by thinking with edible materials as method and metaphor. (p. 13)

57. George. Lakoff and Mark Johnson, Metaphors We Live By (University of Chicago Press, 1980). 238-239

58. Mitov writes about the nature of shapeshifting materials and how we can better understand our interactions with them in relation to metaphor and cultural phenomena, by their reaction and relation to our bodies, food, drink, and beliefs. Jean-Claude Carrière, in: Michel. Mitov, Sensitive Matter : Foams, Gels, Liquid Crystals, and Other Miracles (Harvard University Press, 2012). Preface xi

Oil of Brick, part of research into self-medication and alchemy practices on residency at Phytology's Medicinal Field, 2017.
Appendix A p.10



Mitov's way of thinking was influential in shaping my ideas about using food to translate and discuss materials across disciplines, and to think of it as a creative and generative knowledge practice. The use of metaphor in research allows us to imagine the worlds that researchers are part of outside the research setting, allowing for deeper understanding and connection.[59] Metaphors don't always translate – they can be culturally specific and highly subjective – revealing only how things might be perceived by the receiver. Although their use often enables understanding it can also reveal difference, which however, when brought to consciousness and discussed, can be useful in *situated learning*[60] situations like the MRK. Foodstuffs, when used in this way are extremely useful in cross-disciplinary encounters to translate difficult concepts and jargon-filled areas of research. This observation, reinforced by years of making with groups of people, and working with researchers across disciplines at UCL's Institute of Making, is key to the formulation of this thesis. Familiar, sensory metaphor can be vital in communicating material qualities and properties that are hard to explain, or grasp, like nano-scale structure or the complex properties of composites.

By understanding our likeness to other materials, we can shapeshift in several ways. We situate ourselves through accepted knowledge systems, in hierarchical relationships, but through the transformations involved in taking part in the ecologies of food, we can rediscover more intuitive relations with materials, the metaphors can change to make circular, crystal seeding, mycelial or branching connections. Reflected sensory qualities can connect us to the materials of our environment.

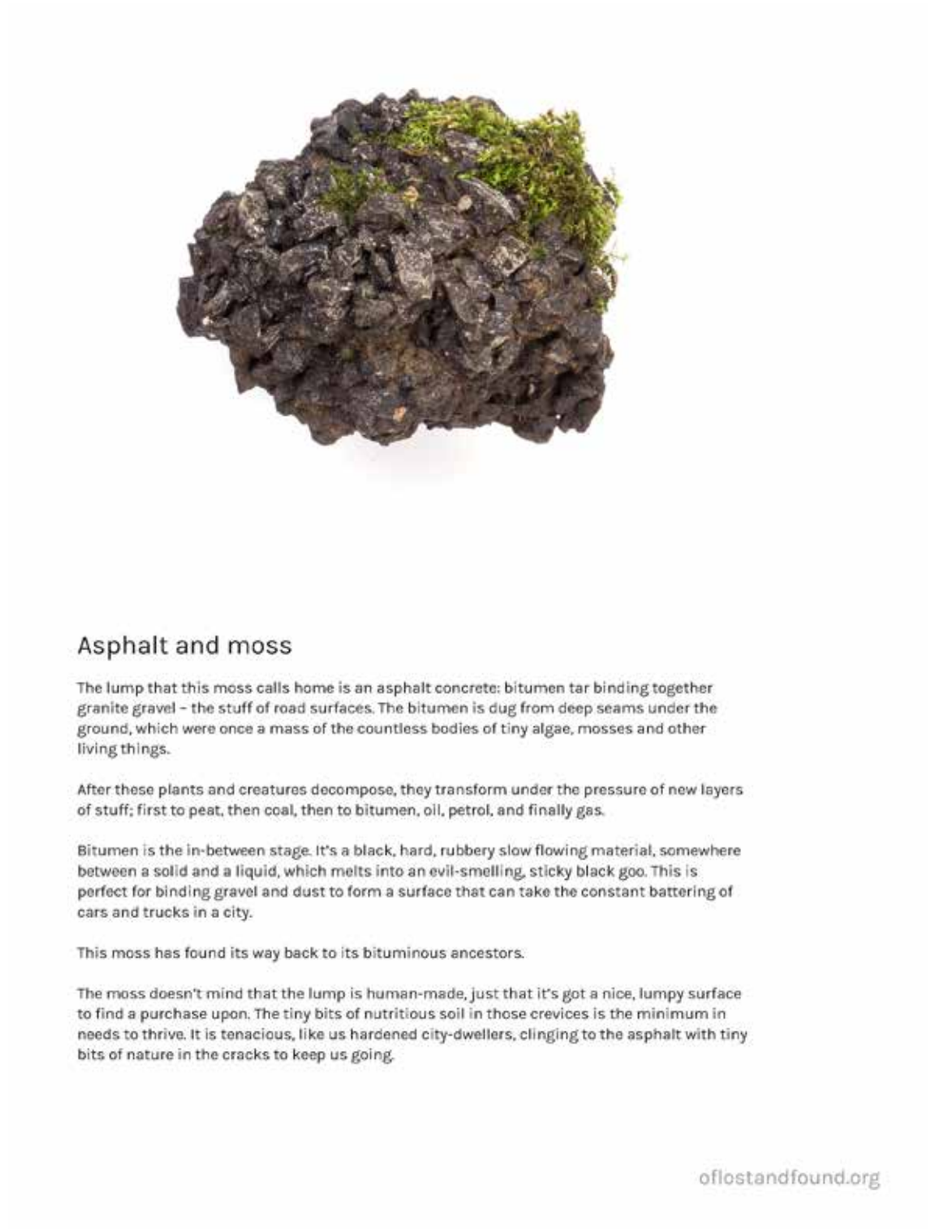
MATERIALS IN THE MIND

The ability to imagine is key to the possibility of acting, and as we can only imagine based on our previous experience, the more experiential the research practice the more scope there may be for imagination of new things.

Materials have behaviour, they act through their properties, but when perceived through the senses and imagination via conceptual metaphor, they create affective qualities - what they are like. They have mutable inner form or structure as well as outer form. The relationships between a material's structure, qualities, behaviour, the way they have been processed, or made, and their context are all interlinked, a language that artists are often able to intuitively use. Tim Ingold says:

> The properties of materials are objective and measurable. They are out there. The qualities on the other hand are subjective… They are part of that private view of the world which artists each have within them. We each have our own view of what stoniness is.[61]

59. See work by philosopher of science Dr Mary Hesse, best known for her view of scientific models as analogies, citing the explanatory function of metaphor in scientific models via a metaphorical transference from a more familiar domain to a domain we know less about: Mary B Hesse, Models and Analogies in Science, 2. print (Notre Dame, Ind.: Univ. of Notre Dame Press, 1970).
60. A term coined by anthropologist Jean Lave and computer scientist Etienne Wenger, to describe the learning process as a set of social relations among people, activity, and world, over time and in relation with other communities of practice: Jean Lave and Etienne Wenger, Situated Learning: Legitimate Peripheral Participation, Learning in Doing (Cambridge [England] ; New York: Cambridge University Press, 1991).
61. Tim Ingold, cites the theorist of design David Pye, (Pye 1968) arguing that artists seek not to express properties of materials but their qualities: 'Materials against Materiality', Archaeological Dialogues 14, no. 1 (June 2007): 1–16



Excerpt from oflostandfound.org project, writing and objects collected on residency at Phytology, Bethnal Green Nature Research, 2018. Appendix A p.18

We will all perceive and react differently to mechanical and sensory properties of materials, and layer them with our own cultural and emotional qualities, which will affect the regard with which we treat that material – based on cultural judgements like common, precious, disgusting, or beautiful. These subjective qualities become imaginative streams of meaning within matter, making liquid connections across different registers, as materials transform, mirroring internal images that are known in the body.

Through my work *ofLostandFound*, (excerpt shown opposite) and in the use of reconfigurable index cards in the MRK sessions, I wanted to confound any fixed ideas of traits that belong to categories, but to look instead at shared, intersecting and shifting affinities which may be highly personal. This perspective might resist this classification, and the temptation to class materials as resources.

Use of cognitive metaphor reveals feelings for materials. A carefully controlled study by linguistic and cognitive neuroscience researchers Citron and Goldberg suggests that: "…since metaphorical words hint to physical sensations, they may generate heightened brain activity in emotion-related regions."[62]

When participants heard metaphors that were tied to sensory experiences, their research revealed activity in the emotion regions of the brain. More people responded to "sweet" than to "kind." More people responded to "bitter" than "mean", suggesting that using metaphorical language based on non-human qualities is more persuasive and emotionally evocative than using literal human qualities. They add that investigation of metaphorical and literal sentences revealed greater activation in the brain areas related to taste when using the metaphors, supporting the idea that material's sensory qualities are linked to emotional concepts.

Philosopher and psychoanalyst Gaston Bachelard's visions go beyond metaphor, to form a swirling poetics of imagination, body material and space, an aesthetics of knowing, through qualities:

> …imagination gives life to materials - matter itself, set aside from form, or in the process of transformation, has its own internal images that are known through the body. …there are…images of matter, images that stem directly from matter. The eye assigns them names, but only the hand truly knows them.[63]

62. Francesca M. M. Citron and Adele E. Goldberg, 'Metaphorical Sentences Are More Emotionally Engaging than Their Literal Counterparts', Journal of Cognitive Neuroscience 26, no. 11 (1 November 2014): 2585–95,
63. Gaston Bachelard and Kenneth Haltman, Water and Dreams: An Essay on the Imagination of Matter (Pegasus Foundation, 2002). 1

A visitor tasting natto at Institute of Making SLIME open day, 2018
Appendix A p.127

Because food becomes us, it is a special category of materials that we know in the body, we have a more personal stake in its qualities and properties. Exploring likeness through food can be a window into embodied conceptualisation of the changing qualities of other materials. This reminds me of how we think about nature/nurture/character in people, to see our mirroring in materials, to recognise emotional and behavioural reflection in ourselves, the traces of our experiences.

Materials that transform or resist our sense of order, can cross the line into the abject, and cause our own boundaries to be troubled. Anthropologist Mary Douglas presents the ambiguous substance as threatening to our selfhood, as if foodstuffs seem to eat us:

> The viscous is a state half-way between solid and liquid. It is like a cross-section in a process of change. It is unstable, but it does not flow. It is soft, yielding and compressible. There is no gliding on its surface. Its stickiness is a trap, it clings like a leech; it attacks the boundary between myself and it. Long columns falling off my fingers suggest my own substance flowing into the pool of stickiness.[64]

This PhD-practice contains a plea to value earlier, more subjective, and relational ways of understanding how materials and people interrelate, valuing imaginative connection over hierarchy and questioning our anthropocentric perspectives. Writing in the introduction to his book The Order of Things, Michel Foucault observed a shift in 16th century European scientific imagination, from cognitive patterns based on resemblance, to that of representation: identity and difference. The world became ordered on a sliding scale of complexity and the old web of affinities kinships and stories disappeared. The neo platonic Great Chain of Being appeared with a (white) God at the top, and the inanimate soil at the bottom. The overriding metaphor changed, along with the way we see ourselves in relation to other entities. Once stuff is neatly classified as different, it can be assigned exchange value leading to oppressive hierarchies of matter, and its conceptualisation as mere resources for humans to use up.

He goes on to make a plea for imagination's continued role in the way we think about the order of things:

> …without imagination, there would be no resemblance between things. The double requisite is patent. There must be, in the things represented, the insistent murmur of resemblance; there must be, in the representation, the perpetual possibility of imaginative recall. [65]

This *insistent murmur of resemblance* fuels my investigations into how materials become embodied.

64. Mary Douglas, Purity and Danger: An Analysis of the Concepts of Pollution and Taboo (London New York: Routledge, 1992). 39, quoting Jean Paul Sartre, L'Etre et le Néant (3rd edit. 1943) 696
65. F. C. T. Moore and Michel Foucault, The Order of Things: An Archaeology of the Human Sciences., vol. 6 (Routledge, 1977) 68

Lemon pomander, and sequin lemon from Food Cultura Barcelona, made and donated items in my Studio Collection, 2017-23.
Report p.163

Foodstuff: Becoming Like Materials

ETHICS OF LIKENESS

Carl Linnaeus's 18th century original taxonomy of animal vegetable and mineral categories *Systema Naturae* took the great chain of being from religious into scientific 'knowledge', becoming the new blueprint for the order of things. The first seven editions included humans in all their variety, but later would begin to assign moral and emotional 'humours' which denoted personality and health traits to people according to categories like geography, skin colour and gender, which set the basis for new, harmful and bogus concepts of race, scientific racism and Eugenics research which, although debunked as pseudoscience, persists today and has created a false rationale for atrocities carried out in the name of science and nationalism.[66]

The very notion of feeling affinity for materials can be seen as a privilege – to see likeness with inanimate matter for example, when hierarchies of class, caste and racialisation are real, instrumentalised factors in people's lives, and the bodies and labour of people are commodified or framed as less-than human.

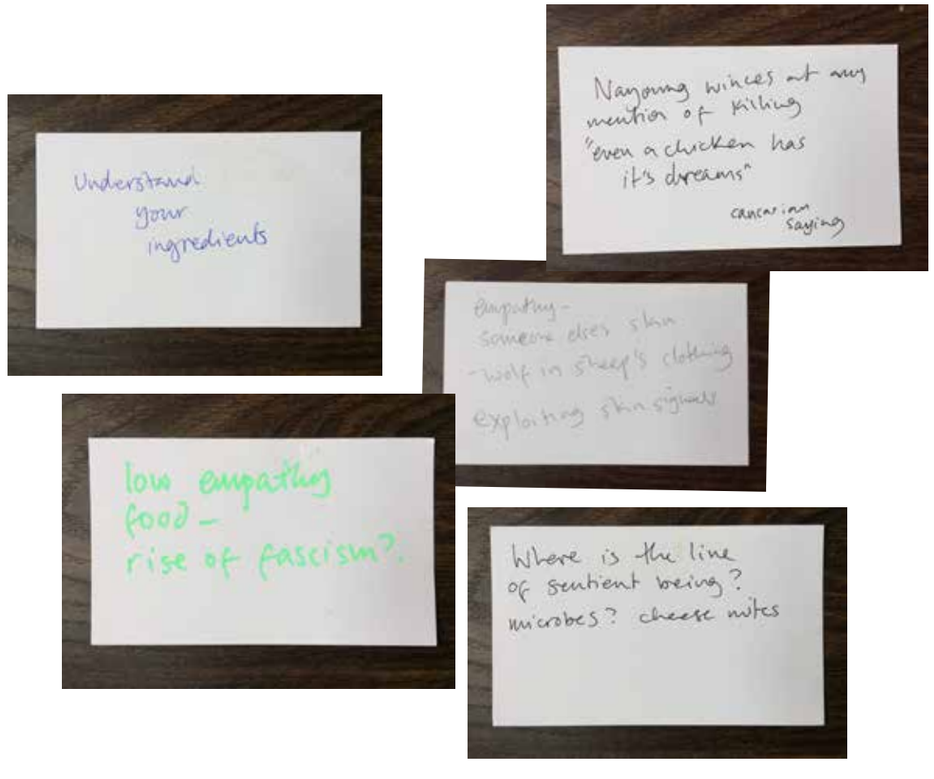
At the time of colonial expansion, various indigenous and first nation ways of thinking and knowing have been othered and disregarded in relation to western European thinking, a tendency which persists in discrimination and structural racism based on dominant western, patriarchal, and capitalist hierarchies of value in materials, species, people, and ways of knowing.

Another possible risk of exploring likeness is anthropomorphism, assigning our own traits or even morality to inanimate entities. Perhaps there is a danger of a colonising impulse here - in the possessive nature of designating something as like to us when it is free and wild and various.

Although my impulse is to connect, to see likeness as part of framing an ethical and ecologically sensitive way of being in the world, my work tries to respect the integrity of materials as having their own various existence, which have nothing to do with me, and take the material world on its own terms rather than projecting subjectivity onto it.

66. Curator and writer Subhadra Das has written and compiled resources on the history of Eugenics at UCL with archive material on work by Francis Galton at the end of the 19/20th century and later Karl Pearson. https://www.ucl.ac.uk/provost/reports/further-reading-and-events As recently as 2018, UCL secretly hosted an annual invite-only Eugenics conference entitled The London Conference of Intelligence. The report can be found here: https://www.ucl.ac.uk/provost/sites/provost/files/ucl_history_of_eugenics_inquiry_report.pdf

Encountering SKINS, at the first of the Sausage Sessions, 2017.
Appendix A p.62



A FEELING FOR STUFF

Through the Materials Research Kitchen, physically exploring ecological links with materials raised the possibility of empathy, a complex feeling. Neuroscientist Jean Decety defines it as caring for another, having emotions that match those of another, or: "…having the separateness of defining oneself and another a blur…" He continues:

> …(it) is not restricted to interaction with kin, nor does it have to be prompted by the actual perception of distress signal or emotional contagion. Rather, it can be extended to strangers and even members of different species and generated from cognitive processing, like imagination and conscious rationalization. [67]

This is emotional consubstantiation. But if we do empathise imaginatively, or with so-called inanimate matter, does that mean we might treat materials with care in practice? Unlike empathy, care invites a shift in who is centred – thinking about the effects of our actions on wider material ecologies that connect to another. Beyond anthropomorphism, the benefits of empathy and storytelling as tools for ethical understanding have been shown to be valuable.[68] It may help us to understand the importance of materials to ecosystems and how our actions will affect them.

Empathy for materials is often spoken about in the craft world – an empathetic relationship with material is an embodied understanding of the principles behind behaviour and qualities, imagining you know what it 'wants' and 'does not want' to do, understanding its limits and affordances. But I want to look deeper inside what makes us care for materials, not whatever form they are fixed in at that moment, but their inner imaginaries, their histories, and futures, political emotional and contexts. This approach has affinities with the Japanese aesthetic feeling of *mono no aware*, a pathos or complex emotion wrapped up in the material world of symbolism, concerning not objects, but a deep emotional connection to the transience of all things, connected with ideas in Buddhism around eternal transformation and flux.[69]

CURIOSITY AND CARE

Empathy is subjective, and many factors affect its expression, including social, moral, or interpersonal dynamics, such as beliefs and ideas people hold, or are given. Given the choice, what we put in our mouths has a lot to do with how we see ourselves and our place in the world, linked to cultural, religious, and personal boundaries and affinities, and influenced by industrial and political interests.

Echoing anthropologist Mary Douglas's work on taboo[70] defining dirt as matter out of place, edibility has a lot to do with what is considered in its right place in scales of empathy and care.

67. Jean Decety, 'The Neuroevolution of Empathy', Annals of the New York Academy of Sciences 1231, no. 1 (1 August 2011): 35–45.
68. After Charles Darwin's ethology, and Jane Goodall's ape studies for example.
69. See Parkes, Graham, and Adam Loughnane, "Japanese Aesthetics", The Stanford Encyclopedia of Philosophy (Winter 2018 Edition), Edward N. Zalta (ed.), URL = https://plato.stanford.edu/archives/win2018/entries/japanese-aesthetics/.
70. Mary Douglas, Purity and Danger: An Analysis of the Concepts of Pollution and Taboo (London New York: Routledge, 1992).

Work in progress made by UCL Chemistry's glassblower John Cowley, towards the barometers Luminal Organs, 2018.
Appendix A p.32

Foodstuff: Becoming Like Materials

People's ethical food choices can be connected to many conflicting priorities tied up with health, identity, aesthetics and politics, including choices like veganism or vegetarianism, concerns with food waste, labour, buying local, organic, or regenerative agriculture, intensive animal farming, ultra-processed foods, lab grown or meat analogues. The sausage has been useful for talking about the human organism and its material ecosystems, but there are obvious ethical issues that arise when talking about raising and killing animals for human consumption, particularly the industrial methods around it, which has made it an even richer illustrative device. A sausage made for the supermarket is a different animal, a changed ecological proposition from its roots as a thrifty subsistence practice. How can we care for everything in a global supply chain? A more considered relationship with our food – seeing how it becomes a part of us, how much we are related to other materials and implicated in its trajectory. In a time of confusing food security, health advice and advertising, we could be trusting our gut feelings more.

Perhaps rather, a care-ful relationship with food and those involved in food systems is needed in these times of industrialisation, monoculture, mass-processing, and detachment from raw material – understanding through our senses how it becomes a part of us, how much we are related to other materials. We inhabit perceptual worlds that are different to others, but we are connected materially, we could be more aware of the other worlds we're eating.

We are in an unfolding ecological crisis, which is causally linked to food-production and results in food insecurity. We have agency where we have choice, but we need to pay attention to ecosystems and our implication in their wellbeing through how we think with them. We can easily become desensitised to these other worlds and what's important to them. Terms like "care" in an art context can be misused and aestheticised. At stake in the question of the relation of the mental and the material is our imaginative ability to understand the political terrain upon which we act during massive and rapid technological, ecological, and social change. Anthropologist Anna Tsing asks:

> How are we able to operate, to research, to make work in this time of global uncertainty?
> …Our first step is to bring back curiosity.[71]

Through making together, I have found the very notion of curiosity, and the emphasis on the senses which are seen as lower in the traditional hierarchy, such as smell and taste,[72] give a grounding to my thesis of cooking and eating together as careful, sensitive engagement with materials. Listening to materials as we transform them through cooking together, in the context of research might engender genuine curiosity and care in the way we interact with our changing worlds.

71. Anna Lowenhaupt Tsing, "Prologue.: Autumn Aroma." In The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins, 1–9. Princeton University Press, 2015. 6
72. Barry C. Smith, 'The Chemical Senses', in The Oxford Handbook to Philosophy of Perception, ed. Mohan Matthen, 2015, 314–53.

Chapter Two:

COOKING & KNOWING

Transformation
Thoughtful Practice
Kitchen as Research Site
Listening to Materials

Through an examination of cooking, this chapter considers how food-making practices can create embodied knowledge about transformation in material and in us. It argues that as these daily experiential ways of knowing are often under-valued in knowledge hierarchies, they deserve to be taken seriously in academic and industry research, as embodied, extended, and enacted 'thoughtful practice'.

Through use of the kitchen as research site, I show how listening to materials through close sensory engagement can stimulate ecological curiosity and care about their past and future incarnations, revealing how much is at stake in their exploitation.

Sugar 'snake', created by burning sugar and baking soda, made for 'Rial Talk podcast interview on Sugar, 2018. Appendix B p.9

Transformation

COOKING MATERIALS

The adventure of making is much more interesting to me than a finished object. To travel with materials as they transform is to understand how stuff fits together through time. Making food epitomises this interest as it implicates our very existence in the life of other matter. The making of everyday foodstuffs reveals extraordinary things: "When we whip up a batch of mayonnaise we are party to one of the deepest secrets in the universe."[73]

Before science we had experimental material cookery: alchemy. Substances known by their character, what they look, feel and smell like, and what they can do, and alchemical 'cooks' investigated what happens when you mix, stew, burn or sieve their dregs. The impulses of the alchemist's kitchen are useful in explaining this doctoral project's quest for meaning in materials, and what extraordinary powers, properties and affordances can be revealed in their transformation.

The alchemists developed cosmologies based on travelling the borders of material and spiritual transmutation and affordance through their cooking processes. Alchemy, the art of transformation in search of gold and its purported corresponding perfection of 'spirit' and immortality, was an art that led to modern chemistry, pharmacy, and materials science. [74]

The psychoanalyst CG Jung used alchemical symbols (like the ouroboros) to represent the psychoanalytic process with regards to the concept of individuation – how a person develops an idea of the self and becomes a full version of an individual by bringing our unconscious processes to light.[75] He proposed a mental interpretation of alchemy, in which the struggle with materials and transformation is metaphorical of the spiritual struggle of the alchemist; the transformation of material, mind, body and soul is the same endeavour – to become a fully realised as we mirror what we engage with.[76] If, as in the previous chapter we understand an expanded concept of selfhood, individuation has to incorporate our material ecosystems.

To partake in the stages of change by which making happens, and to understand the effect of those changes on smell, texture, sound, and visual qualities, creates physical understanding of materials' provenance and affordances. Understanding the many facets to these materials on a bodily level though making, through our senses, can help teach us to know them differently, to care about them as part of our own bodies, and has the potential to affect our treatment of them.

73. Carrière, in: Mitov, Sensitive Matter : Foams, Gels, Liquid Crystals, and Other Miracles. Preface xi
74. Stemming from the great proto-scientific Arabic knowledge practices, the word alchemy derives from the Arabic al-kīmiyā' al = the + kīmiyā' = the "chemistry" of the Middle Ages and early modern times, involving both occult and natural philosophy and practical chemistry and metallurgy. After c. 1600 the strictly scientific sense of the word went with chemistry, and alchemy was left with the sense in which the goal was the transmutation of baser metals into gold: Oxford English Dictionary, "'alchemy, n. and Adj.".', n.d., https://www.oed.com/view/Entry/4691
75. C. G. (Carl Gustav) Jung et al., The Collected Works of C.G. Jung (Pantheon Books, 1953).
76. C. G. Jung and C. G. Jung, Mysterium Coniunctionis: An Inquiry into the Separation and Synthesis of Psychic Opposites in Alchemy, 2d ed, Bollingen Series 20 (Princeton, N.J: Princeton University Press, 1970).

Kimchi communally made for clay ongi jars at Life Underground II workshop with artist Nayoung Jeong, and Compost Mentis, 2018.
Appendix A p.78

COOKING FOOD

The added dimension of food's edibility allows intimate knowledge of taste and mouthfeel, as well as energy, nutritional and cultural value, properties which can be surmised by the qualities of the material and its treatment via cultivation, selection, preparation, and cooking.

Cooking is the transformation of edible materials through physical, chemical, thermodynamic processing or by symbiotic microbial relationships, or with the actions of ingredients on each other. Cooking releases nutrients for digestion and assimilation and transforms flavour and texture in materials and can turn non-food into food.

A significant factor in cooking, fermentation, digestion and metabolisation of food, is time. This is also true of the thinking process in research, and in the way the Materials Research Kitchen functions. Letting things happen, simmer, unfold, reduce, or gel in their own time is vital and something I often forget when devising a workshop. The challenge is to not overprepare or over-direct things, but to set the conditions for research to happen, observe and listen carefully to what is happening, nudge or tweak things as necessary, but otherwise go with the flow. Through this process I have understood that my artistic practice has always worked like this too; things take time to ferment and mature.[77]

It is by thoughtful practice of the daily transformations of cooking, eating, growing, cleaning that I find the revelations have taken place in this project. Sometimes unconscious or embodied changes to understanding only emerge later, echoing during ones everyday; and that's what art can do: slowly change our perspective or lens on ourselves and our worlds – offering alternative ways of going about things. Chef Paul Bertolli describes keeping materials in mind:

> I've learned that the art of cooking consists largely of "watching", with all the senses. To neglect a pear on the table and then return to find it ripe days later is merely a lucky coincidence. But to keep a pear in mind as it ripens is to practice cooking in its simplest form.[78]

77. This research for example – the concept of the sensory tool emerged in its own time. (see Chapter 4 page x)
78. Paul Bertolli, Gail Skoff, and Judy Dater, Cooking by Hand, 1st ed (New York: Clarkson Potter, 2003). 27

Slick of Joy
Still from video artwork for Laura White's tenderfoot.co.uk, 2018.
Appendix A p.44

COOKING OURSELVES

The messy process of cooking together is part of being human. Anthropologist Claude Levi-Strauss tells us that due to his observations, he regards cooking as the symbolic activity that separates the world's human cultures from other animals, famously using cooking as his metaphor to explain the human transformation from raw nature to cooked culture. However, this insight was prefigured by several hundred years in ancient Chinese philosophy, which held cooked food as the mark of civilisation.[80]

Primatologist Richard Wrangham's cooking hypothesis[81] contends that human evolution took a leap when we started cooking food, enabling larger brains and smaller guts, allowing time for other activities, and 'civilising' time spent cooking and eating together rather than alone. We are now dependent on cooked food (and increasingly processed food), which has cooked us, changing our bodies and social structures.

This process: cooking's paradoxical ordinariness and extraordinariness, and its two-way transformational properties, are key to how my methods of practice research function, and forge new paths to transdisciplinary research through making.

79. Claude. Lévi-Strauss, The Raw and the Cooked (University of Chicago Press, 1983).
80. Cook and writer Fuchsia Dunlop cites Li Ji, the Zhou Dynasty Book of Rites (BC) in : Fuchsia Dunlop, Invitation to a Banquet: The Story of Chinese Food (London, UK: Particular Books, 2023).22-23
81. Richard W. Wrangham, Catching Fire : How Cooking Made Us Human (Brilliance Audio, 2009).

Luminal Organs, two types of collaboratively made barometer, using glass, wax and colloidal gold solution, and saturated camphor solution, 2018.
Appendix A p.32

TEMPER

One important strand of thinking behind this thesis is the layered concept of temper. The word has various dictionary definitions that refer to: the mixture, balance, constitution structure, condition, character, quality, habit, tendency or emotions of a person, material, atmosphere, or weather.[82] It connects many of the things I am investigating - material structure and its relationship to properties, quality and behaviour, time and inner transformation, craft making, cooking, experimenting, emotion and flavour.

We temper metals by hammering, heating, and quenching by plunging into cool water or oil, to adjust their degree of hardness resiliency and brittleness by changing the size, shape, and arrangement of the crystal structure inside. The science of materials reveals the results of micro-scale dynamic changes to inner structures on the matter in question which lends the materials temper, a transformation of inner form, without changing the visible form.

We can temper chocolate, a controlled process of melting and growing cocoa butter crystals, to achieve a glossy and brittle bar of chocolate that snaps, and then melts in the mouth just right. We temper a custard, by adding a ladle of hot cream to eggs to warm them through before adding the rest, to ensure the microscopic egg protein strings don't unfold too quickly and too much, to tangle and scramble. We also temper whole or ground spices by sizzling in hot oil to bring out the aromatic essential oils from their cells, before adding to a dish, as in South Asian cookery. Small variations in how and when this is done can transform its qualities.

And it follows that the matter we ingest makes us, tempers us by its qualities and properties -what we ingest can change us physically, even epigenetically – treatment affects structure which affects behaviour. I relate this to the ability of materials to transform the elements or qualities of the self. This research shows how through interaction with materials, they temper us, changing how we understand them and the care with which we treat our material ecosystems, relating the science of materials, the engineering of structure, temper, and behaviour, to the physical effects of mental ideas on the matter of the body. As I suggested in chapter one – when ingesting food, we are enacted by what we eat (p. 75) - then, while making food, is the food making us?

82. Oxford English Dictionary, "'temper, n.'.', n.d., https://www.oed.com/view/Entry/198874?

Recreating 17th C sugar refining moulds for FEAST: Sugar, with potter Darren Ellis, 2018.
Appendix A p.106

Thoughtful Practice

Over the past few decades, a corporeal turn has emerged in philosophy and critical studies, focusing on bodily experience and activity. Evidence from diverse disciplines shows that the mind – the process of cognition – is no longer held to be situated solely within the brain but is embodied.

The latest stream of cognitive science scholarship holds that many features of cognition are shaped by aspects of the entire body of the organism and are the product of evolutionary processes, both biological and cultural. If we are constantly becoming other materials, they must be involved in shaping our cognitive processes too. Further, the mechanisms of our thinking and understanding are constituted by the body in active interchange with its surroundings, in other words by experience – doing is knowing.

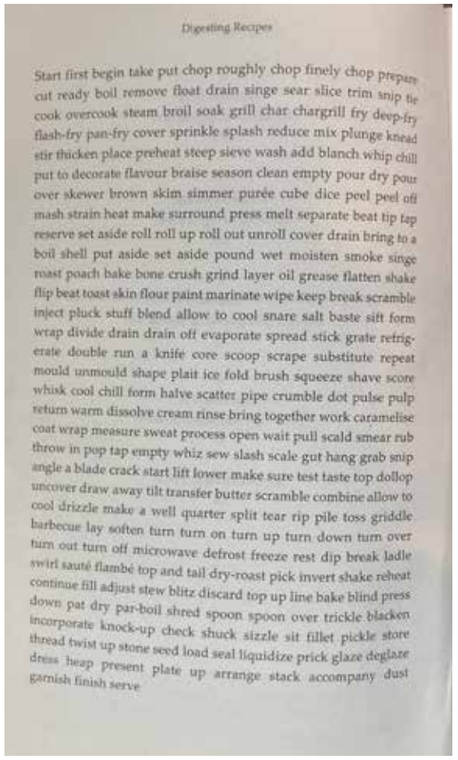
This collection of related theories of mind have come to be known as 4E cognition: embodied, embedded extended, and enactive.[83] If cognition is enacted in this way, and we depend on ecosystem health then it is ever more important to practice thinking with our environment, particularly in formal research settings which result in peer-reviewed work that informs policy and drives further research.

MAKING TO KNOW

I understand that being and doing is as integral to knowledge-making processes as is the gathering and testing of ideas.[84] Making, the material encounter, creates embodied knowledge about materials. Philosopher Dr Lisa Heldke terms it thoughtful practice;[85] as she applies this to food making processes – insisting that we make food as a means of garnering knowledge about its diverse aspects.

The traditional model of embodied knowledge defines 'know-how', as experientially learned types of knowledges, ingrained in the muscles and habitual movements of the doer. The body knows how to act in certain situations, often subconsciously. It can't be transmitted through language or symbols but must be mirrored or copied and practiced. It is highly personal knowledge born of sensory experience – messy, contingent, emotional, and subjective, but important in that it situates intellectual and theoretical insights within the material world and celebrates the complexity and diversity involved in knowledge production.[86]

83. "…a relatively young and thriving field of interdisciplinary research. It assumes that cognition is shaped and structured by dynamic interactions between the brain, body, and both the physical and social environments": Leon de Bruin, Albert Newen, and Shaun Gallagher, eds., The Oxford Handbook of 4E Cognition, Oxford Handbooks (Oxford: Oxford University Press, 2018). Abstract
84. See recent history scholarship examining artisanal material practices representative of knowledge-making processes involving experimentation and observation which parallel scientific processes: Pamela H. Smith, Amy R. W. Meyers, and Harold J. Cook, eds., Ways of Making and Knowing: The Material Culture of Empirical Knowledge, First paperback edition, Cultural Histories of the Material World (New York City: Bard Graduate Center, 2017).
85. She suggests this after an analysis of John Dewey's distinction of the difference in the modes of theory and practice as that of *degree*, rather than *kind* of practice. Heldke, Lisa M. (1992) Foodmaking as a Thoughtful Practice. In: Curtin, Deane W. & Heldke, L. eds. Cooking, Eating, Thinking: Transformative Philosophies of Food. Indianapolis: Indiana University Press: 203-29.
86. 'Embodied Knowledge', in The SAGE Encyclopedia of Qualitative Research Methods, by Lisa Given (2455 Teller Road, Thousand Oaks California 91320 United States: SAGE Publications, Inc., 2008) .



Digesting Recipes

Start first begin take put chop roughly chop finely chop prepare cut ready boil remove float drain singe sear slice trim snip tie cook overcook steam broil soak grill char chargrill fry deep-fry flash-fry pan-fry cover sprinkle splash reduce mix plunge knead stir thicken place preheat steep sieve wash add blanch whip chill put to decorate flavour braise season clean empty pour dry pour over skewer brown skim simmer purée cube dice peel peel off mash strain heat make surround press melt separate beat tip tap reserve set aside roll roll up roll out unroll cover drain bring to a boil shell put aside set aside pound wet moisten smoke singe roast poach bake bone crush grind layer oil grease flatten shake flip beat toast skin flour paint marinate wipe keep break scramble inject pluck stuff blend allow to cool snare salt baste sift form wrap divide drain drain off evaporate spread stick grate refrigerate double run a knife core scoop scrape substitute repeat mould unmould shape plait ice fold brush squeeze shave score whisk cool chill form halve scatter pipe crumble dot pulse pulp return warm dissolve cream rinse bring together work caramelise coat wrap measure sweat process open wait pull scald smear rub throw in pop tap empty whiz sew slash scale gut hang grab snip angle a blade crack start lift lower make sure test taste top dollop uncover draw away tilt transfer butter scramble combine allow to cool drizzle make a well quarter split tear rip pile toss griddle barbecue lay soften turn turn on turn up turn down turn over turn out turn off microwave defrost freeze rest dip break ladle swirl sauté flambé top and tail dry-roast pick invert shake reheat continue fill adjust stew blitz discard top up line bake blind press down pat dry par-boil shred spoon spoon over trickle blacken incorporate knock-up check shuck sizzle sit fillet pickle store thread twist up stone seed load seal liquidize prick glaze deglaze dress heap present plate up arrange stack accompany dust garnish finish serve

Verb list from Susannah Worth's book: Digesting Recipes: The Art of Culinary Notation, 2015.

to roll
to crease
to fold
to store
to bend
to shorten
to twist
to dapple
to crumple
to shave
to tear
to chop
to split
to cut
to sever
to drop
to remove
to simplify
to differ
to disarrange
to open
to mix
to splash
to knot
to spell
to droop
to flow
to curve
to set
to inlay
to impress
to fire
to flood
to smear
to rotate
to swirl
to support
to hook
to suspend
to spread
to hang
to collect
of tension
of gravity
of entropy
by nature
by grouping
by layering
by felting
to grasp
to tighten
to blindle
to heap
to gather

to scatter
to arrange
to repair
to discard
to pair
to distribute
to surface
to complement
to enclose
to surround
to encircle
to hide
to cover
to wrap
to dig
to till
to bind
to weave
to join
to match
to laminate
to bond
to hinge
to mark
to expand
to dilute
to light
to modulate
to distill
of waves
of electromagnetic
of inertia
of ionization
of polarization
of refraction
of simultaneity
of tides
of reflection
of equilibrium
of symmetry
of friction
to stretch
to bounce
to erase
to spray
to systematize
to defer
to force
of mapping
of location
of context
of time
of carbonization
to continue

Richard Serra
Verb List (1967-68)

Embodied knowledge of this type is celebrated in some Arts and Humanities research, but it is also vital to parts of Science, Engineering, and Medicine for example, if we are to ground research ethically in the effects it has on people's lives - it is a growing field that finds relevance to almost all areas of study. This kind of thoughtful practice - the kind of everyday knowing we can generate in the kitchen - aids in something akin to Jung's individuation, an examination of the thinking that happens at the body-material-consciousness interface. Important bodily knowledge about other materials and their transformations can be seen here as *becoming, with materials*.

EMBODIED METAPHORS

Lakoff and Johnson, in work further to Metaphors we Live By,[87] assert that the mind is inherently embodied, that most thought is unconscious, and that abstract concepts are largely metaphorical. We know that metaphors are more than just linguistic devices; they are conceptual, but crucially they are physically represented in spatial brain activity, which drives our movement and has the potential to influence behaviour.

They argue that this observation comprises a new understanding of personhood, driven in part by external forces and the metaphors we use, the physical and sensory experiences we've had, and our social norms, enabling us to act upon our sense of likeness.

So, making, the meaning of bodily action and the responses from physical behaviour of materials, is filled with metaphorical, but often subconscious significance. My workshops aim to collaboratively bring to light some of this significance through food and cooking.

Writer Susannah Worth's list of verbs, conjure up a rich flow of feelings and associations, describing an (arguably) gendered physical engagement with materials and tools. Compare this to Richard Serra's verb list of material processes, of which he says:

> It gives you a way of proceeding with material in relation to body movement in relation to making, that divorces you from any notion of metaphor, any notion of easy imagery.[88]

On the contrary – the language for the materials and actions he chooses to make work with do throw up imagery and metaphor, by the qualities and properties they afford, and the imagined powerful masculine performance of the artist in his studio making the gestures. He seems to suggest that the way he treats quite industrial materials and holds his body is neutral, a primal *man with his material*.

87. They cite the cognitive scientists' 'rule of thumb' that embodied knowledge - the cognitive unconscious, comprises more than 95% of our thinking, shaping the small amount of thinking and decision making we're aware of:
George Lakoff, Philosophy in the Flesh the Embodied Mind and Its Challenge to Western Thought (Basic Books, 1999). 5.

88. Susannah Worth, Digesting Recipes: The Art of Culinary Notation (Winchester, UK: Zero Books, 2015).x
Richard Serra, Tools & Strategies. Serra discusses his early focus on the nature of the art production process itself which resulted in his writing a Verb List (1967-68):
Video, 3.13 Filmed in 2000 at the artist's Manhattan studio. https://art21.org/watch/extended-play/richard-serra-tools-strategies-short/

Kitchen Show, Bobby Baker, LIFT, London, 1991. Photo by Andrew Whittuck

In 2003, Rosler announced an open call for a live re-staging of her 1975 video *Semiotics of the Kitchen*, to be held at the Whitechapel Gallery in London, for *A Short History of Performance*, Part II. Twenty-six women — actors, artists, curators, and museum staff including me and my friend, costume designer Ameena Kara Callender (pictured bottom right) — participated in a rotating performance of the work. I was given "knife".

2011 | 00:09:44 | United Kingdom / United States | English | Color | Stereo | 4:3 | Video

But as artist Martha Rosler explains as she speaks the names of kitchen tools, suggesting gendered, emotionally, or politically charged processes, revealing materials' depth:

> The material subconscious speaks in the language of objects. Objects can carry a great deal of freight, of memories and emotions, of psychological and social meaning. …I was concerned with something like the notion of 'language speaking the subject,' and with the transformation of the woman herself into a sign in a system of signs that represents a system of food production, a system of harnessed subjectivity.[89]

Another piece of art action using the language of food and cooking is Bobby Baker's 1991 Kitchen Show, which reveals the beautiful and absurd expertise involved in wrangling domestic materials and processes in the day-to-day lives and labour of women.

> Kitchen Show took place exclusively in working kitchens, beginning with Bobby Baker's own. Baker decided to open her kitchen to the public to display and perform one dozen routine kitchen actions. These included opening a new tub of margarine to see its unsullied perfection and throwing a ripe pear against a distant wall in moments of extreme rage. Each action was accompanied by a story and a rationale for its importance and was then 'marked' on Baker's body.… …a provocation for her audience to consider the lack of social transformation in women's lives.[90]

My partner is a talented pastry chef who owns a batch-produced ice cream and dessert company. She tells me that when she used to make large mixes on her own, she sometimes wrapped her entire arm in cling-film and used it to hand-combine up to 30kg of cake mix, mousse or parfait. She says that feeling it helps connect her to a better bodily understanding of the state of the material and its individual ingredients being fully incorporated, feeling the powders liquids and air fully combine. When it comes right, the resistance changes, and she can be more sensitive with her arm and wrist movements to keep the bubbles intact, something hard to achieve with a machine or even a hand whisk. This exemplifies how feeling can be inseparable from knowing, from experience. She also finds this creates more of an emotional connection with her food, and how she feels about eating it or feeding others being a part of the food.

89. Martha Rosler and Jane Weinstock, 'Interview with Martha Rosler', October 17 (1981): 77–98.
90. Bobby Baker live production made in collaboration with Polona Boloh Brown 70 minutes. Original performance: Artist's own home, Holloway, North London. Toured internationally thereafter: https://www.dailylifeltd.co.uk/projects/kitchen-show-

'still lives': encaustic wax, pigments and materials made for mobile phone microscope filming on residency at Phytology, 2017.
Appendix A p.10

MAKING AS ECOLOGICAL CORRESPONDENCE

In their 1998 paper The Extended Mind, philosophers Andy Clark and David J. Chalmers address this question to suggest an active externalism, the extended mind thesis, which encompasses more than the body, proposing the active role of environment, objects, and others in driving cognitive processes. Our minds not only overspill our brains, but our skins. They address the question:

> Where does the mind stop, and the rest of the world begin?...
> …the human organism is linked with an external entity in a two-way interaction, creating a coupled system that can be seen as a cognitive system in its own right. All the components in the system play an active causal role, and they jointly govern behaviour in the same sort of way that cognition usually does.[91]

They propose that our material ecosystem has an active role in driving cognition, and our 'mind' is made up of neural, bodily, environmental, and cultural factors. Our thoughts, reasoning, perception, imagination, intelligence, emotion, and experience are not simply contained within our brains but distributed throughout our bodies and the world. This process is enabled by the tools, technologies, institutions, materials, and techniques we might use to orientate our understanding of ourselves. Cognitive processes and states can be partly constituted by features of the world around us, such as pens and paper, smart phones, rooms, routes, and physical routines. As holobionts, (p.67) we are part of a network of microbes and materials, and if mind and body are not separate, our thinking and acting also depends on extra-bodily networks.

Various proponents of the extended mind thesis and active externalism take issue with the idea of fully tacit embodied knowledge alone, arguing that know-how – "the collected habits that enable practitioners to move on in the accomplishment of their tasks" – is not merely held in the body but "generated and enacted in an attentive and kinaesthetic correspondence with tools, materials and environment."[92]

This kinaesthetic, or senseoaesthetic correspondence with materials and environments constitutes a situated cognition.

Lakoff and Johnson further philosophise that the individual is not radically free, as so much of that underground sea of thought is contingent and influenced by, for example, emotion, hormones, and weather, and is ecologically linked to others. There is no hard divide between mental processes and non-mental biological processes which also drive aspects of cognition.[93]

91. A. Clark and D. Chalmers, 'The Extended Mind', Analysis 58, no. 1 (1 January 1998): 7–19.
92. Tim Ingold, Imagining for Real: Essays on Creation, Attention and Correspondence, 1st ed. (London: Routledge, 2021), Chapter Chapter 15, Of work and words: Craft as a way of telling .
93. Lakoff, Philosophy in the Flesh the Embodied Mind and Its Challenge to Western Thought.

Models made to imagine and discuss the relationships between microbes and materials at micro and nano-scales, by Dr Sarah Wilkes, used as part of our Roving Microscope workshop Close Encounters with Materials and Microbes, 2019.
Appendix A p.98

If you are cooking a stir fry – you might have the embodied knowledge transmitted from watching your mum' movements in cooking it before, and from experience you know roughly when the veg is cooked, using smell and the look of the caramelisation on the carrots. But this knowledge is tempered by a barely conscious awareness of the material and thickness of your wok, the temperature of the refrigerated vs room temperature ingredients, how far you can take things before your smoke alarm goes off, so how high your flame should be. You are craving salt, so you add more soy sauce. You saw swimming costume adverts on Instagram today, so you add less oil. Your hormones are fluctuating so you don't stop eating when you are full.

You are extending that cognition into the unconscious dimensions that the materials and tools around you have, and it is also affected by your situation, and by biological and cultural factors. If you use someone else's kitchen these thoughts might have to rise to consciousness – you might need to find out some of this information before you start or notice it along the way and adapt.

Cognitive scientist David Kirsh presents a version of the extended mind thesis, which states that minds can extend beyond the nervous system to include external memory systems, controls, and computations, generally embedding ourselves with the technologies around us at this time in history:

> Our immediate environment functions like a cognitive biome. Because of that we are shape-shifting cyborgs – cognitive symbionts. This has significant implications for the design of structures, surfaces and objects… Our cognitive biome is transforming fast.[95]

This ecological, physical, situated model of mind holds the notion that cognition is necessarily a dynamic response to our surroundings, an enactivist-constructivist approach to understanding.

94. Professor David Kirsh, 'Cognitive Symbiosis: Humans, Objects and Surfaces' (Leverhulme Lectures, The Bartlett School of Architecture, 11 May 2017), https://www.ucl.ac.uk/bartlett/architecture/events/2017/may/leverhulme-lecture cognitive-symbiosis-humans-objects-and-surfaces.
95. Alva Noë, Action in Perception, 1. MIT Press paperback ed, Representation and Mind (Cambridge, Mass.: MIT Press, 2006).
Shaun Gallagher, How the Body Shapes the Mind (Oxford ; New York: Clarendon Press, 2005).

Making 'bokashi' bran with microbes and materials to ferment and compost food waste, with compost educator Melissa Thompson, as part of Through the Microscope, 2019.
Appendix A p.100

Cooking: Thoughtful Practice

MAKING AS DISTRIBUTED KNOWLEDGE PRACTICE

Many anthropologists and cultural theorists have explored the 'social life of things', the cultural and historical journeys of materials and the ways in which our made relationships with materials and objects – specifically those that could be termed 'technologies' are intimately connected with the making of personhood. [96]

Cognitive Archaeologist Lambros Malafouris's Material Engagement Theory brings the idea back to making, proposing that:

> Minds and things are continuous and interdefinable processes rather than isolated and independent entities. I argue that by knowing what things are, and how they were made what they are, you gain an understanding about what minds are and how they become what they are and vice versa.[97]

Tim Ingold expresses frustration about a conference he attended on materiality during which materials themselves were never mentioned. He then makes this plea for understanding through direct transformation of materials:

> Might we not learn more about the material composition of the inhabited world by engaging quite directly with the stuff we want to understand: by sawing logs, building a wall, knapping a stone or rowing a boat? Could not such engagement – working practically with materials – offer a more powerful procedure of discovery than an approach bent on the abstract analysis of things already made? [98]

He notes that: "Boiling fish bones yields an adhesive material, a glue, not a fishy kind of materiality in the things glued together." He implores that we "…reverse this trend, and once more take materials seriously, since it is from them that everything is made."
Literature on new materialities often misses something. It tends to neglect the knowing in the body that sensory engagement and physical transformation of materials enables though the senses, tools and processes in their explorations, much like Michel Serres urges us to pursue. (p. 81)

But – this glue is still made from fish. Consequently, it gets eaten by silverfish beetles where PVA glue does not. It smells fishy. Thinking of this glue as just a useful adhesive material divorces its stickiness from the proteinous and oleaginous gums that fish bodies need to be flexible and buoyant underwater, the slippery coating or the biofilm of algae and bacteria living on the surface. It also means that fish-glue could be seen as a sustainable choice as it comes from a renewable source and is biodegradable. But are glue-fish renewable at an industrial scale? Perhaps fish are off the glue-menu for you for religious or ethical reasons.

96. See Susanne Küchler, and Sarah Wilkes 'Social Life of Materials', n.d.
Steven Connor, Paraphernalia : The Curious Lives of Magical Things (Profile Books, 2011).
Feminist theorist Karen Barad acknowledges the active role of instruments, environment, and observers in knowledge making and human-material entanglements, as quantum systems can be in multiple states at the same time until measured or observed – a different kind of 'consubstantiation' (see Chapter 1 page x)
97. Lambros Malafouris, How Things Shape the Mind : A Theory of Material Engagement (The MIT Press, 2013).
98. Tim Ingold, 'Materials against Materiality', Archaeological Dialogues 14, no. 1 (2007): 1–16.

From a Sausage Session taking Ursula K Le Guin's essay The Carrier Bag Theory of Fiction as a starting point, exploring gender in relation to food, the body, food tools, the choreography of making, metaphor, and the structure of writing and storytelling itself, with charcutier Adrienne Eiser Treeby, 2022.
Appendix A p.70

Kitchen as Research Site

Taking materials seriously means going back to the moment of engagement itself – paying attention to their sensory and affective qualities as we manipulate them. Anni Albers, an artist whose interdisciplinary practice spans craft, industrial design and learning sees it as an adventure:

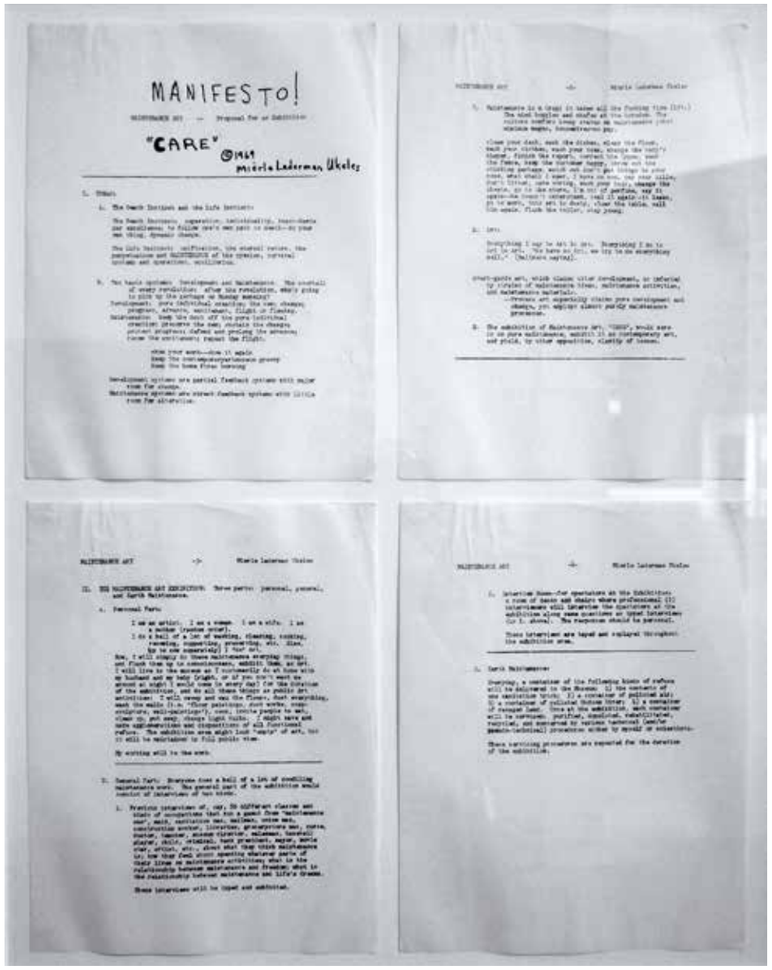
> Civilization seems in general to estrange (us) from materials... For the process of shaping these is so divided into separate steps that one person is rarely involved in the whole course of manufacture, often knowing only the finished product. But if we want to get from materials the sense of directness, the adventure of being close to the stuff the world is made of, we have to go back to the material itself, to its original state, and from there on partake in its stages of change.[99]

TRANSFORMATIVE KITCHEN TOOLS

Tools, in a figurative sense, can be defined as a "means of effecting something",[100] physical or abstract devices that that can extend an individual's agency in the surrounding environment or situation. Food-making allows us to think through foodstuff but also through the tools and processes we use to transform it, like the right spoon or action of the arm, situated factors like the kitchen, the microbes present, the temperature, the outsourcing of cognition in recipes, or the application of cultural or specialist knowledge and traditions. Our relationships situate us. By thinking though making, we gain knowledge of ourselves.

But in extending that agency we effect changes in ourselves too. Social practices co-evolve with our use of new tools and the modifications we make to existing ones. For example, refrigeration technologies affect fermentation practices and thus gut bacteria, along with the globalisation of fresh food production and supply. This affects the chemical makeup of the land, the populations in particular areas and the time freed up by not needing to obtain and cook fresh food every day. Our tools change our environment, our ecologies and our behaviours and affordances, and thus our communities and our cultural and physical selves, extending our senses and abilities.[101]
If the body is contingent on, and in dialogue with, its material surroundings, the extended body's vocabulary includes materials, tools, and technologies. Seeing everyday or domestic tools as of lower value than 'professional' or 'research' tools is to deny the everyday transformations that are fundamental to our future ecological health. These tools are embedded in the way humans understand the world, through cognitive metaphor; they are an incredibly powerful aid to understanding agency.

99. Anni Albers, "Work With Material", Black Mountain College Bulletin 1:5, Nov 1938. 2
100. Oxford English Dictionary, "'tool, n.'.', n.d., https://www.oed.com/view/Entry/203258.
101. To take a material example: glass, and its effect on light changed the world, enabled microscopes which revolutionised health, and created buildings you can see out of through windows, and communication tools like optical fibres. For more on transformations of materials and society see, Mark Miodownik, Stuff Matters: The Strange Stories of the Marvellous Materials That Shape Our Man-Made World (London ; New York, New York: Viking, an imprint of Penguin Books, 2013).)


MANIFESTO!

"CARE"

Mierle Laderman Ukeles

Mierle Laderman Ukeles, "Manifesto for Maintenance Art 1969!, Proposal for an exhibition 'Care'" (1969).

Mobile Sink, at UCL Sustainability Week event, with Arte Útil Working Group, 2018.
Appendix A p.84

COOKING AND KNOWING

Cooking is rich in technique, preference, social, familial, and cultural, regional, and tribal rituals, structures, and identities. For some, it's the only time we get to handle, dismember, and really understand the anatomical and sensual world of plants, animals, fungi, and the sometimes-delicious, sometimes-repellent work of microbes.

And in the UK, most of us have a workshop-cum-materials-lab at our disposal. We have flammable gas and electricity fed into our homes, we use sharp knives, meat hammers, thermometers, multi-processors, freezers, and microwaves. Through cooking we have the chance to be experts in materials and the tools to transform them.

When we cook, we undertake practical and aesthetic experiments in physics, chemistry, microbiology, and synthesis, in a kind of edible alchemy. We wrestle with our own concepts of death, decay, social mores, and religious and cultural observances. We blaze our own trail, or we do things by the book. The kitchen is a place where we conduct quite sophisticated material transformations, which we often do without thinking. The MRK aims to bring these internal entanglements to consciousness and celebrate and take people's everyday expertise seriously – if we are not all cooks, then we all experts in just how we like food to be.

Food making practices are circular systems that rely not only making the food, but tending land and animals, growing or shopping, planning, cleaning, washing up, equipment maintenance and material stock keeping. The mental and physical labour of managing all this, while simultaneously accommodating others' needs and desires, has historically fallen to women.

Valuing these ways of life as knowledge-making, knowledge-holding, and knowledge-transmitting activities recognises domestic, rural, indigenous, religious, and working-class subsistence practices, and is a necessary intersectional feminist position. Seeing them as such, allows us to alter the received architecture of knowledge in a patriarchal and increasingly marketised education system, understanding that these (often unpaid) labour practices have always been greasing the wheels of more conventional epistemological practice, and taught hand-to hand.

Beating the pig fat until it's white, important for the fluffiness of your tamales. From Three Sisters: Practices of Usership Zine, 2023. Appendix B p.61

Some scholars however - e.g. Zen master Dogen , Brillat Saverin or Margaret Visser – always maintained that cooking practices deserve detailed and serious study.[102] There are now well established contemporary practical research methods in experimental archaeology which re-enact historical recipes and processes as a rich knowledge practice.[103] There is a precedent for the importance of domestic knowledge practices in the experimental history of science, as detailed by Historian of Science Simon Werret, in early modern England:

> …men and women routinely made investigations into the natural world through labors in cookery, the preparation of medicines, housekeeping, and distilling; and there was much overlap between these domestic labors and the investigations of experimental philosophers like Newton. …Early moderns did not speak of "objects" and "subjects" but "bodies," referring to both material things and people. This is one of the reasons why manuals of oeconomy included advice on both the family and possessions, on repair work and medicine.[104]

Food studies scholar Jennifer Brady's practice research method *Cooking as Inquiry* extends Heldke's *Thoughtful Practice,* proposing cooking together as a means of inquiry that explores social and power relations through:

> Recogniz[ing] bodies and food as sites of knowledge and engages researchers as researcher-participants in reflexive, collaborative study that explores the ways in which the embodied self is performed relationally through foodmaking… [which] thereby challenges the Cartesian separation of mind and body, theory and practice, intellect and emotion, and cognitive and sensual awareness. …Cooking as inquiry builds on the existing foundation of food scholarship by offering a methodological approach that understands food not simply as an object of study, but makes foodmaking the means of garnering understanding about food, identity, and the body.[105]

102. Dōgen, Thomas Wright, and Kōshō Uchiyama, How to Cook Your Life: From the Zen Kitchen to Enlightenment (Boston: Shambhala, 2005).
Brillat-Savarin and Fayette Robinson, The Physiology of Taste, or, Transcendental Gastronomy: Illustrated by Anecdotes of Distinguished Artists and Statesmen of Both Continents (United States? Merchant Books, 2009).
Margaret Visser, Much Depends on Dinner: Since Eve Ate Apples, 2nd ed (New York, NY: Grove Press, 2008).
Physicist Nicholas Kurti, (who went on to found the International Workshop of Molecular Gastronomy in 1992) remarked in 1969 "it is a sad reflection on our civilisation that while we can and do measure the temperature in the atmosphere of Venus, we do not know what goes on inside our soufflés."Harold McGee, McGee on Food and Cooking: An Encyclopedia of Kitchen Science, History and Culture, new ed. (London: Hodder & Stoughton, 2004). 2
103. See Experimental Archaeology and the cultural 'meaning' of food and drink, in early modern Ireland: Brewing - https://foodcult.eu/research/experimental-archaeology/
104. Simon Werrett, 'Food, Thrift, and Experiment in Early Modern England', Global Food History, 11 July 2021, 1–17,.
105. Jennifer Brady, 'Cooking as Inquiry: A Method to Stir Up Prevailing Ways of Knowing Food, Body, and Identity', International Journal of Qualitative Methods 10, no. 4 (December 2011): 321–34.

Recipes for Tamales and Chicha Morada, demonstrated and performed by Cecilia Cruz and Phaxi Coca, Illustration by Josh Knowles, 2018.
Appendix A p.88
Appendix B p.60

The MRK builds on this approach, foregrounding materials as the key which connects our diverse ecologies, to be opened up through making food together. It is a way of realising that by experience we can gain knowledge and understand that power is not always in the grip of institutions but our own hands and tongues and bodies, ancestors, and communities.

Bringing the everyday know-how of cooking processes into consciousness, framing them as knowledge practices, reveals the extent to which not-cooking, in consumer culture, has divorced us from our relationship with material transformations. The industrial kitchen conducts even more arcane alchemical processes on our behalf such as 'ultra-processed' and 'functional' foods, preservatives and texture and flavour enhancements. This further disconnects the substances we eat and our desires from their contexts, ecosystems, and nutrients.

RECIPES FOR TRANSFORMATION

Where we cannot be taught hand-to hand, written forms of food-making knowledge can guide our actions. Lists of ingredients, along with how-to in the form of recipes can be interpreted in many ways, as secret formulas, intellectual property, spells to engender effects on the eater, cultural histories,[106] or performance scores for each iteration of the act of cooking, never to be exactly repeated.

106. E.g. Claudia Roden, The Book of Jewish Food: An Odyssey from Samarkand to New York, 1st ed (New York: Knopf, 2013).
See Rebecca May Johnson, Small Fires: An Epic in the Kitchen (London: Pushkin Press, 2022).
There are many artist's recipe books, see my interview with artist and curator Cedar Lewishon for a discussion on them – in Three Sisters, Practices of Usership Zine pp. 94-103 (Appendix B p.65).

Selecting ingredients for a Medicinal Mushroom Broth workshop at Fungifest, 2019.
Appendix A p.102

Listening to Materials

…material is a means of communication - listening to it, not dominating it makes us truly active, that is: to be active, be passive. The finer tuned we are to it, the closer we come to art.[107]

The active/passive listening that artist Albers encourages here, aims not to harness, dominate, or impose meaning on materials but to be alive to what their properties and qualities communicate about their connections through making, to better understand how to live with care for ecosystems in mind. Paying attention to what might be termed intuition, gut feelings and divination has links to individuation, our microbial needs and desires, our cognitive biome, and the concept of the *Sensicle*.

SENSEOAESTHETICS

An important strand of research at UCL's Institute of Making is the study of *Senseoaesthetics:* the qualities of materials that we can perceive with our bodies – the aesthetic, sensual and emotional side of materials.[108] We relate materials to the body to know more about them. The mouth is an extremely sensitive way of knowing; we might bite gold to gauge its purity, tap a comb against our teeth to see if it's plastic or horn (to judge if it would char or melt with the hairdryer) Touch the tip of the tongue to ceramics to see how high it's been fired (and how much glaze it will soak up), how strongly your tongue sticks will tell you.

Dr Zoe Laughlin, founder of the Materials Library, introduced the material-object as a new type of *swatch*,[109] in order that the materials themselves might perform their own properties through the experience of their qualities. Examples she made included the spoon, to reveal the taste of materials, how they interact with other edible materials, and how they are perceived in the mouth. How we perceive materials and how we feel about materials gives us clues to how they might have been made and what they might be capable of in the future. Different disciplines might use this information in different ways. In cross-disciplinary work, they will need to communicate about materials for which they use different jargon, cultural references, or languages. Head of Materials Library Dr Sarah Wilkes further developed a set of swatches that aimed to enable cross-disciplinary communication between designers and engineers through the materials themselves.[110]

My thesis uses food to extend Senseoaesthetic theory in practice, through the materials of food and cooking as interdisciplinary research tools, in the context of the Institute of Making.

107. Anni Albers, Material as Metaphor Statement on panel "The Art/Craft Connection: Grass Roots or Glass Houses" at the College Art Association's annual meeting. New York, February 25, 1982.
108. The Institute of Making are actively conducting research into developing a sensoaesthetic theory of materials - applying characterisation methodologies of materials science to the study of the aesthetic, sensual and emotional side of material (their Sensoaesthetic properties) – to improve understanding of how people interact with materials, leading to more innovative and multisensory design, and understanding between disciplines. https://www.instituteofmaking.org.uk/research/sensoaesthetic-materials (Accessed 12.06.23)
E.g. Mark A. Miodownik, 'Toward Designing New Sensoaesthetic Materials', Pure and Applied Chemistry 79, no. 10 (1 January 2007): 1635–41.
109. Zoe Laughlin's PhD thesis, 'Beyond the Swatch: How Can the Science of Materials Be Represented by the Materials Themselves in a Materials Library?', 2010.
110. S. E. Wilkes and M. A. Miodownik, 'Materials Library Collections as Tools for Interdisciplinary Research', Interdisciplinary Science Reviews 43, no. 1 (2 January 2018): 3–23.

Close Writing exercises with artist and writer Dan Robinson as part of Close Encounters with Materials and Microbes workshop, 2018.
Appendix A p.98

TRANSFORMATIVE ENCOUNTERS

in my workshops, acts of making food as material, metaphor and method for interdisciplinary, embodied knowledge-making encourages care for materials, which has been positively reinforced by what I have found throughout the course of my research. Encouraging curiosity linked to our senses encourages care.[111]

Interdisciplinary researcher Dr Maria Puig de la Bellacasa's writing posits contact with materials as touch, and she sees this sense as a two-way experience, enabling thinking with care, but also attending to disregarded or less noticed perspectives or aspects of experience:

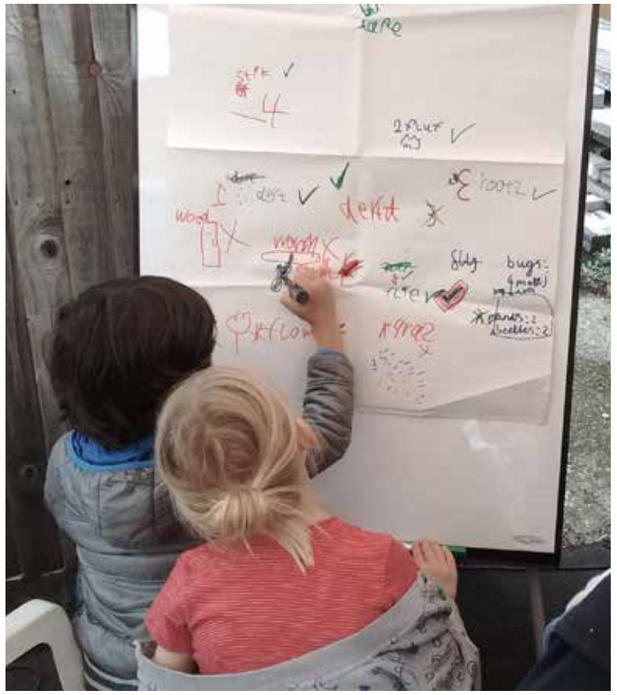
We can see without being seen but can we touch without being touched?

> …Attention to what it is to touch and be touched deepens awareness of the embodied character of perception, affect and thinking. Understanding contact as touch intensifies a sense of the co-transformative, in the flesh effects of connections between things.... where boundaries between self and other are blurred.
> …Engaging with touch also has political significance. In contrast to expecting visible effects that are accessible to or ratified by the politics of representation, fostering of 'haptic' abilities figures as a sensorial strategy for perceiving the less noticeable politics in ordinary transformations of experience missed by 'optic' objectivist representation.[112]

GROWING AND KNOWING

Foodmaking also includes the cultivation, raising and processing of living plants, animals, and microbes. Being able to view these processes as connected to kitchen practice is vital for knowledge of our metabolic relationships, but it is now a privilege in times of basic food insecurity. In industrialised and increasingly digitised societies an embodied understanding of provenance and sustainable food systems is often estranged from urban communities by limited access to private or shared soil, and in more rural areas, by large-scale agricultural practice and the cultural ubiquity of supermarket shopping, structural, social, and environmental inequalities,[113] leading to a loss of food soverignty, a loss of fundamental connection.

111. Here, we revisit the study by Citron and Goldberg referenced in Chapter One, on taste-related metaphors and emotion: Citron and Goldberg, 'Metaphorical Sentences Are More Emotionally Engaging than Their Literal Counterparts'. (see Chapter 1 page x)
112. María Puig de la Bellacasa, Matters of Care: Speculative Ethics in More than Human Worlds, Posthumanities 41 (Minneapolis: University of Minnesota Press, 2017).
113. Large supermarket brands account for over 96% of all grocery shopping in the UK from 2017-2023 and megafarms are growing to meet the need of bulk prices. https://www.statista.com/statistics/280208/grocery-market-share-in-the-united-kingdom-uk/ (accessed 23/05/23)



Curious participants at Roving Microscope and Sausage Sessions workshops.

This is tangible in the world of both academic and consumer technology research.[114] For this reason, as part of this thesis I have situated practice around two main urban growing sites and have held one-off workshops and investigations at several other growing projects, to enable an embodied understanding of food ecologies. (p. 23)

The recent ecological turns in art as in many areas of research, thought and activism, are an understandable response to the unfolding ecological disaster happening in our planet. Looking at our nature/culture condition in different ways and noticing the mutual aid models of the lives of plants, fungi and animals, there are increasing metaphors for reimagining the mess we have got ourselves into, with a growing conviction that imagining different futures may not be a utopian dream but the only way we will be able to live.

I do not want to academicise community activity - we must value and support community gardens and grassroots organisations, not attempt to co-opt them into the university. Tacit knowledge is valuable and shouldn't always have to be translated or communicated into words and recorded in order to become legitimate. However, there is value in sharing and learning from the way in which people use food as a familiar language across cultures, to ask research questions differently and to respect and learn from diverse knowledge practices.

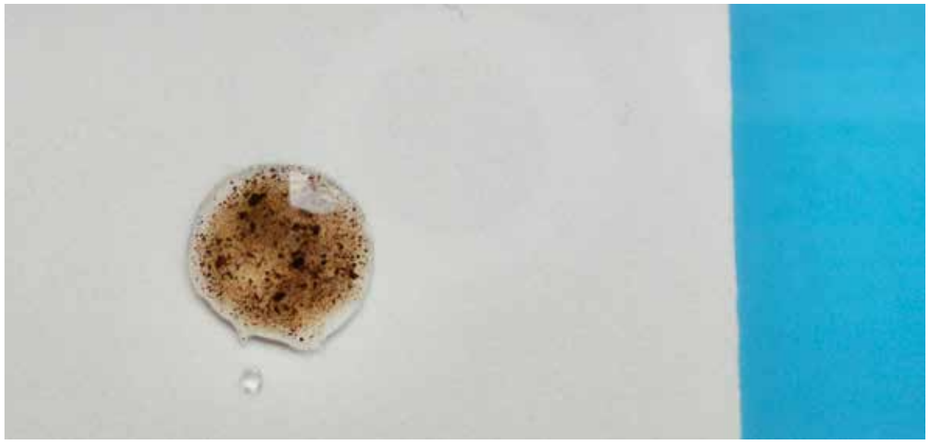
Western education knowledge traditions have arguably become top of an apparent global hierarchy, leading to a reduction in epistemic diversity. Because of the power that these traditions hold, other forms of knowledge are sometimes suppressed and seen as inferior – a situation described as coloniality. The University must work toward recognising more diverse forms of knowledge, but not by the assimilation of these knowledges, it must change structurally to reflect its populations, to become a *pluriversity*.[115]

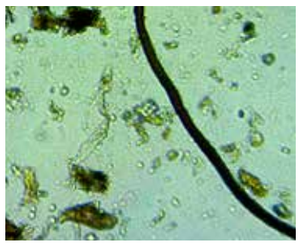
CLOSE ATTENTION AND SELF-REFLECTION

Thoughtful practice requires a different kind of attention, something deliberate, as I demonstrate in my workshops. Sometimes technologies can enable a new understanding of selfhood and can extend what we are. Attention alters what is attended to. By reflecting on our likeness to materials, to our environment, to others, we can practice wider forms of self-care.

114. More education institutions are incorporating food projects into their research and teaching strategy in a cross-disciplinary way; current food-growing initiatives at UCL alone have grown over the last 10 years to include Wild Bloomsbury, Bentham's farm student halls allotment, Pigment Farm at Slade School of Fine Art, UCL Pharmacy's Medicinal Herb Garden and Sarah's Roof Garden at the Institute of Education, Anthropology's Edible College London network, and The Global Generation Skip Garden (now the Story Garden), initiated by students from Bartlett School of Architecture and the Built Environment, and the planned Roof Gardening Group at Pool Street, UCL East.

115. For more on the concept of the "Pluriversity", see Achille Mbembe, arguing not for interdisciplinarity but for interculturality. However, the University system first has a long way to go with basic anti-racist practices. Achille Joseph Mbembe (2016). Decolonizing the university: New directions. Arts and Humanities in Higher Education, 15(1), 29-45.





With the Roving Microscope sessions – experimental community microscope gazing lunches initiated by fellow soil fans Melissa Thompson, Hari Byles and I – we were able to capture the interactions of microbes and materials in action which helped communicate the intricacies of the micro-world. This was particularly useful for helping people to understand and identify the way a micro-organism moves, how fast, and how they interact. Gazing through the microscope during lunch, watching microbes eat their own lunch and realising that they are part of us became a communal form of self-reflection and understanding.

This activity enables a different lens on being human. It questions our former idea of ourselves as individuals, the nature of eating and metabolism, our situatedness and the connections we have to our communities and what we count as our 'selves'. The practice of looking, making food and eating together forges new connections and affections, curiosity, and care, informing the PhD-practice. The opportunity to understand ourselves as a collective of organisms working together for mutual benefit, through looking at our food and responding creatively as a group while sharing the lunch we have brought, is profound. Microscope gazing reminds us that 'nature' is not external to us, we are nature and natural, alongside our social, culinary, and microbial cultures.

We have a responsibility – as those who can deliberately exert power and agency over other parts of our material ecosystems to use and create without extracting or using too much, and to leave our ecosystems functioning. We have never been simply individuals.[16] We are multispecies material composites, always contingent and context dependent. We evolved together from the moment chemicals became alive, and mitochondria took up residence in living cells. [117]

This kind of close attention to materials, through making focuses not just on face-value properties but attempts to be receptive to its hidden properties and qualities, its linked ecosystems and environment, its past and future incarnations – an ethical proposition.

Renewed material awareness is increasingly important in an era of rapid ecological, social, and technological change, and growing climate crisis. Knowing the ethical and political dimensions of a material's past and future changes its aesthetic qualities too. The idea of beauty or appropriateness in material is changed if you know that it is mined by enslaved or exploited people, used to make a single-use tool that will go straight to landfill, or is coated with endocrine disrupting or biocidal forever chemicals that will go into the soil food web. Perhaps this realisation could create a contemporary change in taboo.

116. Gilbert, Scott F., Jan Sapp, and Alfred I. Tauber. "A symbiotic view of life: we have never been individuals." The Quarterly review of biology 87, no. 4 (2012)

117. Margulis, Lynn. Symbiotic planet: a new look at evolution. Basic books, 2008.

Urban Mudlarking at Roving Microscope workshops, 2019.

Craft and design historian Glen Adamson talks about making as amoral, with no intrinsic ethics.[118] We know that invention is not an unalloyed good – art, design and creativity can be used for hurtful purposes.[119] Some early inventors in science and technology believed that they were 'objective' and in the business of facts and possibilities, not values.[120]

But my research suggests that we might care for our material ecosystems more if we know more about materials through our senses, through the act of transforming them. We also might care more about material ecosystems if we know the history or the provenance of (edible) materials, if we accept that knowledge is embodied, and contingent on the knowledge maker/holder's perspective shaped by their related ecosystems, and if we work together across disciplines to solve problems and to see things from other perspectives.

In a confusing time of food insecurity, climate emergency and geopolitical instability, of changing health advice, misinformation, and advertising, we should be trusting our gut more. However, our guts are withering: our microbiomes are declining in diversity, and our food system which favours monoculture over e.g. permaculture is reinforcing that drift. Ideally, we would all have the time, money, or privilege to "go back to the material itself, to its original state, and from there on partake in its stages of change" as Albers suggests, (p. 123) but the world does not work like that now.

Thinking with the environment, noticing, and caring about it as part of ourselves matters practically, not just conceptually or philosophically. We are not tourists in this world, we make it as it makes us. This PhD-practice involves us not as spectators but as part of the materials of the world.

118. Glenn Adamson, Thinking through Craft. London New York Oxford New Dehli Sydney: Bloomsbury Visual Arts, 2018.
119. Larne Abse Gogarty, 'The Art Right', Art Monthly, no. 405 (April 2017): 6–10.
120. For a detailed exploration of objectivity, ethics epistemology and representation see: Lorraine Daston and Peter Galison, Objectivity, 1. paperback ed (New York: Zone Books, 2010). David B. Resnik and Kevin C. Elliott, 'The Ethical Challenges of Socially Responsible Science', Accountability in Research 23, no. 1 (2 January 2016): 31–46.

Chapter Three:

PRACTICE AS UTENSIL

Materials Research Kitchen
Activated Works
Making Knowledge Together

Chapter Three contextualises the Materials Research Kitchen as a collaborative art research practice which uses cooking and eating together as both method and metaphor. As part of this I have produced various Activated Works: made and collected items which are generative thinking tools for use with others.

I show how this thoughtful, embodied PhD-practice can be used to learn about human-material relationships, through making knowledge together towards usable transdisciplinary understanding.

Honey Time Machines, a seed preservation experiment with shared seeds, part of Seed Stories and Symbionts, a Roving Microscope workshop, 2019.
Appendix A p.101

MRK

Utensil: Any vessel (article, implement, etc.) serving a useful end or purpose.[121]

At the centre of this research is physical and metaphorical transformation, and I am interested in the PhD-practice itself as a transformative process. This is something that has shaped me, my ethics and perspective, as I – alongside everybody who has taken part – have shaped its trajectory. Using the metaphor of the kitchen utensil allows me to understand it as a tool for transformation, for making sustaining knowledge, which then becomes part of us, allows us to extend ourselves physically and cognitively into our environment. The art research workshop can be such a vessel – a holding space for experiential knowledge.

The PhD-practice takes form in combining exploratory kitchen workshops, with collecting, and collaborative experimental making. This activity does not take place in a gallery or within the art 'world', but finds uses or applications in sites of education, industry, and local growing projects.

During this research project I have used transformative and experimental tools for knowledge-making, ways to extend my thinking, with which I aim to influence research culture. To give some examples, these tools include:

- Materials: meat, cabbage, gold, glass, soil, iron
- Objects: mortar and pestle, thermometers, fridges, jars, cards
- Processes: cooking, writing, tasting
- Methods: practical workshops, imaginary prototyping, close looking
- My practice and role: communard, artist, researcher, technician
- Sites: mobile kitchen, community garden, science park

121. Oxford English Dictionary, "'utensil, n.'.', n.d., https://www.oed.com/view/Entry/220750?rskey=13NMGU

Dr Sarah Wilkes preparing biscuits using moulds 3D printed from nano-scale surfaces of everyday materials, to see where different size and shape microbes (sprinkles and seeds) like to lodge.
Appendix A p.98

WORKSHOPS AS PRACTICE

Kitchen workshops - cooking and eating together as a happening or event of exploratory art practice - have become a medium, and a natural progression of my sculpture enquiry.

Alongside studying craft-making techniques in wood, metal, plastics and ceramics and glass, I found that everyday materials and making practices became increasingly useful in terms of reflecting and interpreting my way of perceiving the world and connecting with others. I began to use soils, bread, bone, blood, kitchen utensils, and waste plastics. In a time of increasing disembodied and abstracted information, I wanted to ground ideas in the familiar, sensory material world.

I found that making with others - making out loud - allowed deeper and broader understanding of materials. Food workshops as research medium reunite thinking with being and doing in their everydayness accessibility and relationship to change, embracing many different knowledge practices as valid.

Science understands a medium as:

> …a pervading or enveloping substance… in which an organism lives; esp. one in which microorganisms, cells, etc., are cultured.[122]

The workshop form acts as a generative way to spark exploratory situations and dialogue with others and inculcate thinking through materials.

The MRK methods were born out of this need to think with others, and a hunch that using food to investigate human-material relationships might attract different people's curiosity beyond that of arts professionals. They were then developed through use – seeing what worked and what got people talking and thinking deeply early on, and allowed for weirdness and awkwardness as we proceeded without a clear roadmap. (Appendix A p.53) The research path has not been a controlled experiment, but a pursuit of ideas as they evolve and a making of new connections.

Their form draws from community arts and crafts which often have therapeutic or social aims. These sessions – a PhD-practice where process is the work – include not only the action on the day, but their preparation and rehearsal, the building of networks, relationships, and the development of trust between the people who take part. The invites, the imagery used, the documentation via cards and photography, all serve as a part of building a generative enquiry relationship – the people and workshops are transformed by each other.

122. Oxford English Dictionary, "'medium, n. and Adj.'.', n.d., https://www.oed.com/view/Entry/115772?redirectedFrom=medium.

Nutritional Sculpture on silicon wafer in the studio (iron cooking ingredients/ tools, part of Activated Works), 2019. Appendix A p.36

AESTHETICALLY MOTIVATED CURIOSITY

I am attracted to an aesthetics of materials' qualities and associations, intrinsically linked to their past and future incarnations, I am drawn to the work of material science which reveals and manipulates the shifting inner form, or microstructure of materials over time that determines their properties, behaviours, and affordances, and as an artist I find this informed imagination of matter's *temper* (p. 109) as interesting and important as the shifting outer forms they can take on.

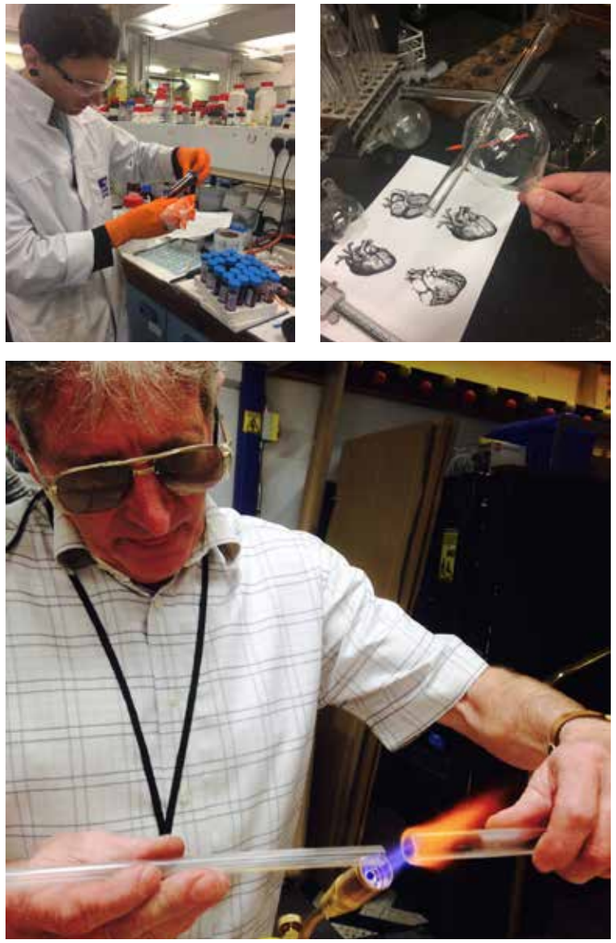
This aesthetically motivated curiosity in the hybrid art-research-pedagogy of this PhD-practice means I don't see the performance of the Materials Research Kitchen workshop as an artwork itself, or food and cooking as the subject of art, but as its method. The emphasis is on the process and what it generates, rather than on objects and the relations between people. The embodied thinking that happens during the workshops, and which echoes in people's physical encounters, is where the art occurs and reoccurs. There are no viewers for this work, there are makers, doers, researchers, generators, eaters, and metabolisers. This follows Mol's suggestion that rather than merely to make cognitive reflections about the world, we take our cues instead from human metabolic engagements with the world, to enact our bodies, our thinking process.

In thinking about these issues, I return to Gaston Bachelard's aesthetic of knowing materials-in-motion, through the sensory imagination of their changing qualities, properties, histories, psychologies, behaviours, and potential uses. Our unconscious mind is projected onto sensory imagination of matter. It is revealed in my understanding of Active Ingredients, or tools which can be activated, or applied to different situations in order to make things happen - to create knowledge which allows us also to act through the extended mind. I understand being and doing as integral to the knowledge-making processes and see aesthetics in this way. As we continue into a time of global instability, I find this an important grounding activity that enables me to cope with change and recognise everyday agency.

According to curator Professor Irit Rogoff, we are experiencing a research turn in contemporary cultural production, where the emphasis has shifted from research as an activity that contextualises art from a distance, to one that inhabits the art world and necessitates engagement with our material conditions across so-called disciplines:

> We are together in this. We have to bring people together. At moments of crisis we need to move away from the disciplinary curricula and towards an engagement with the conditions we are living out. An engagement without drawing conclusions or making predictions, and without designating productivity but speculative research and imaginative invention. In this situation, students, teachers we are all becoming researchers.[123]

123. Irit Rogoff, 'Becoming Research: The Way We Work Now | Irit Rogoff (April 9, 2018) on Vimeo', accessed 9 February 2019, https://vimeo.com/271887079.



Making Luminal Organs with Tom MacDonald and John Cowley, UCL Chemistry, and John demonstrating at the Institute of Making, 2018.
Appendix A p.32

These ideas resonate with the context of my work in further and higher education, finding that there are different, more embodied learnings about materials' qualities and affordances to be had through practicing research together in the kitchen. This thesis *inhabits* art, as a tool for the generation of further research, learning, making, or other forms of action, as research itself, rather than providing context for the action.

This work has developed on a Fine Art PhD programme, but to use the term 'research-based art'[124] seems to downplay the joyful, sensory, and social connections that occur between people and materials in a workshop.

COLLABORATION

I am an enthusiastic collaborator. My ideas feed off the relationships between others and an active environment. Throughout this project I have worked with others to carry out the research; the activated works and sculptural objects that have resulted from this process have been made with other artists and technicians.

The MRK methods have been developed in collaboration with Beko, and some of the research events have been jointly conceived and realised with other artists, practitioners and researchers. (p. 241)

Through this process we were each able to achieve individual and intersecting aims, but there were also other outcomes that arose, that weren't in our own aims, but were important to the work and transcended disciplines.

Matters of authorship and intellectual property are not explicitly claimed between attendees when these research sessions are conceived, developed, and enacted collaboratively during the workshops. The interaction of ideas between those at the workshops become part of the work, allowing people to take away what they need for their own practice, while consenting to their participation in published doctoral research under my name. (Appendix B p. 9)

I wanted to co-create the trajectory of the work as much as possible and allow these methods to grow in relevance to people's own fields. However, true co-constructed research:

> … facilitates equal partnership in research between at least one academic party and one non-academic party (for example a community organisation, charity, museum, or public sector organisation) over all phases and aspects of the research from research design, analysis and output.[125]

124. Defined in an essay by Claire Bishop, excerpted from her book Disordered Attention: How We Look at Art and Performance Today, forthcoming from Verso. https://www.artforum.com/print/202304/claire-bishop-on-the-superabundance-of-research-based-art-90274
125. Horner, Lindsey, K. 2016. Co-constructing Research: A Critical Literature Review. AHRC: https://connected-communities.org/index.php/project_resources/coconstructing-research-a-critical-literature-review

From Sugar Metamorphosis workshop, 2017.
Appendix A p.54

As such, the work of this thesis is not co-constructed, (design and analysis were done my me) but presents methods and knowledges that I hope will be used in further co-constructed research. Knowledge about materials is often in the hands of practitioners and workers, and this thesis proposes that using and evolving these methods to feed into true co-research can begin to address power imbalances in who holds and makes new knowledge about materials and making.

Workshops – using food as a method of connection and metaphor for shared thought and exchange across academia, community groups and industry – can provide those serendipitous moments, and could be useful in transforming this power imbalance. I am not trying to directly make societal changes with this project, but to use food as a connector and thoughtful practice to generate ideas in projects that do change us.

THE COMMUNARD

Early on, I chose to think of my own position in this project using the analogy of the communard. In the military-style system of the French classical kitchen, the communard makes the family meals for the chefs, servers, and porters. This is not usually something fancy but tasty and hearty to keep people going, more like home cooking. I began to understand my research role as a communard of art research; a researcher for researchers, aiming to take a sideways position on hierarchies to question what research can be, and who gets to drive it. It is a host, facilitator, and co-worker role, taking a utilitarian, familial approach to research methods. The position of the communard creates, supports, and sustains the conditions for work to take place, lays the table for embodied research and can be seen as a catalyst and translator in a research university, particularly as it aims to widen participation outside of the academy, and work across disciplines and hierarchies.

This is not to say that there is not still a power dynamic in the position of the communard, as one who has access to funding and institutional legitimacy and resources, but I wanted to encourage multi-potentiality of the workshops rather than to bend them solely towards institutional ends.

LOCATION
Workshop as practice: a brief historic overview

Workshop is a word describing a place for making, or an act or process of making, and – as I have used it - a *happening* or *enquiry.* (p.145) It assumes that materials, objects, or ideas are being generated or transformed. Composed of the words work and shop, it signifies a process of production and exchange. [125a] Historically, the workshop was a form of skill transmission via apprenticeships, focusing on cooperative learning and collaboration. Similarly, the artist's workshop became a term for the team of skilled workers who made commissioned works of art during the Italian Renaissance period, often under the name of an established individual artist. Before this time, 'artists' were more akin to artisans: imagemakers were classed in the same group as blacksmiths, piemakers or brewers. [125b]

125a. Ben Cranfield and Marianne Mulvey, 'More than a Meeting: Performing the Workshop in the Art Institution', Performance Research 28, no. 2 (17 February 2023): 4–13.

125b. Dr. Laura Tillery, "The role of the workshop in late medieval and early modern northern Europe," in Smarthistory, August 15, 2021, accessed May 16, 2024, https://smarthistory.org/workshop-northern-europe

Alison Knowles' Make a Salad.
This iteration was part of the FluxField event at Walker Art Gallery Minneapolis, 2014.
https://walkerart.org/magazine/artists-respond-to-fluxus/
Photo: Gene Pittman

Rirkrit Tiravanija, 'Untitled 1992 (Free),' at 303 gallery in New York

New forms of artistic practice emerged in the early 20th century. with movements like *Futurism, Surrealism* and *Dada*, in which artists increasingly used the language of everyday materials and acts, such as food and cooking. [125c]

This was perhaps a reaction to authoritarianism and commodification in modern European society by moving away from the site of the gallery and the art object, to expand art's participatory and live possibilities. This continued later with, for example, Alan Kaprow's 1950s *Happenings*, and the *Situationists International*, derived from Marxist ideas, and the 1960s *Fluxus* movement's prompts for participation by artists like Alison Knowles, Yoko Ono and Bruce Nauman, and later, for example, Hans Ulrich Obrist's *DO IT*, a manual of instructional procedures for human interpretation and participation.[125d]

Both Gordon Matta-Clark and Carole Gooden's 1971 restaurant *Food*, and 1990s artist Rikrit Tirivanija's participatory kitchens within exhibitions, focused on relations between people as they collaborate, create situations and eat together as a medium for art, the latter known as an example of "*Relational Aesthetics*", a term coined by curator and critic Nicolas Bourriard. [125e] This term made explicit the growing focus on creating temporary environments or events where art viewers actively participate, challenging the traditional canon of art, where the experience was more important than product – itself perhaps a reaction to the individualism of the 1980s and 90s. Claire Bishop's critical writing – which includes a criticism of Bourriard's perspective, countering that socially engaged art often becomes exempt from art criticism – explores and identifies efforts over the years to remove art viewers from the role of passive observers to that of co-producers. [125f]

> This expanded field of relational practices currently goes by a variety of names: socially engaged art, community-based art, experimental communities, dialogic art, littoral art, participatory, interventionist, research-based, or collaborative art. These practices are less interested in a relational aesthetic than in the creative rewards of collaborative activity—whether in the form of working with preexisting communities or establishing one's own interdisciplinary network. It is tempting to date the rise in visibility of these practices to the early 1990s, when the fall of Communism deprived the Left of the last vestiges of the revolution that had once linked political and aesthetic radicalism. Many artists now make no distinction between their work inside and outside the gallery, and even highly established and commercially successful figures like Francis Alÿs, Pierre Huyghe, Matthew Barney, and Thomas Hirschhorn have all turned to social collaboration as an extension of their conceptual or sculptural practice. [125ff]

125c. Filippo Tommaso Marinetti, "The Futurist Cookbook" (London: Penguin Classics, 2014).
Barr, Beryl & Sachs, Barbara Turner Eds. "The Artists & Writers Cookbook", Introduction by Alice B. Toklas (Contact Editions, 1961

125d. Hans Ulrich Obrist, based on 1993 discussions with Christian Boltanski and Bernard Lavier (http://projects.e-flux.com/do_it/itinerary/itinerary.html)

125e. Nicolas Bourriaud, Relational Aesthetics, Nachdr., Collection Documents Sur l'art (Dijon: Les Presses du Réel, 2009)

125f. Claire Bishop, 'Antagonism and Relational Aesthetics', October 110 (October 2004): 51–79
Claire Bishop, ed., Participation, 3. pr, Documents of Contemporary Art (London: Whitechapel, 2010).

125ff. Claire Bishop, 'The Social Turn: Collaboration and its Discontents' ARTFORUM February 2006 Vol. 44, No. 6 https://www.artforum.com/features/the-social-turn-collaboration-and-its-discontents-173361

Charcutier Adrienne Eiser Treeby and participants discussing sausagemaking and gender at our "Bags O' Mystery" workshop as part of a CRASSH Conference: Beyond Cooking. Appendix A p.70

Art Workshop as Knowledge Event

The 'workshop' as event , situation or verb rather than place has since taken on different meaning through education and the corporate world, crossing over into the art world in galleries and community arts contexts (including art gallery, museum, formal education settings), where artists give workshops, often to participants, alongside or as part of their art practice, as part of an exhibition contract, or as a public engagement requirement of funding – as in the UK with the new Art's Council of England's focus on *Leading through Learning* under New Labour in the 1997. [125g]

Post-millennium, the UK's art practices showed the beginnings of 'workshop turn' in art practice itself, as theorised by e.g. Irit Rogoff [125h] within what she terms *Pedagogical Aesthetics*. This has been seen in modes of socially engaged art, 'fieldwork' in interdisciplinary arts research in higher education, and grassroots collaborative experimental work with no audience but the participants. [125i] She criticised this aesthetic. In the late 2000s, when this turn to educational form within art was newly declared, the instrumentalising effects of the Bologna Declaration [125j] were being felt, as those involved responded to the neo-liberal marketisation of higher education, and indeed art. She notes that:

> ...a shift away from the structures of objects and markets and dominant aesthetics towards an insistence on the unchartable, processual nature of any creative enterprise… has led all too easily into the emergence of a mode of "pedagogical aesthetics" in which a table in the middle of the room, a set of empty bookshelves, a growing archive of assembled bits and pieces, a classroom or lecture scenario, or the promise of a conversation have taken away the burden to rethink and dislodge daily those dominant burdens ourselves. (I say all this with a certain awkwardness, in light of my own involvement with so many of these initiatives. Exhibitions, self-organized forums within the art world, numerous conversation platforms: all shared the belief that turning to "education" as an operating model would allow us to reinvigorate the spaces of display as sites of genuine transformation.) [125h]

She emphasises the drive to turn – the curiosity and urgency of responding to political or cultural need as a generator of modality, rather than pure aesthetic:

> In a "turn," we shift away from something or towards or around something, and it is we who are in movement, rather than it. Something is activated in us, perhaps even actualized, as we move. And so I am tempted to turn away from the various emulations of an aesthetics of pedagogy that have taken place in so many forums and platforms around us in recent years, and towards the very drive to turn. [125h]

125g. Arts Council of England, Annual Report 1998 https://www.artscouncil.org.uk/sites/default/files/download-file/The%20Arts%20Council%20of%20England%20Annual%20Report%201998.pdf

125h. Irit Rogoff, Turning, e-flux Journal Issue #00, November 2008 https://www.e-flux.com/journal/00/68470/turning/

125i. See Thomas Hirschhorn's work as part of "Commonwealth" 2014 at Tate https://www.tate.org.uk/whats-on/tate-modern/common-wealth and Susan Lacy "Crystal Quilt" https://www.tate.org.uk/art/artworks/lacy-the-crystal-quilt-t15536, and artists and curatos e.g Marjetica Potrč, Tania Bruguera, Alisatair Hudson, Charles Esche, Renée Green, Emily Pethick, Kathrin Böhm, Theaster Gates, and Jeremy Deller.

125j. Dieter Lesage, The Academy is Back: On Education, the Bologna Process, and the Doctorate in the Arts, e-flux Journal Issue #04, March 2009 https://www.e-flux.com/journal/04/68577/the-academy-is-back-on-education-the-bologna-process-and-the-doctorate-in-the-arts

Dr Nick Laessing serving salad grown in his Plant Orbiter at the Slade, 2019.
Plant Orbiter is an auto-rotating hydroponic food production system which puts to test the NASA theory that plant growth and yield can be increased through subjecting plants to anti-gravity conditions.
The project also engages with questions surrounding the future of urban food production and the role of technology in self-sufficiency.

MRK workshops and contemporary and local influences

In the Materials Research Kitchen our workshops foreground senses, feelings, listening to materials on-site. This method takes its participants away from merely the *aesthetic* of pedagogy but to a forum for shared attention anchored at this moment in time. If – as I see it – art is a way of sensing: focusing, reflecting or speaking the world, then the form of the sensory making workshop is how I have practiced this during this research, process, as an artist, in the context of collaborative academic research, industrial R&D, and practical research in community gardens – to extend the reach of art.

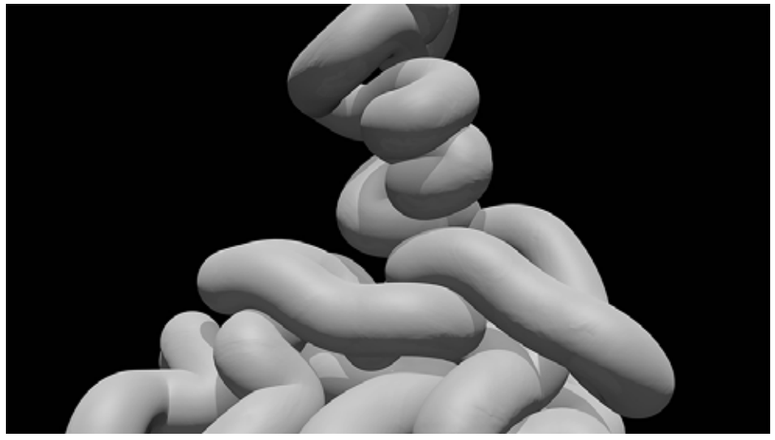
The methods which I have developed focus not only on relations between people, but between the materials, microbes and environments involved, as an investigative field, led by aesthetic curiosity, towards finding out more about our material relationships, together.

There are many different contemporary practitioners and organisations whose work has been influential to this PhD-practice. In my early exposure to transdisciplinary practice research, artist Dr Hannah Drayson's work[126] on instruments, sensing the body, placebo, and our shared investigations of temper, active ingredients, and taste have been formative to the development of this thesis. Artist Annie Cattrell's practice on the intersection of art, craft, research, and technology to reveal invisible transformative forces through materials was pivotal in understanding the expanded possibilities of practice.

Dr Nick Laessing's practice research on utopian technologies and futures and our collaborative teaching work, and Dr Alfonso Borragan's work on embodiment of magic and meaning in ingestion of materials have been influential in the development of this thesis and its methods including workshops and teaching as part of art practice research.[127] Artist Dr Teresa Stelhikova's Sensory Workshops were also influential and fertile meetings of minds and bodies as she brought people together across disciplines in original sensory research workshops. (see Appendix A page 54)

Dr Nir Segal's art hospitality moments kickstarted my methods at the Slade, with his coffee bar set up in the studios, and the familial way in which he included us all in his art practice.[128] The conception of the role of the communard in this PHD practice was influenced by his performative methods of conducting research with others. Early on, I was influenced by artist Bobby Baker[129] in her highly original explorations into the joy, humour, horror and politics in physical/pscychological engagement with the materials and the performing of tasks associated with the everyday realities of her life as an artist, and a woman, who has had disabilities. She always makes you feel part of the performance, and her more recent work has involved making with, and feeding others.

126. https://www.trans-techresearch.net/research/contributing-researchers/dr-hannah-drayson/
Hannah Elizabeth Drayson, "Gestalt Biometrics and their Applications; Instrumentation, objectivity and poetics." (PhD Thesis Plymouth University, 2011)
127. https://www.nicklaessing.com/
https://www.alfonsoborragan.com/
128. https://www.ucl.ac.uk/slade/research/mphil-phd/nir-segal
129. https://www.bobbyartistbaker.co.uk/



Melanie Jackson and Esther Leslie, Deeper in the Pyramid, 2018. Production still:: Melanie Jackson, Esther Leslie and Modern Activity Jackson and Leslie, Deeper in the Pyramid. Banner Repeater, 2018

See also: https://www.cabinetmagazine.org/issues/62/jackson_leslie.php

Katarzyna Depta-Garapich fermenting beetroot in the studios, Slade Research Centre UCL, 2017.

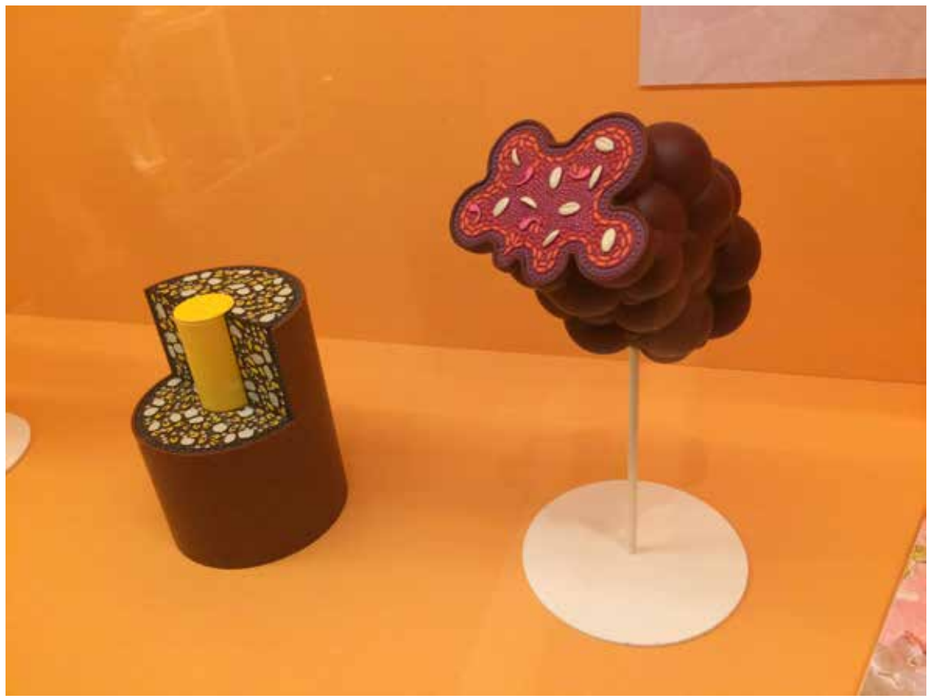
Artist and materials expert Dr Zoe Laughlin's practice of place and community-making and research facilitating, including the Materials Library and the Institute of Making, has shaped the way I see research as a generous, generative endeavour.[130] Phytology's medicinal herb garden and the activities on site at Bethnal Green Nature Reserve introduced me to longer-term action research, and opened my eyes to working outside the studio. The work of artists Michael Smythe and gardener Hari Byles encouraged my interest in organising and hosting situated community activity as part of artistic practice.[131] Prof Kieren Reed's approach to facilitating collaborative and situated practice through 'social sculpture' has similarly been an influence on my ways of framing practice.[132]

At Frieze Art Fair 2012 I noticed collective work on food fermentation and preservation by artists with Grizedale Arts who were championing craft skills, collaborative production and the expertise of non-'artworld' artists. I have learnt from many artists associated with them[133] over the years who also practice art, politics, humour, hospitality and beauty in everyday culture, with the philosophy that artists can effect change in society. Learning about the Arte Útil movement, seeing art as a tool, inspired me in considering how my work can be of use.[134]

Fermentation became a part of the project almost by accident, after experimenting with foraged ferments on residency at Phytology, I learnt from artist Kasia Depta Garapich,[135] one of our contemporaries on the Slade PhD programme, who made work through practicing local polish fermentation traditions in collaboration with Karen Guthrie of Grizedales' *House of Ferment*, a theatrical version of the larder at Lawson Park farm. She taught us all how to make Barszcz in the studios – a chilled clear Polish soup made with veg and fermented beetroot brine. Artists using fermentation as part of an ecological or social practice has been increasingly visible - part of a growing number of artists using craft methods, clay, dyed textiles, botanical and sustainable pigments, and photography and film made with food waste or edible materials.

I had also been influenced by self-sufficiency and sustainable food practices, in a queer political art context in the work of fermentation revivalist Sandor Ellix Katz and artist Sean Roy Parker,[136] and by artist workshops at MadLab's DIY biology residency at The Arts Catalyst,[137] a gallery project space who focus on intersections of art, science, technology, and ecology, and have hosted many influential alternative practitioners like bio and genetic engineering, with links to the local community.

130. https://zoelaughlin.com/
131. https://nomadprojects.org/
https://compost-mentis.com/
132. https://www.kierenreed.co.uk/
133. https://www.grizedale.org/ - artists
134. https://www.arte-util.org/
135. https://katarzyna-depta-garapich.com/
136. https://www.wildfermentation.com/
https://fermentalhealth.substack.com/
137. https://artscatalyst.org/



Carolien Niebling's influential research project The Sausage of the Future: models shown at FOOD: Bigger than the plate, London, Victoria and Albert Museum, May 18 - October 10, 2019.

My thinking about the interior properties and meanings within materials is stimulated by Dr Melanie Jackson's further work with Dr Esther Leslie, a psychoanalysis of bodily fluids and the way they wind through our subconscious through consumption of imagery and metaphor, art, pop culture and socialist politics.[138] Writer and critic Chris Fite Wassilak's exploration of critical theory and cross-disciplinary thinking through mundane and extraordinary materials like cheese,[139] as well as Dr Alaena Turner's work on foodstuffs and meaning. Cooking Sections book Salmon, a Red Herring,[140] expanded my ideas on aesthetic curiosity as a way of understanding bigger, even global issues in human-material ecologies, and how artists can make change.

Designer Carolien Nieblung' sausage of the future project was influential in its meticulous examination of sausage anatomy and materials science, and their links to the environment and the future of food. I loved Daniel Saloman's self-portrait as a sausage.[142] I have enjoyed the way interdisciplinary artist Amanda Couch practices academic research into material cultural histories through physical engagement with food and the digestive system, in her use of offal, biscuits, pies and sausages, growing, foraging and the commons.[143]

Artist Laura White engages with materials as a sculptor, and her recent work involves learning fine pastry and baking techniques to interrogate the materiality through physical research and edible sculpture.[144]

I found many links to my practice in writer Rebecca May Johnson's documentations of eating, growing, cooking and recipes as an embodied literary and political exploration.[144b] Artist Jasleen Kaur's work has been influential in many ways. This spans her earlier work on exploring tools, agency, embodied knowledge and identity,[145] her playfulness with everyday materials, cultural practices and artefacts, food and cooking, design and imagery in her sculpture and installation, together with her deep engagement with colonial and personal social histories, politics and injustice in her written works and dialogues with family members and other important practitioners e.g., Raju Rage.[146]

138. https://melaniejackson.net/
Melanie Jackson and Esther Leslie, Deeper in the Pyramid (London: Banner Repeater, 2018).
139. https://cfitewassilak.wordpress.com/
140. Salmon: A Red Herring (New York: Common Era Inc., 2020).
141. Carolien Niebling, The Sausage of the Future: A Research Project (Zürich, Switzerland: Lars Müller Publishers GmbH, 2017).
142. Daniel Salomon, performance, Everything Daniel Salomon ate in One Day, 26 January 2019, The Institute for Endotic research, TIER.space, Berlin. In Aaron Cezar and Dani Burrows, eds., Politics of Food (Berlin: Sternberg Press, 2019). 174
143. https://amandajcouch.wordpress.com/
144. https://www.laura-white.co.uk/
144b. Rebecca May Johnson, Small Fires: An Epic in the Kitchen (London: Pushkin Press, 2022).
145. https://jasleenkaur.co.uk/tala-curry-measure
146. Jasleen Kaur, Be Like Teflon.. (S.l.: Glasgow Womens Library, 2019).
https://feastjournal.co.uk/issue/spice/
Serpentine Radical Kitchen programme: https://www.serpentinegalleries.org/whats-on/radical-kitchen/#article

Breadmaking together at Rochester Square, 2019.

Dr Marina Chang and Lukas Meusburger's project Food Junctions[147] at UCL was the first in-depth celebration of food as a translator and connector of research in Higher Education, and she encouraged me to continue. Her project at Calthorpe Community Garden where she is a trustee, frames the activity there as a Living Lab, alongside practitioners Rokiah Yaman, Katherine Patonay and Mila Campoy who work to maintain circular systems of nourishment with their community.[148]

Airspace Gallery,[149] Stoke-on-Trent's work championing artists, civic material history and creativity in local communities, and advocating for artists' role in society has been an inspiration, particularly the Portland Inn Project[150] and its associated workshops around re-making a closed pub. Theirs is a social practice, making together as transformational art practice and living their values in their community while being hilarious and creating joy in everyday life. Katrin Bohm's Company Drinks[151] was important in seeing how a project like reviving the old East End tradition of hop picking could grow to become a company that made positive social and economic effects in a community – through involving people in the making and selling of foraged fizzy drinks, embedding art ethics and political action in everyday life.

Making workshops and teaching as a community of practice is also evident in Francesca Anfossi's founding work at Rochester Square with food, clay and growing. Dr Ros Grey's hosting of the Goldsmiths' allotment as teaching tool was similarly significant to the development of these ideas. In approaches to teaching as part of an artist's practice, Rosalie Schweiker's little red book,[152] and Thomas Hirschorn's lecture-workshops have been influential in their spirit, and in the encouraging of the individual's authentic perspective over artistic 'quality'. Anni and Josef Albers focus on letting materials teach us, and on using technique to an experimental end, has also guided my hand.[153]

147. Marina Chang and Lukas Meusburger, The Food Junctions Cookbook: Living Recipes for Social Innovation (London: University College London, 2011).
148. https://www.calthorpecommunitygarden.org.uk/
149. https://www.airspacegallery.org/
150. https://www.theportlandinnproject.com/
151. https://companydrinks.info/
152. Mirjam Bayerdörfer and Rosalie Schweiker, eds., Teaching for People Who Prefer Not to Teach (London: AND, 2018).http://www.thomashirschhorn.com/workshop-energy-yes-quality-no/
153. https://www.albersfoundation.org/alberses/teaching

Work in process, cast iron for Nutritional Sculpture at Coles Castings, Dorset, 2019.
Appendix A p.36

Nutritional Sculpture, as placebo, or votive copper 'supplements' with active properties, made with copper clay as part of Sugar: Transformation, 2019.
Appendix A p.110

Activated Works

In my materials-focused sculpture practice I had become dissatisfied with the making of objects or installations that were shunted around, exhibited, and traded in an increasingly neoliberal art market. I had become more interested in process – engaging with materials and making, but as parts of a practice of positive, generative works that were active and had a tangible continued life in different forms – aside from creating wealth or exchange value. While objects get made and collected as part of this doctoral research, I see them not as discrete works of art, but as tools for making knowledge that can be propagated and used.

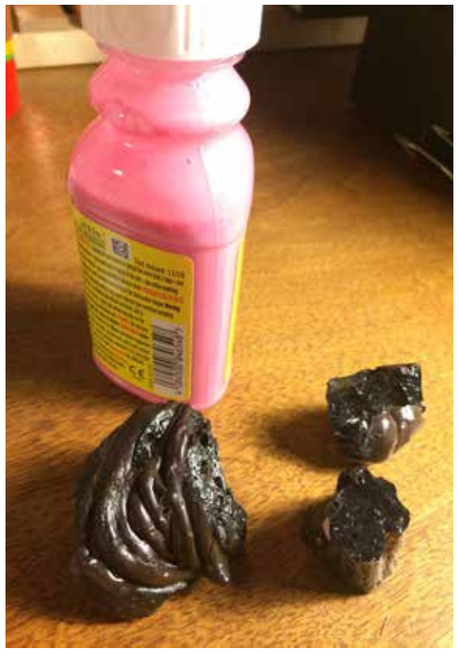
This section details these collected and co-made research tools which I have termed Activated Works. They are a material thinking process made alongside the workshops, to be transformed and be transformative through their use, demonstrating this thesis.

EXPERIMENTAL MAKING

I have developed these works because as I assert that materials create us as we do them. I want to make this connection visible, allowing us to reflect on our material relationships through interpretation. I make this connection even more directly through works that could literally become us.

These pieces are made in collaboration with materials specialists like iron founders and scientific glassblowers, often as a response to a collaborative project. It feels important to co-produce works that will be used in this PhD-practice research process. It is also important that I use the activated works together, to discuss, interpret and transform materials and us in community with others, which includes more-than human others. This sculpture practice has become research and learning method.

A collection by students as part of research for Material Body Anatomy class has merged with my studio collections to become a portable Material Body handling collection.



Cutlery and other studio objects attracted to a 'cow magnet', which cows are made to swallow to prevent 'hardware disease, where nails and bits of fence can be ingested and cause them damage.

Pepto Bismol, which contains bismuth, and glass slag from the iron pour.

COLLECTING

I began to explore the active power of materials by making collections and making connections. These materials enable different modes of thinking in my research, sensorially through handling them, smelling/tasting, ingesting them, through cultural properties – gauging different people's responses and connections with them, and through their significance within different disciplines.

Collecting as an instinctive visual research method has re-occurred in my work since I began making, as an extended cognitive process and a way of thinking through materials. It is a way of relationship building and forming a sensory language that exists as a material matrix supporting made objects. It is a way for me to materialise, order and communicate my thoughts and ideas when I find it difficult to verbalise them.

It allows reflection on the act of accumulation – surrounding myself with important items and materials – to question why they are important in a formal thinking process, and what materials and their cultural associations make up a person.[154] Histories of museum 'collecting' and taxonomy are part of the European colonial project, and recent movements to decolonise museums and collections have led me to look at the activity differently,[155] noticing how I present or frame materials and objects, in relation both to extractive or exploitative practices in material production, or the histories and provenance of cultural artefacts.

154. See Delfina Foundation' programme: Collecting as Practice, Exploring the philosophy, psychology and politics of collecting: https://www.delfinafoundation.com/programmes/collecting-as-practice/

155. See for example, Professor of contemporary Archaeology Dan Hicks's work on collections, colonial violence and restitution https://www.danhicks.uk/essays

All Gender Liquid Loo, Nissa Nishikawa, 2018. Made for the co-designed accessible compost toilet, Bethnal Green Nature Reserve.

Making Knowledge Together

ART IN USE

Art easily crosses boundaries. Philosopher and Sociologist Henri Lefebvre links art to play, saying that, like play, art is trans-functional, with many 'uses' and none. He talks of the work of art as a yeast – the fungus that eats sugars: it is generative, spreading through the body of a substance, transforming it.[156]

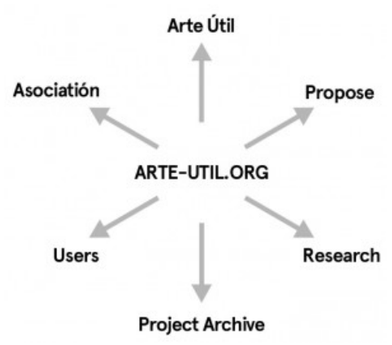
In recent years there has been a surge of renewed interest in the act of everyday or domestic making in art contexts, exploring the politics of usefulness and the democratisation of art-making in the engagement of craft skills, materials and methods, making disciplinary boundaries in art and design less useful. At the same time, we have seen the emergence of a stream of participatory and socially engaged art practices that focus on communal activities which empower people, collective action, and the commons, often focusing on food-growing, making and sharing, and craft-making as accessible everyday creative acts which are political in practice.

Craft and design critic Glenn Adamson says:

> Craft matters, too, because it is the art world's best path to diversity. There is a reason that Linda Nochlin never wrote an article called "Why Have There Been No Great Women Weavers?" There have been plenty. And potters. And jewellers. And metalsmiths. Craft is also a rich tapestry of ethnic diversity, having been practiced expertly by people of all nations and regions for millennia. You can make a strong case that the long-standing marginalization of the crafts—and the self-evidently crazy idea that painting isn't one—was just the art world's way of practicing sexism and racism, barely disguised as a policing of disciplines rather than people.[158]

This art has multiple aims, including those that could be described as utilitarian, for constructive transformation of often marginalised groups, a movement to emphasise connection and care beyond the exclusivity and privilege of the gallery and art market; art as an active enquiry: a generative yeast for home-fermentation, rather than a pre-made loaf.

156. Henri Lefebvre, Critique of Everyday Life: The One-Volume Edition, One-vol. ed (London: Verso, 2014).
157. E.g Palestinian Embroidery at Kettle's Yard, https://www.kettlesyard.cam.ac.uk/whats-on/material-power-palestinian-embroidery/
158. Glenn Adamson, Thinking through Craft (London New York Oxford New Dehli Sydney: Bloomsbury Visual Arts, 2018).



From: www.arte-util.org

One contemporary art movement which makes their useful aims specific is the *Asociación de Arte Útil*, co-initiated by activist artist Tania Bruguera which explicitly aims to create useful art that fulfils specific criteria.[159]

> Arte Útil roughly translates into English as 'useful art' but it goes further, suggesting art as a tool or device. Arte Útil draws on artistic thinking to imagine, create and implement tactics that change how we act in society. [160]

Arte Útil looks for art's use in ordinary life - an initiative to reinstate art as a process that is fully integrated into society, including new methods and social formations to deal with issues that were once the domain of the state. The criteria describe the re-casting of artists as initiators rather than authors, and participants as users. This has affinities with the figure of the communard, and with research collaborators, and people who might use the Materials Research Kitchen's tools in future. I tend to refer to MRK participants as *makers* of research. This thesis emphasises making and usership as experience or action rather than the production of products, access rather than ownership, connection over identity, and transformation over static objects.[161] The human-material ecologies involved are an integral part of the work of togetherness.

I don't believe that all art, or even all my practice, must have use value, but some of my drivers are socially or educationally motivated and can apply to ordinary life. The importance of enabling daily creativity is political, supporting people to realise their own agency. Art can operate as an integrated language, in and outside of the everyday, to be a disruptive force in business as usual. Paying attention to materials can reawaken us to our shared ecosystems of materials and making, and make a difference to people's lives. This means paying attention to different conceptions of ourselves in relation to other materials, and the ecological, ethical, and political ramifications of this. I am interested in working outside the context of the gallery, and creating works with – or in the context of – local projects because more diverse voices are needed in research.

159. The notion of what constitutes Arte Útil has been arrived at via a set of criteria that was formulated by Tania Bruguera and curators at the Queens Museum, New York, Van Abbemuseum, Eindhoven and Grizedale Arts, Coniston UK.
Arte Útil projects should:
1) Propose new uses for art within society
2) Use artistic thinking to challenge the field within which it operates
3) Respond to current urgencies
4) Operate on a 1:1 scale
5) Replace authors with initiators and spectators with users
6) Have practical, beneficial outcomes for its users
7) Pursue sustainability
8) Re-establish aesthetics as a system of transformation
From: www.arte-util.org

160. www.arte-util.org

161. As Lakoff and Johnson have shown, the way we think is revealed or made by the metaphors we use. (see Chapter 1 page 85)

Session 6: Terrine and Terroir - The Material Body: Anatomy Through Materials and Making, Art and Food, UCL Medical School, 2020.
Appendix A p.120

EMBODIED LEARNING THROUGH MATERIALS AND MAKING

Glen Adamson's exposition on making and thinking leads us through historical European approaches to materials-led pedagogies, citing educational practitioners and theorists who resist the hierarchical division of fine and useful crafts. These include: John Dewey's art as experience – a refusal to let people's skills be instrumentalised; Walter Gropius' craft as the basis of democratic mass-produced modernism – as instrumentalising as possible, and Josef Albers' advocacy for: "open-ended exploration, an engagement with materials that may result in 'readiness' in the mind, but nothing by way of product."[162]

Adamson notes that medium-specific courses are disappearing in arts education: people are learning skills as and when they need them. Inventor and theorist James Lovelock views artists and inventors as the true innovators, but still sees disciplinary divides as fictional – citing personal and physical engagement with materials as the key to understanding:

> If you want to know about something it's got to be hands-on. Your hands have got to be involved somehow, and the atmosphere has to be different – it has to be personal to you.[163]

Surgeon Roger Kneebone observes:

> …medical students and trainee surgeons often don't seem as comfortable with doing things with their hands … than they used to even perhaps five or 10 years ago. People are no longer getting the same exposure to making and doing [things] when they are at home, when they are at school, as they used to.[164]

Observing these changing trends in learning through the body urges me to engage in making and learning together, not to make education a more efficient way of building the economy, but rather a means of working towards a sound, empowered and well-equipped society.[165] To this end, experimental teaching has become part of my art practice, and transmitting direct knowledge of how to understand, manipulate and respond to materials and the passing on of embodied knowledge learnt by watching other makers, is a natural response to my craft background. The communication of technical knowledge is something to be celebrated as empowering our agency. In teaching practice, I view my role as facilitator, communard, or guide rather than instructor, building in student support, and cultural and environmental context and connect with materials themselves to the process of embodied and situated teaching and learning from each other.

162. Glenn Adamson, Thinking through Craft (London New York Oxford New Dehli Sydney: Bloomsbury Visual Arts, 2018)
163. J. Lovelock et al., Ever Gaia (ISOLARII, 2023), https://books.google.co.uk/books?id=Bpq5zwEACAAJ. 86
164. Roger Kneebone: https://www.theguardian.com/society/2018/oct/30/medical-students-raised-on-screens-lack-skills-for-surgery
165. This is interesting in the light of the new cross-disciplinary developments at UCL East which focus on trans-departmental facilities, disappointingly not backed up by the current government's education and 'creative industries' policies.

Ecologies of Art & Making: five-day
Slade School of Fine Art foundation
taster course, 2020.
Appendix A p.122

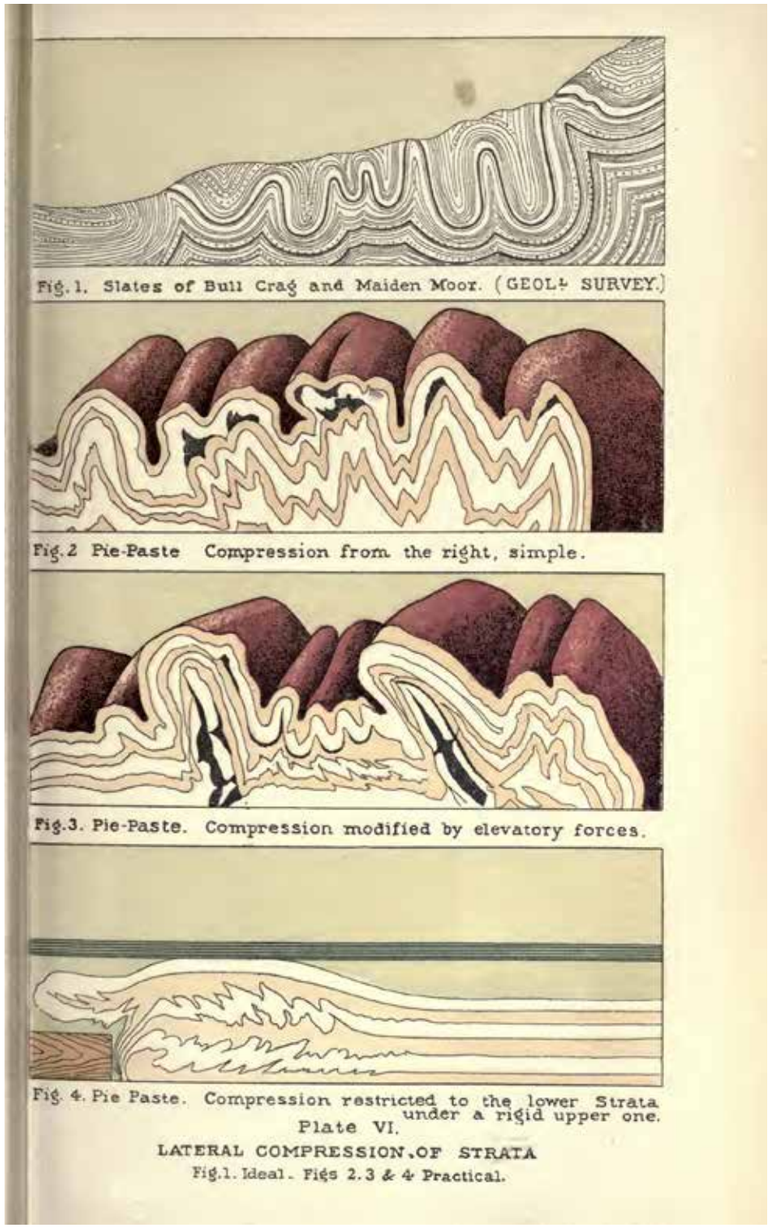
Learning from experience in real time is not easy. For me, active listening in the workshops meant holding back as a facilitator, being ok with uncomfortable moments, waiting to see how things unfold, not trying to force instant outcomes or sense-making, observing, and paying attention to others' responses. This means sometimes being alive to when people feel confident to respond and follow their curiosity, or don't. My own positionality as a white and middle-class presenting university insider must affect things in a group, inhibit or provoke people. Hosting the workshops at UCL or at local growing projects, on people's own turf or in an unfamiliar space, changed things too. The concept of temper returns here; its Latin origin *Tempere* - to mix, is also translated to trouble, to stir up. The strategy of staying with the trouble is one that keeps coming up for me – doing this research has been difficult, a long process, which has required a trusting of the gut, to allow for transformation.

Acting on gut feelings as a workshop develops can mean processing and figuring out connections later, which is where the index cards continue to be 'useful'. I understand that for me, research is a slow-moving transformation process.

For this reason, the MRK learning outcomes focus on energy, engagement, and experiential response, rather than canonical quality or correctness.[166] To encourage this I introduce activity prompts that ask groups to enter a learning relationship in good faith without a map.[167] This is not the banking model of education,[168] but an ongoing dialogue, enabling the trying on or juxtaposition of different perspectives. This is less about acquiring knowledge than entering a relationship with knowledge, which will continue to develop after the session is over.[169] As Sociologist Anna Harris says: "We learn things in life with others and with things… we develop ourselves in relation to our material experience and environment."[170]

And by noticing, we develop sensory awareness for what things are like. I claim not to *teach art* but to use artistic methods, with foodstuff, to participate and facilitate learning *with others* about materials and their own subjects and interests: a perspective which accords with the recent pedagogical turn in art.[171]

166. See Thomas Hirschorn "Energy: Yes! Quality: No! 2013 http://www.thomashirschhorn.com/energy-yes-quality-no/
167. For excellent examples of experimental experiential learning prompts see Mirjam Bayerdörfer and Rosalie Schweiker, eds., Teaching for People Who Prefer Not to Teach (London: AND, 2018).
168. See Paulo Freire, Pedagogy of the Oppressed, New rev. ed, Penguin Books (London: Penguin Books, 1996).bell hooks, Teaching Community: A Pedagogy of Hope (New York: Routledge, 2003).
169. See Shawn Wilson, Research Is Ceremony: Indigenous Research Methods (Halifax Winnipeg: Fernwood Publishing, 2008).
170. Anna Harris, A Sensory Education (Abingdon, Oxon: Routledge, Taylor & Francis Group, 2021).
171. As previosly descussed on page 152, a theme that emerged in the 1990s, the educational or pedagogical turn in art refers to collaborative or research-based art where the work is in the process rather than object-based – and where the form of the art includes co-production of knowledge as means ather than subject.
See also https://designopendata.wordpress.com/portfolio/a-pedagogical-turn-brief-notes-on-education-as-art-2007-kristina-lee-podesva/



I recreated Ruskin's pie-paste geology demo at Low Parkamoor Cottage at Grizedale Arts, and again with medical students at The Material Body Anatomy sessions
Appendix A p.78
Appendix A p.96

Image: Lateral Compression of Strata (Drawn by L. Hilliard; engraved by G. Allen), In John Ruskin, Deucalion and Other Studies in Rocks and Stones: Vol. I, Illustration XV p. 257 (Allen, 1906).

PEDAGOGIES OF ART AND FOOD

Both Adamson and Claire Bishop trace participatory art back to Dada – where food events as art began to blossom at the Bauhaus: a higher education context. The design of the Bauhaus was about connection and sharing; the central eating area was important to the socialising between the arts, crafts, theatre and industrial and architectural design, as disciplines and hierarchies blurred. Black Mountain College came out of this idea, and mixes education with everyday life skills in cooking, gardening, and maintenance.[172]

In the 1970s, Peter Kubelka introduced film and cookery classes at the Städelschule, Frankfurt, establishing a tradition that is maintained to this day in the 'film kitchen' run by students and in the Städelschule's refectory. His improvised lectures: *Metaphors for Mouth, Eyes and Ears*, allowed art history and philosophy to exist on an equal footing with everyday items such as kitchen utensils, musical instruments and food. For Peter Kubelka cooking is: "the origin of culture, as the mother of all arts, it is the original communication."[173]

More recently, food-making is being taken seriously as a way of knowing and explored in science and art departments internationally.[174] The Institute of Making Stratford's forthcoming Experimental Kitchen [175] will provide a forum for hands-on materials and making research through kitchen tools and food-safe processes. The MRK workshops will contribute to the methodological framework of the space, further developing the engagement of hands-on research together in active, embodied thought processes.

Contemporary examples of an experiential learning by cooking and eating together in art institutions are La Cuina del MACBA [175a] hosted by artist Marina Monsonís from an ecofeminist perspective at Barcelona's Art Museum, and Goldsmith's Allotments, initiated by Dr Ros Gray, variously proposed as

172. https://www.blackmountaincollege.org/history/
173. 'Peter Kubelka: The Edible Metaphor', accessed 20 February 2019, https://www.berlinale-talents.de/bt/program/telelecture/158.
174. Roger Kneebone surgical training with craftspeople and advocacy for continued dexterity and material intelligence in science making has led to a collaborative experiential kitchen venture: Imperial College's Chemical Kitchen for introducing undergraduate Chemistry students to lab practice through the transdisciplinary parallel of gastronomy. Jakub L. Radzikowski et al., 'The Chemical Kitchen: Toward Remote Delivery of an Interdisciplinary Practical Course', Journal of Chemical Education 98, no. 3 (9 March 2021). https://www.imperial.ac.uk/chemical-kitchen/about-chemical-kitchen/
See also, Lab 13 UCL Chemistry during the pandemic, an undergrad remote lab providing a 'chemistry kit for the 21st century' placing a focus on measurement and data collection in everyday contexts. The kit comprised pH meter, a clip-on microscope for a phone, kitchen scales, and a digital thermometer, to making e.g. cakes. https://www.nature.com/articles/s41557-020-0543-z
In art and design institutions, for example via Marnie Badham at RMIT: https://rmitgallery.com/events/bruised-food-a-living-laboratory/
Amanda Parmer – Snacks, 2022 in Dr Shannon Mattern's Resesigning the Academy: https://redesigningacademy.wordsinspace.net/spring2022/snacks/
And at alternative pedagogical programmes, for example the Art and Food MA at Gramounce https://www.thegramounce.com/alternativema
175. https://www.ucl.ac.uk/ucl-east/study-and-research/institute-making
175a. https://www.macba.cat/en/activities/the-kitchen-learning-programme-led-by-marina-monsonis/

Saturated camphor solution
crystallising with weather conditions
for use in the Luminal Organs
barometers.
Appendix A p.32

an art research garden, and as part of the MA Art & Ecology programme, but open to all at Goldsmiths, aiming:

> …to facilitate a wider range of artistic research into living systems, cultivation and processing of plants, from food to pigments, rewilding, soil care, composting, techniques for alleviating pollution, eco-pedagogy, and the therapeutic and social benefits of gardening, as well as a space for teaching and public engagement through workshops, performances and other events. [176]

AGGREGATES OF UNDERSTANDING

Carl Jung's interpretation of individuation involved bringing some of the unconscious parts of the self to the surface of the mind, to become a full version of an individual.[177] Although Jung did not write about a sense of embodied knowledge, I relate the technical knowledge that we each hold about making, which goes into 'autopilot', to Jung's idea about he unconscious mind. The French philosopher Gilbert Simondon studied the process of psychic and physical individuation, a view of things coming into being in relation to each other – no separation of animal vegetable and mineral except by that of degree, rather than kind. As described by philosopher and writer Matt Bluemink:

> Just as the crystal becomes a physical individual through the creation of a supersaturated milieu which serves as the source of its individuation, the psychic being is constantly part of a collective milieu of other psychic beings, through which they form a collective unity.[178]

Simondon continues to describe what he called "co-individuation", or "trans-individuation",[179] the process in which a group of entities and their related unconscious form a collective that constitutes more than the sum of its parts. In this process the person is inseparable from the other entities around it and within it – social technological and material. This relates back to Lambros Malafouris' Material Engagement Theory, in which minds and materials (and microbes) are seen as a continuous making process, and to David Kirsh's Cognitive Biome. Irit Rogoff and philosopher Bernard Stiegler talk about how individuation works in an educational or research process, towards this state of trans-individuation, "Not the production of something unique, but of a circuit to which others can add themselves by building on it."[180]

Bringing our unconscious processes to mind through making art as a collaborative knowledge practice, we become like composite materials or aggregates – a word that means a gathering, or flock of things in one body. Through these workshops I have been able to consider ways in which we make each other through reciprocal exchange and reflection - thinking with an aggregate of the body, others, environment, materials, and tools – a situated, embodied PhD-practice.

176a. A series of talks and seminars in 2021 posed the question 'what can a garden be?' towards an Art Garden at Goldsmiths https://www.chase.ac.uk/events-1/what-can-a-garden-be

177. Jung et al., The Collected Works of C.G. Jung.

178. Matt Bluemink "On Psychic and Collective Individuation: From Simendon to Stiegler" Epoché Magazine Issue 40 May 2021 https://epochemagazine.org/40/on-psychic-and-collective-individuation-from-simondon-to-stiegler/

179. Gilbert Simondon, L'individuation psychique et collective: à la lumière des notions de forme, information, potentiel et métastabilité (Paris: Aubier, 1989).

180. Irit Rogoff and Bernard Stiegler, 'Transindividuation - Journal #14 March 2010 - e-Flux', accessed 9 February 2019, https://www.e-flux.com/journal/14/61314/transindividuation/.

Research sausages from a Sausage Session: Bags O' Mystery', 2022
Appendix A p.70

USING TRANSDISCIPLINARY KNOWLEDGE

The term 'transdisciplinary knowledge' has come to signify new ways of thinking about, and engaging in, enquiry. It has taken various forms: a quest for a unified integration of knowledge; a transgressive or critical anti-disciplinary stance; the creation of overarching or transcendent methods to tackle big problems; or the inclusion of non-academic contributors in the process of knowledge production, working together towards socially responsible research.[181] Broadly, if multidisciplinarity juxtaposes the aims, methods and outcomes of disciplines (for example), interdisciplinarity integrates them, and transdisciplinarity transcends them, with the aim of changing the structure of knowledge itself.[182]

There is no right way to know things, knowledges constantly change and diversify. This process can be uncomfortable or messy, but rewarding. I see it as increasingly necessary if we are to tackle big issues in a disordered and structurally unequal world. As Dr Helga Nowotny, one of the founders and presidents of the European Research Council asserts:

> …knowledge… is inherently transgressive. Nobody has anywhere succeeded for very long in containing knowledge. Knowledge seeps through institutions and structures like water through the pores of a membrane. Knowledge seeps in both directions, from science to society as well as from society to science. It seeps through institutions and from academia to and from the outside world. Transdisciplinarity is therefore about transgressing boundaries.[183]

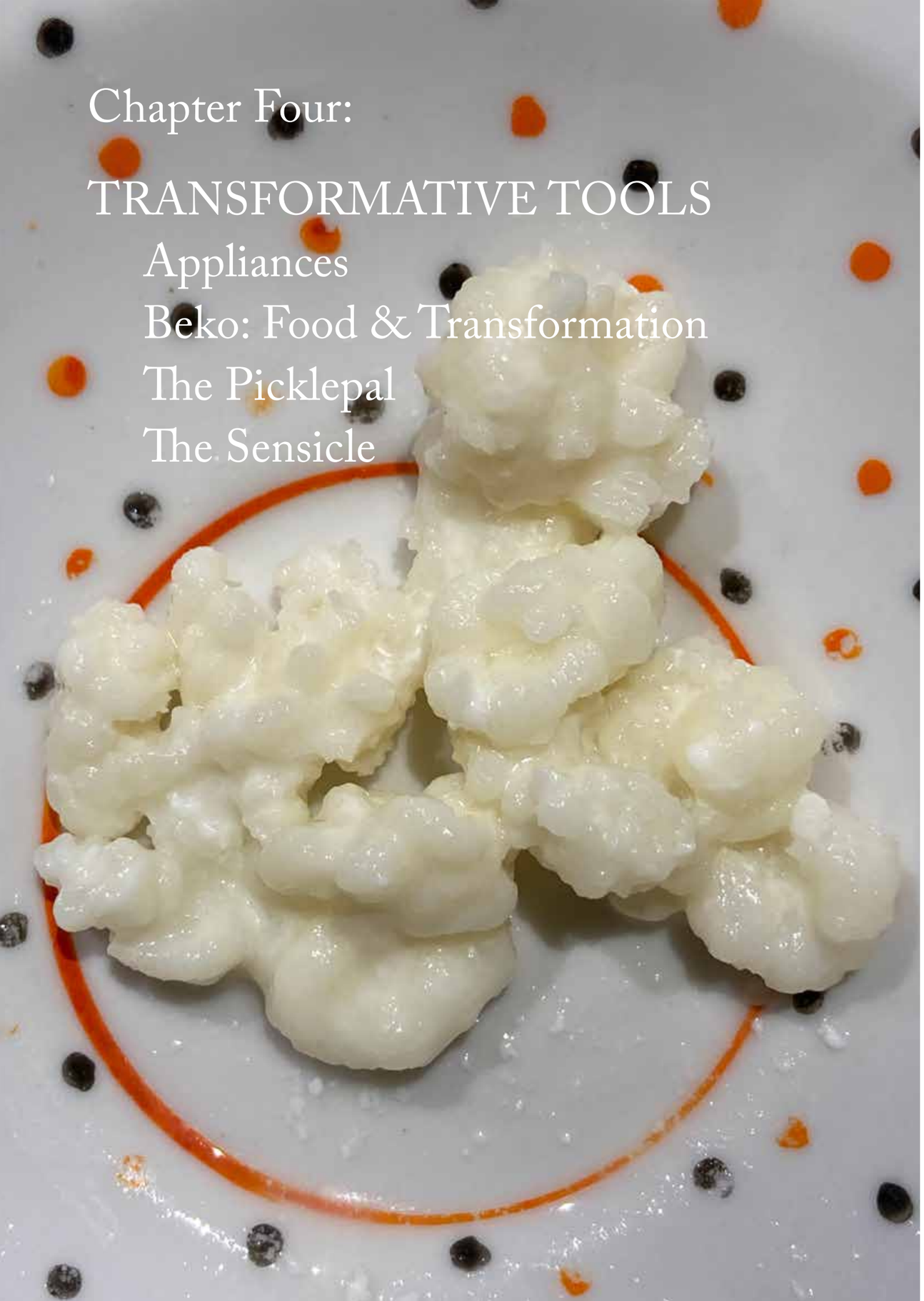
The boundaries between the disciplines in the MRK workshops became porous, connecting with craft, social practice, sensory research, action research, pedagogy, performance, materials science, health and wellbeing, technology studies, domestic science, ecology, and cross-disciplinary research facilitation. The MRK deliberately sited itself within the corporate bodies of both UCL and Beko Plc, and brought up issues of intellectual property, funding, who gets to do research and who benefits, and the balance between contribution, compromise and complicity with the political and ethical ties, interests, and environmental impacts of global businesses and institutions. I had mixed feelings about working with a multi-national company but felt hopeful that the work would bring up ethical questions around 'consumers', and our relationship with the materials of our environment with the potential to influence their work.

This work demonstrates that the MRK as art practice can be used to deepen transdisciplinary embodied knowledge into human-material intra-action. Likewise the disciplinary, cultural and experiential approaches of the participants meld to create something new. This gives rise to a broad range of impacts across domains. (p. 5)

181. See Julie Thompson Klein, 'A Taxonomy of Interdisciplinarity', in The Oxford Handbook of Interdisciplinarity, ed. Julie Thompson Klein and Carl Mitcham, vol. 15 (Oxford University Press, 2010).

182. At a 1972 conference, Jean Piaget and Andre Lichnerowicz first defined it as a conceptual tool, capable of producing interlanguages based on reciprocal assimilations. For more see: Martha Blassnigg & Michael Punt, Transdisciplinarity: Challenges, Approaches and Opportunities at the Cusp of History. in Martha Blassnigg et al., Deep History, Contingency and the Sublime: Transtechnology Research Reader 2012/2013 (Plymouth: Transtechnology Research, 2013).

183. Michael Gibbons and Helga Nowotny, 'The Potential of Transdisciplinarity', in Transdisciplinarity: Joint Problem Solving among Science, Technology, and Society, ed. Julie Thompson Klein et al. (Basel: Birkhäuser Basel, 2001), 67–80,



Chapter Four:

TRANSFORMATIVE TOOLS

Appliances

Beko: Food & Transformation

The Picklepal

The Sensicle

This last chapter introduces how I applied disciplines, technologies, methodologies and thinking in this project. It then tells the story of the foundational research collaboration with Beko Plc entitled Food & Transformation, reflecting on the workshopping of methods, and how I used them to develop the PicklePal: a home fermentation appliance idea.

It then documents the project's subsequent change of direction which led to my development of the Sensicle: a prototype tool for tracking transformation and revealing likeness. It concludes with how this concept exemplifies my thesis as a way of knowing that extends our understanding, connecting the materials of foods, soils, and bodies as they transform.

Live mozzarella cooking demo and tasting, for UCL's Food Metabolism and Society Research Domain's Summer Lecture - Reinventing the Wheel: Milk, Microbes and the Fight for Real Cheese by Bronwen Percival and Francis Percival, 2018.

Previous page: live cultures for making kefir, a traditional yoghurt-like fermented milk product.

Appliances

I have always been drawn to applied subjects – applied sciences, applied arts – ways to employ theory and aesthetics, materials, and technologies as tools to achieve or enrich practical aims.

I get excited about the way that the *use* of appliances – domestic and everyday tools and materials – can help us understand the way the world works, through being able to manipulate it ourselves. As demonstrated in this report, the idea of use and usership[185] are important to my PhD-practice, and the realm of food is an accessible form of everyday making.

Usership in the context of this thesis is an ethical proposition: to expand the idea of use to that of understanding and supporting the material and living ecosystems that sustain the user, not just their immediate needs; including materials and microbes into our cognitive biome.

Creating tools for applying these ideas that are themselves transformative, as well as creating a sense of care for the past and future life of materials, can be instrumental in further transformation of the way we live, with curiosity and care.

APPLYING EMBODIED KNOWLEDGE

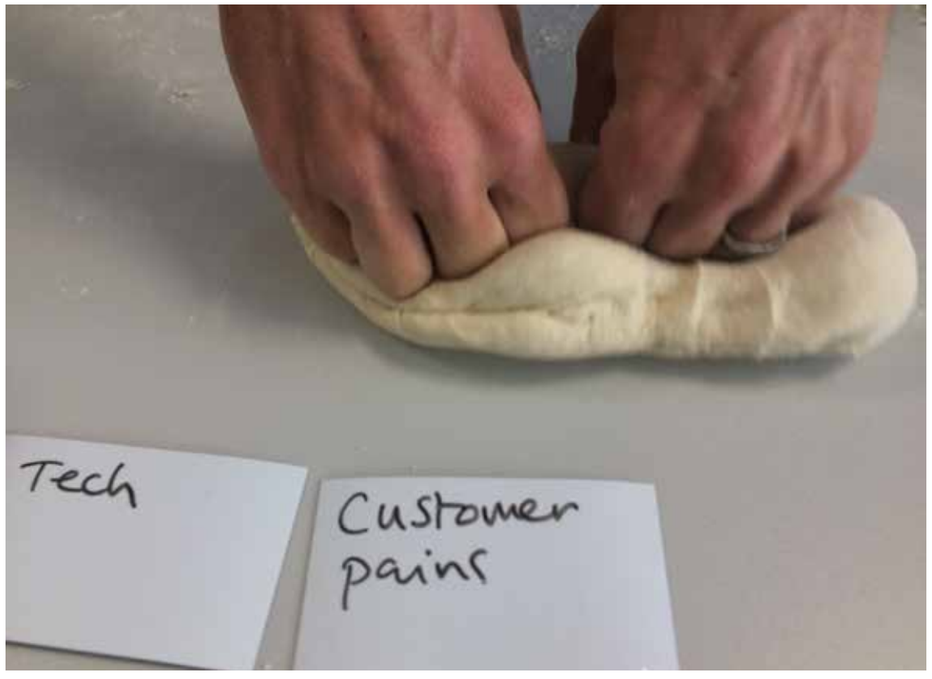
In creating so-called innovation – the practical implementation of ideas to result in something both original and useful – Cyril Stanley Smith's argument for aesthetically motivated curiosity in science and technology is instructive - we notice how materials tools and their interactions are perceived by different people: how things make us feel. During collaborative workshops I have found it important to stay open, curious, and to sit with uncomfortable unknowns in new territory, acknowledging complexity, *Staying with the Trouble*.

In my work with Beko's R&D team, I found it challenging to put experimental methods into practice towards innovation, which was one of their aims. It was tempting to resort to tried and tested methods and ideas which were easier for them to accept. Nevertheless, I went with the flow and followed my hypothesis, (p. 15) that foodstuff and its transformation together can enable new knowledge about our deep material connections.

However unfamiliar the team found the process, this became advantageous to us both, as I show in this chapter. In developing the MRK, I applied the 4Es - embodied, enactive, embedded, and extended theories of cognition to think through kitchen tools, not to replace our bodily capabilities but to extend them.[186] Hands are a sensitive and dextrous cooking utensil, and mouths and noses are sophisticated chemical sensors.

185. Usability, user experience design, or UX is an entire interdisciplinary profession entailing the endeavour to ensure a product or situation responds to specific user needs, a form of problem solving that links ease of use to profits.

186. e.g., Clark & Chalmers 1998, Malafouris 2004, Gallagher 2017, Noë 2009, (p. 117-121)



Flatbread making with Beko Plc's R&D team, 2018.
Appendix A p.146

In their 1995 discussion of consumer technology R&D, knowledge science and business science professors Ikujiro Nonaka and Hirotaka Takeuchi suggested that one difference between a Japanese approach to knowledge and a western one is the importance placed on tacit vs explicit knowledge – akin to technê vs epistêmê.[187] Explicit knowledge can be computed and remotely shared, leading to organisations that function like a machine. Tacit knowledge must be communicated through a range of means which include the body, imagination and a communication of ideals and philosophies. This offered a more rounded, qualitative view of knowledge, resulting in innovation in popular technology and, in their view, the creation of 'organisational knowledge', which is embodied in the company's valuable employees. Their most notable example was the ground-breaking and best-selling Home Bakery breadmaking machine released in 1987 by Matsushita Electric Industrial Co. (now Panasonic). It was invented through trial and many errors, followed eventually by close observation of a baker's technique of twisting the dough as they knead it, and their application of traditional fermentation knowledge to consider when to introduce the microbes (yeast).[188] They valued hands-on skills training, and the passing on of traditional knowledges as research for their R&D team, enabling the company to retain its technological edge over its competitors for many years.

More recent work on new knowledge creation in kitchen matters comes from innovation strategist Dr Vaughn Tan, who studied critically acclaimed international restaurants and found that their 'prowess' grew in situations of desperation. Tan talked of instances where a project was just beyond the team's current capability, and there was a real risk that it might fail, but they were also entirely committed and there was no option to quit. He advocates that teams stay with a productive, uncomfortable, not-knowing, accepting uncertainty in research and development to make new connections and create the conditions for innovative work.[189]

187. Two of Aristotle's types of knowledge; technê corresponds to know-how, qualitative or skill/craft knowing, episteme corresponds to know-what, quantitative or scientific knowing.

188. Nonaka and Takeuchi interviewed Matsushita's electrical team's Home Bakery R&D team and identified the "knowledge creation spiral" around the development of the breadmaker. They were having no success until a software engineer Ikuko Tanaka suggested training with head baker at Osaka Hotel and managed to convey her learned tacit knowledge of kneading (gluten development) back to the team using the direction 'twisting stretch', directing faster or stronger movement by the prototype kneading machine. The other members of the team took on Tanaka's tacit knowledge of how bread is developed properly though her physical directions. Another breakthrough later in the R&D process came, when a member of the team suggested that they use a traditional technique in Japanese fermentation called 'chumen', which added the culture (yeast) at a later stage so that fluctuations in room temperature did not change the fermentation rate. (a process they then patented). I. Nonaka and H. Takeuchi, The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation (Oxford University Press, 1995). Chapter 4, Creating Knowledge in Practice, 95-123

189. Vaughn Tan, The Uncertainty Mindset: Innovation Insights from the Frontiers of Food (New York City Chichester, West Sussex: Columbia University Press, 2020). https://vaughntan.org/innovation-and-not-knowing (p.57)

Dr Zoe Laughlin remakes trainers: BBC Four, How to Make, Series One, The Trainer.

Little Sun Diamond is one of a line of solar-powered lamps by Artist Olafur Eliasson that aim to provide access to light for people who have limited access to reliable energy.

Barbara Steveni in the Brain at Flat Time House, Peckham. Unknown date. Acid-burn photo.
© Barbara Steveni Archive
Via: https://barbarasteveni.org/Work-BS-Barbara-Steveni

APPLYING ARTISTIC THINKING

In the collaborative setting of the MRK workshops, the lines between disciplines become less pronounced. Everyone brings their different learnings and influences to the table, as food-knowledge-holders.

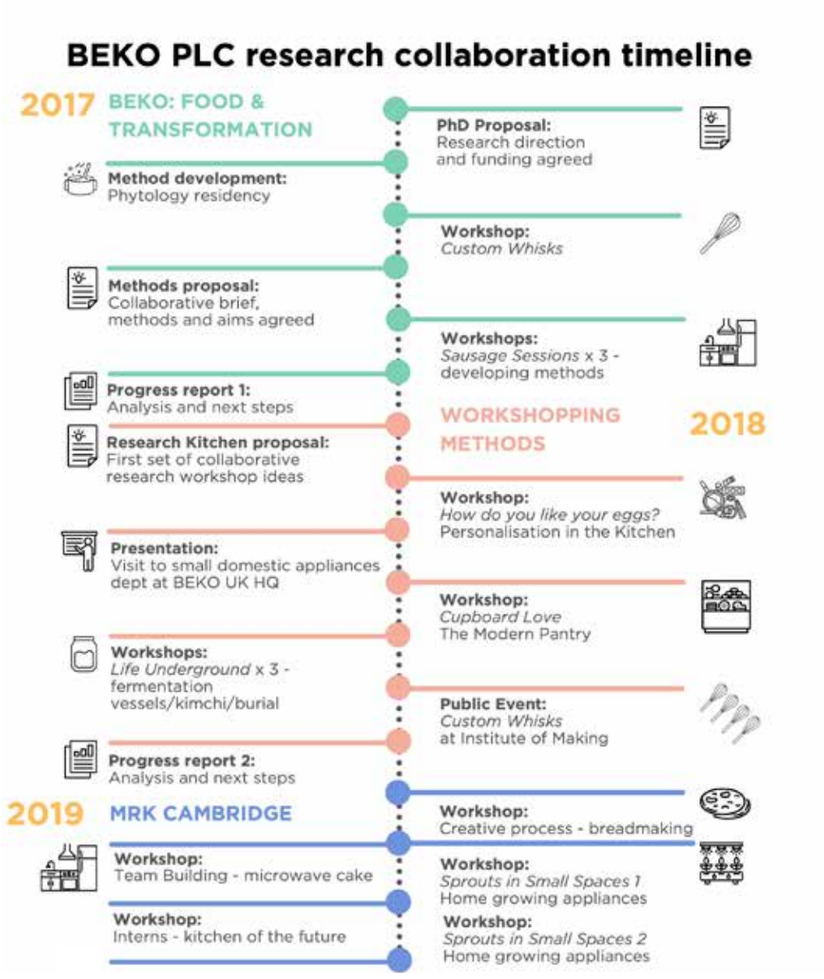
An artist designing a product from beginning to end as part of a multinational company is a highly unusual situation. I was inspired and guided in this process by Dr Zoe Laughlin in her programme series, *How to Make*.[190] She analyses materials and techniques used in industrially produced objects, such as trainers, the toothbrush, and headphones, to investigate them as design technology, by making them from scratch as an artist and materials expert.

Often, artists are brought in to push projects beyond the skill set and 'discipline' of the project team, encouraging risk-taking and imaginative leaps. Artists can also readily connect material, affordance and affect, understanding how aesthetics affect emotions, and how those emotions affect choice. When developing an appliance, there is a need to understand what the user wants to achieve, and how they feel about the interaction between their bodies, the tool, and the desired effect of the substrate they are processing.

In the UK in the 1960s, when experimental artists continued to stage interventions and 'happenings' outside the gallery, there were a few examples of artists working with industry. These include APG – *Artists Placement Group*,[192] founded by Barbara Steveni, (but usually attributed to her husband, John Latham) in London in 1966 to place artists in paid contractual positions within the institutions that govern our lives.[193] The idea behind these activities were akin to their contemporary Joseph Beuys' *Social Sculpture*, a belief that every aspect of life could be approached creatively. Steveni's work emphasised the importance of context in artmaking and expanded the possibilities of the role of the artist; the work of administrating and archiving the activity was a part of the artwork. The APG's activities and structures were foundational to present-day public art programmes and artist-in-residence schemes.

Experiments in Art and Technology (E.A.T.) founded in 1967 New York, aimed to make technology accessible to artists by arranging collaborations with engineers, in a two-way exchange of knowledge and ways of working. Begun by partnerships of artist Robert Rauschenberg and Bell Laboratories research scientist Billy Klüver, artist Robert Whitman and engineer Fred Waldhauer, the group went on to become a non-profit foundation to promote art and technology collaborations and further expand the artist's role in society. [194]

190. Zoe Laughlin, How to Make, Wonder for BBC4 https://www.bbc.co.uk/programmes/m000gwzd
192. APG now exists as O + I (Organisation and Imagination) as an independent international artist consultancy and research body founded by Barbara Steveni in response to the Arts Council's adoption of the idea of artists placements in a different form, but also because the Arts Council had withdrawn funding from APG on the basis that their aims were more akin to 'social engineering' than to 'straight art'. https://www.bl.uk/voices-of-art/articles/victoria-lane-barbara-steveni-and-the-creation-of-the-artist-placement-group
193. Garth Hall was placed with the British Steel Corporation, where he interviewed apprentices and produced reports and papers to the industry. Other placements included ICI Fibres Ltd (artist Leonard Hessing), British Rail, and British European Airways (Ian Breakwell, David Parsons, David Hall) https://www.tate.org.uk/artistplacementgroup/chronology.htm
194. For, more on E.A.T see https://www.fondation-langlois.org/html/e/page.php?NumPage=306



Beko - Food & Transformation

PROJECT PROPOSAL

When the idea for this thesis was forming, I wanted to ground in everyday life the things I was finding out about human-material relationships through my art practice, and my work at the Institute of Making. Specifically, to bring artistic and embodied thinking into the tools we use at home, through food and cooking. I saw a gap in this research activity at UCL, and I had a hunch that through doing this formally, I could connect and widen interdisciplinary cultures.

The idea to site the research in foodmaking led to the need to develop a flexible research kitchen as there was nowhere food-safe to cook as a participatory research activity at UCL, and so I sought a collaborator in the field of kitchen technology. Inspired by research students in engineering who often partner with industry to financially support their work at the same time as generating practical significance and wider impact, I found interest in engineer Dr Natasha Conway, Manager of Technology, Networking and R&D at Beko Plc.[195]

Their UK R&D centre is a concentrated team of 4-6 people located in Cambridge Science Park with stated aims to:

> …investigate novel technologies and develop new products and features for the home which respect the environment and support consumer comfort, meeting their current and future needs. With sensing, smart home technologies and sustainability as our focus, Beko R&D collaborates with UK Companies and Universities on both direct and government funded projects to achieve its aim.[196]

Beko make domestic appliances: machines and electric tools that help with tasks in the household environment, and for this project we focused on their kitchen tools. The project was initially entitled Food & Transformation and set out to develop both real tools that could feed into their roster of domestic appliances and methodological tools for creativity within their team.

Natasha had the courage and imagination to take a risk on an unusual PhD project in a conventional context to develop her team. What I brought to the collaboration was an alternative view of materials and their use, in the development of domestic tools and related technologies. For me, thinking though materials and their intersecting properties and qualities, as well as the past and future lives and ecosystems was important. Material use is wrapped up in emotional, political, and ethical dimensions, and how we live in relation to them and reflect each other, and I wanted to explore this in a context in which it was possible to make practical change.

195. Beko are one of the largest home appliance brands in Europe, and a household name. Arçelik A.S. their parent company, has an R&D and design network of 17 centres worldwide, where they operate under various popular brands including Grundig.
196. https://www.BekoPlc.com/innovation/research-and-development/

Custom Whisks, our first meeting at Beko's UK R&D lab in Cambridge involved making whisking tools from thermosoft plastic and chopsticks, 2017. Appendix A p.134

COLLABORATIVE AIMS

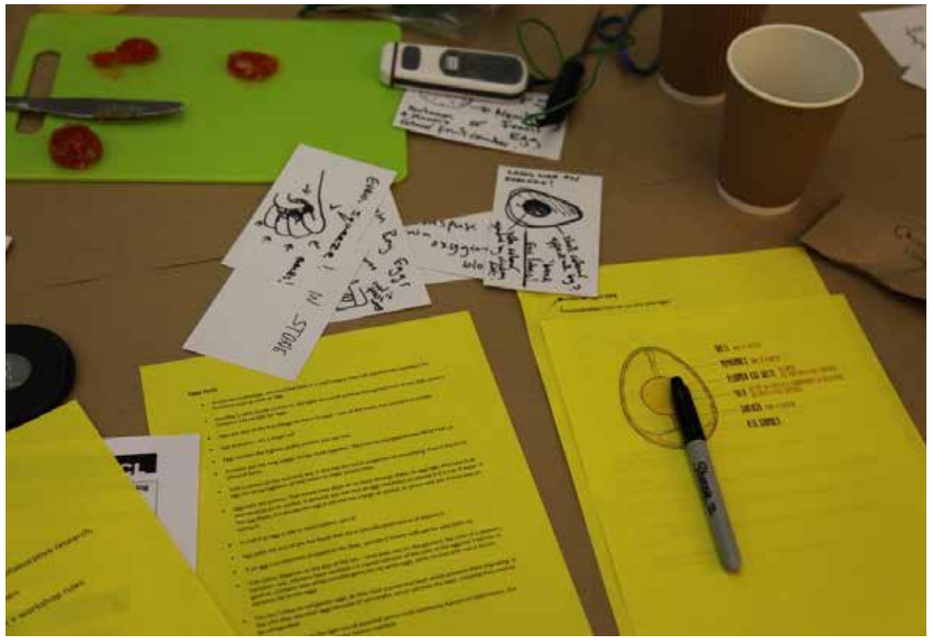
I aimed to develop ways of working on these tools that would be useful for both my research priorities and that of the R&D team. I wanted to see them use and test the tools and materials they were designing for, to encourage them to work with non-engineers and end-users to inform the development process right from the start.

Beko need to stay ahead of their competitors through the innovative solutions to everyday problems that make users' lives easier, developing fresh ideas, insights, and use of emerging technologies. Expanding the process of R&D, my research contribution asked: "Could thinking through using the materials and tools themselves, help us create new and useful tools together, allowing Beko achieve their aims?"

Our initial meeting at the Cambridge office took the form of a making workshop, allowing the team to meet, discover more detailed aspirations for our collaboration and to clarify how we might work together.

From this workshop we set our collaborative aims and terms for the project:

- Stimulate ideas for new kitchen appliances or technologies.
- Develop new approaches to creating the conditions for innovation in the team.
- Develop new approaches to user experience research early in the R&D process.
- Add value through their home Internet of Things (IoT) ecosystem, integrating emerging technologies, user interfaces and materials into existing products.
- Address their current brand priorities: healthy eating, minimising food waste, living sustainably, low buying and running costs of appliances.



Notes on How Do You Like Your Eggs?
A workshop on personalisation in the kitchen, 2018.
Appendix A p.136

MRK METHODS

The process of developing the MRK as a PhD-practice, was interwoven with the Beko collaboration. Our research later diverged as their aims became more specific, but then came together again as I developed the sensory tool as our final project. This section presents the development of a method.

On a visit to their company HQ in Watford, I realised that any user research or focus groups they do only take place after the product has been conceived, designed, and made – and by the marketing team, rather than the technologists. The existing ideation process at Beko R&D seemed to rely on an imagined empathy with the immediate user needs and imagined "customer pain".[197]

Natasha confirmed that the team are very good technical problem solvers but need help from the user experience side, and I suggested basing our workshops on user experience from the very beginning.
I proposed to achieve this through bringing together expert researchers across disciplines, alongside food experts from domestic, community and amateur spheres, to think through the cooking and eating process together. The aim was the development of a new method of devising inventive ideas for products, technologies, and research avenues, which were fun and accessible, yet tackled advanced questions.

The action research methods I developed in 2017 suggested that working with the materials and tools in an interdisciplinary workshop setting might garner more detailed insights about how people prepare food and how they feel about it.

I sought to cultivate this way of working through collaboration with Beko to develop more specific methods that would both meet their needs and enable me to explore my own wider research questions towards transdisciplinary insights.

In applying my hypothesis to this context, my own motivation was to investigate how kitchen appliances and the materials they are made of, extend our senses and cognitive processes, enriching our relationships with the materials they process, helping us see how connected we are to other materials. I aimed to gather more data from the perspective of curiosity and care for appliance users, tools, and material ecosystems. To this end the workshops I devised allowed open-ended discovery on a series of themes agreed with Beko's R&D engineers.

197. For an analysis of the failure of design thinking that does not listen to the user, see: Rebecca Alderman, "Design thinking was supposed to fix the world. Where did it go wrong?" MIT Technology Review, February 9, 2023: https://www.technologyreview.com/2023/02/09/1067821/design-thinking-retrospective-what-went-wrong/

Dr Antonio D'Ammaro, mechanical engineer and technology developer.

By this stage, Beko R&D engineer Antonio D'Ammaro had been tasked with supervising my PhD project. A lively and creative person, he became very involved in developing methods and structure with me throughout the project, ensuring the learnings went both ways. For our first two proposed workshops, I suggested a list of concepts for the team to choose from, that addressed two specific priorities within Beko's agenda, based on upcoming trends in customer desires and kitchen technology. Antonio chose two ideas to take forward of these, *The Pantry*, and *Personalisation in the Kitchen.*

- Surfaces: pancakes - temperature, roughness, skin, substrate, transparency, softness, gravity, stretchiness, attraction & repulsion, stickiness, microstructure, pleasure and disgust in touch, biofilms, cleaning, reflection, light, cost.

- Mixing: mayonnaise, oil & water, liquid and solid, speed, surface, shape of blades or paddles, air incorporation, particle size, viscosity, integration with other tools or home ecosystem, power, cleaning.

- Cold: freezing points, ice cream, ice, conductive materials, heat sucking materials, cold mediums: air, water, oil, gases, condensation, using energy from other tools.

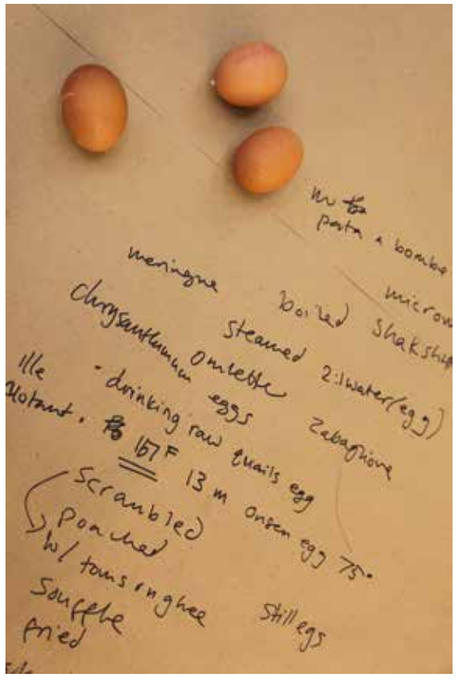
- Heat: radiance, conductivity, burning, warming, flames, residual heat, waves, hot tools, heated materials, heated mediums: hot air, water, oil.

- Air: convection, heating and cooling, humidity, trapped air, expanded air, vacuum, pressure, gases – nitrogen, carbon dioxide, energy use.

- The Pantry: bread processing and storage, surfaces for heating and cooling, dry goods storage, freshness, humidity, pests, fermentation, condiments, ageing, food waste, fuel use.

- The ghost of kitchens past in the kitchen of the future: Outdated kitchen design, The pantry, the larder, the washboard, the crock pot, the herb garden, home ecosystem.

- Personalisation in the Kitchen: how do you like your eggs? Your go-to healthy meal, tools used, the character of materials, the taste of home / how your grandma used to do it, choice and happiness, modifying your tools/kitchen hacks, kitchen annoyances. integrating your tools and home.



How Do You Like Your Eggs? A workshop on personalisation in the kitchen, 2018. Appendix A p.136

MRK BEKO

Each time, as with the Sausage Sessions, I prepared a workshop structure, a handout of provocations, and gave people cards and pens with which to note thoughts or ideas which arose during the discussion and making.

We would introduce ourselves over food, and present what we'd brought to add to the pantry. Each time there was a demo, and experimental session and a making task, and I tried to experiment with how much instruction to offer each time.

After the session the cards were stuck on the wall and rearranged to find themes. Post-workshop I drew up a list of questions for Beko which arose from the cards to spur our own ideas.

The first Beko MRK workshop focused on personalisation in kitchen tools, and my own focus was - how are materials like us? How are we like our food? Through cooking the iconic and globally recognised chicken's egg, we explored several themes relating to the idea of personalisation, in *How do you Like Your Eggs*?. (Appendix A p. 136)

A diverse group in background and discipline signed up from my food-research mailing list, and engaged in tasting, making, recipe writing and discussion, to experiment with prototyping cooking tools that enabled eggs done a specific way. Discussions were documented using the index cards while we made bespoke tools to cook our eggs in the exact way we like them done. They ranged around ontological questions about food, material qualities properties and how we feel about them – sensory affect, and emotional, memory and cultural links. How we like our eggs – recipes as reflections of culture and sensory preference. Food technologies, and how we interact with them as extensions of our bodies, and how to achieve food done to our preference.

Questions and insights that I found interesting include:

- Senses and culture: how do sensory perceptions, whether it's flavour, sound, texture, door-click equivalent, or cultural use, remind us of home, or just feel 'right', or the converse, feel 'wrong' to us?
- How can we make cooking implements extensions of our own senses or even our tacit knowledge?
- Could we include data from tools, plants, microbes, pets, materials, into Beko's *Home Wiz* (Internet of Things) connected system? Can we make it a reciprocal communicative environment?
- The connection between you and your stuff could be meaningful: the work horse frying pan – having something solid in your life.
- What do your appliances say about you? What do they know about you?
- Can your kitchen be a mirror?
- Texture and process is personal, emotional, and cultural. We know in a very sophisticated way how we like our food. Tools that can achieve very specific effects are a unique extension of our needs and desires.

Cupboard Love: the modern pantry, a workshop on living with your food, 2018. Appendix A p.140

The second workshop they chose from the list was: The Contemporary Pantry. My focus was – how do we live with our food?

Pantry comes from the French word panetere, which, in a big house would be where the bread would be kept, cool and dry. This session took the form of a preservation workshop - making and eating fermented and preserves, materials handling, to consider the way materials and technologies involved in the way we store food - Cupboard Love. (Appendix A p. 140)

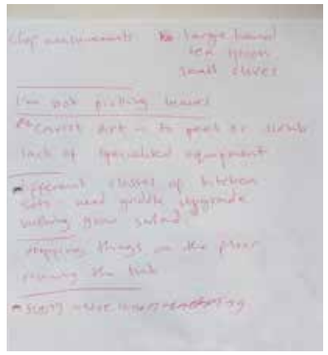
Through this we explored ideas of conditioning and care for the materials which we will put in our bodies, and how we might live with our food and its associated microbial communities. We aimed to take inspiration from the way pantries and larders of the past worked with the properties and actions of materials and microbes, to re-imagine the modern pantry to encourage a healthy relationship with our food.

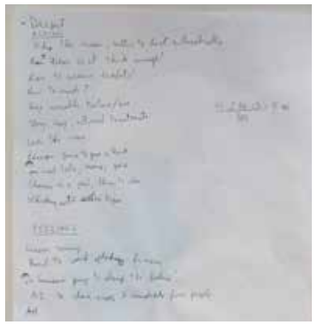
With tacit knowledge of material properties, you can create tools that keep foodstuffs in the desired condition but use no power – terracotta and water fridges, marble larders, cheese safes. It was held in the Materials Library at the Institute of Making which enabled us to experience some of the material properties we were interested in.

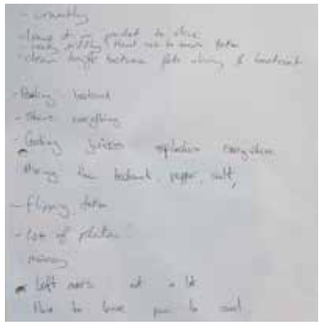
Questions and discussion points I took forward from this workshop were:

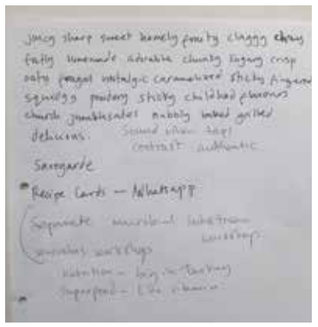
- The role of the pantry.
- The pantry as metaphor, and ways of seeing it in relation to ourselves.
- Living with edible materials and microbes as a reflection of our own health.
- Existing food relationship practices that could be revisited for future food needs in a changing climate. Ideas for materials for a modern pantry.
- Preservation recipes.
- How to live with transforming materials - thinking about 'condition' and care for edible materials and microbes that are valuable, and that we will then eat.
- What surfaces do microbes like to live in e.g., salami caves, not keeping tomatoes in the fridge.

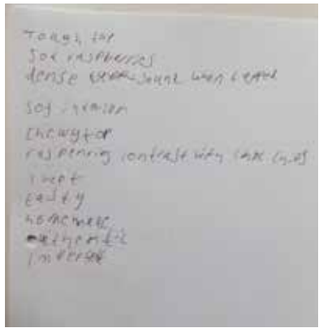
These index cards led on to some of the thoughts around our *Close Encounters with Materials and Microbes* workshop. (Appendix A p. 98)

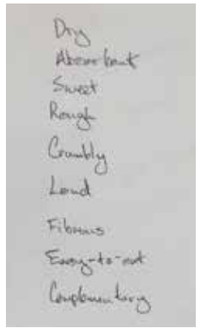


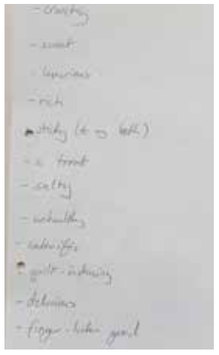


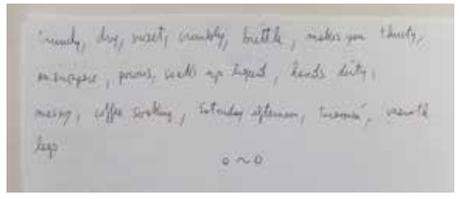












Intern and researcher notes on our sandwich workshop, alongside their notes on our 'biscuit meditation' as we begun the a session by noticing the qualities and properties of foodstuff, 2019.
Appendix A p.147

MRK CAMBRIDGE

It was clear through meeting and working with Beko that the team could benefit from more daily use and experimentation with materials and tools for cooking, to play with ideas. I felt like the project would be a success if we could establish a culture of collaborative experimentation and cooking together, even if in a small way. So, after the first two workshops at UCL, I set up several workshop sessions in Cambridge with the idea of forming a Materials Research Kitchen and do some team building at their research centre.

Through contact with the Cambridge team, and their involvement in the research sessions I was pleasantly surprised by our interactions, their generosity and openness to new ideas, this was particularly the case with Antonio, and engineer Gavin Summers, who were both willing to guide me in developing ideas for their industry, while trying my approaches.

We trialled a workshop to think through the possibilities of kitchen automation and the kitchen of the future with the Beko team and their young interns, but I soon realised that following recipes together was too complex with the limited kitchen equipment we had at our disposal and left no room for thinking about the matter at hand.[198] The workshop did, however, highlight how difficult kitchen automation is, due to the messiness of cooking and the variability of the raw materials of food.

Natasha had concluded through our Cambridge workshops that although we needed a use case for a new product idea – a description of how a user might interact with a tool towards their goal – the use case was not what Beko R&D team should be brainstorming. A use case should be developed with users; therefore the MRK concept would fit better with initial ideas, or prototype ideation, rather than technical ideation.

My ideas of what might make a successful collaboration changed throughout the project. I initially thought we might develop a method that the team could use to think through cooking. However, I found that the MRK helped us come up with specific ideas and future challenges with participants from different disciplines. These ideas, on the index cards, could then be developed in-house through creative workshopping with the R&D team themselves to generate ideas for how things could be made.

198. This was partly a bad decision on my part to supply sandwich recipes by Nigel Slater, which were too unusual and complicated for the context, not the sort of thing you could automate.

Successful participant cress growing, documented via text message group in between our Sprouts in Small Spaces workshops, 2019.
Appendix A p.142
Photograph: Pascal Durrenberger

TOOLS FOR EXTENDED SELF-CARE

Towards the end of the second year of research the team asked me to apply the developing methods to an upcoming area of their interest, home growing appliances for a specific demographic: higher education graduates, London based, aged 20-40 with an interest in healthy living. The Beko team asked for quantitive results and insights from the two sessions.

My main insight from these two workshops was that people from this demographic claimed to be motivated to grow food for recreation, aesthetics, and for wellbeing and ethical reasons, and supplying yourself with food was low on the list. This realisation led into the idea of a two-way appliance, allowing people to care for something and see it develop every day, which in turn cares for them through improving their mental health. This insight arose after basing so much of my work in community gardens, where I met urban residents who longed to reconnect with material and food ecosystems. This was evident with my home grower group who felt that by nurturing something growing in their flat or windowsill helped with their general wellbeing.

Looking at the *Internet of Things* as outsourced cognition in this context is interesting in relation to how much of our thought processes we might entrust to technology, allowing it to become a two-way part of the extended body. Data from plants, microbes, pets, materials for example could become part of a home appliance ecosystem.[199]

With this group I used a mobile group chat for the group to share their growing progress and thoughts about the appliances, which encouraged the group to track and share the transformation progress, to be a part of a wider process; the mobile group became part of the workshop method which I continued for the rest of the project.

199. Notwithstanding the possible ethical issues of data sharing the details of our everyday life to private companies who might then use them in ways we have not consented to, which confounds any notion of care in this context.

Cucumbers fermenting in brine, after our online Fermentalong, 2020.
Appendix A p.152

The PicklePal

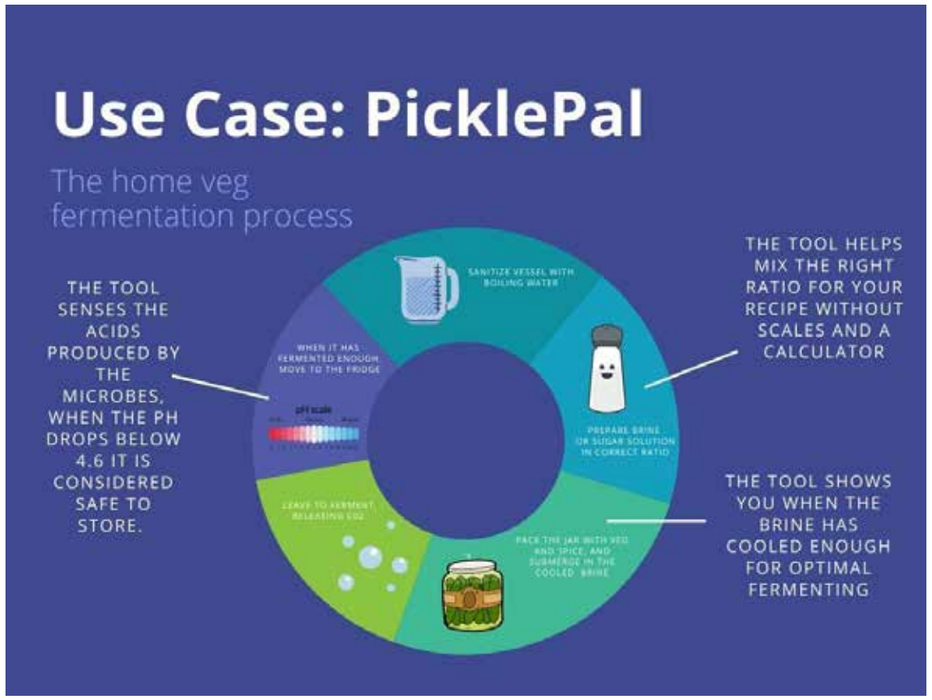
During the third year, we agreed to work together on the development of a design for a new fermentation appliance, from conception to prototype. Natasha and Antonio had indicated that a focus on a collaboratively developed product would be more desirable for them rather than a focus on general research methods, but that specific research methods could further develop alongside the process of invention. By then, Gavin Summers, a sensors expert had joined the team, and I worked closely with him to prepare our proof of technology. (Appendix B p. 204)

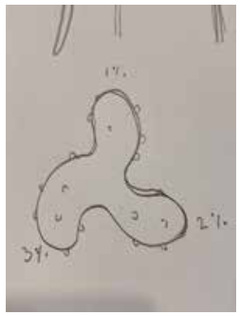
The interest in transformation began on residency at Phytology where I got interested in the constancy of change and manipulating materials to work alongside the life that was there, making beeswax plums, vervain mead, buddleia wine, meadow herb paneer, nettle rennet, connecting with volunteers, staff and locals on site who were herbalists and medicine specialists. (Appendix A p. 14)

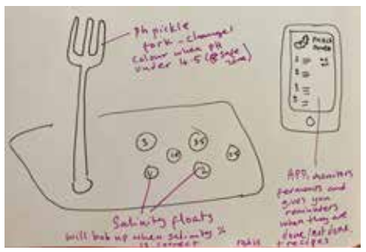
Artists often flag up wider developments and I saw fermentation appearing in art and culture, and the importance of gut health also on the rise in national consciousness, I wanted to encourage Beko to tackle something which was missing in their kitchen tool repertoire. Through our workshops on the sausage, the pantry, kitchen tools and then home growing, I believed that people wanted to pickle at home to extend the life for their food and themselves, to add value to cheap ingredients, reduce waste, and tend a microbe garden. My consumer research indicated that people wanted to have the expensive colourful fancy probiotics at home without the expense or too much work.

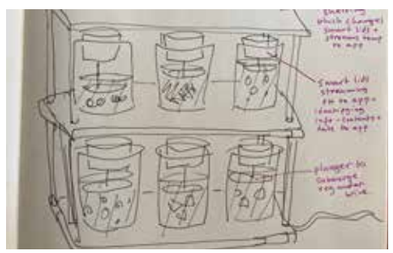
Discussing the collaboration with student mechanical engineer Prashanthan Ganeswaran, one of our members at the Institute of Making, I voiced my worry that technologies like smart fridge sensors that told you when food was going bad, and thus to dispose of it, might replace or blunt our senses. His view was that they could end up educating us about what microbial activity looks and smells like, retraining the senses we've lost due to industrialisation. If, as I have discussed, embodied knowledge is vulnerable to disappearance if it's not passed on person to person, perhaps technology can help with the re-education of gut feelings, linked to gut microbes. Gut feelings about mould and smells have culturally different levels of acceptability and taboo, something I had to bear in mind when developing tools for a multicultural yet overall quite conservative UK food consumer market.[199a]

199a. For a recent discussion of the abject in aesthetics of microbial growth, see Parker, Brenda, and Marcos Cruz. "Chapter 11 Augmented Polycultures: Scaling up Algal Ecosystems and Design of a Biofouling Aesthetic". In Being Algae, (Leiden, The Netherlands: Brill, 2024)









Use case, ideas and initial proposals for fermentation tools.

HOME FERMENTATION

Using these insights, I pitched the idea of a home fermenting tool that would enable human material microbe intra-action in practice, and to encourage curiosity and care through tending to living ferments, monitoring, and understanding their conditions. This would encourage self-care alongside care for food, microbes, and the environment, in a circular relationship. The importance of a healthy microbiome, not only to digestive health but to our immune system and many other parts of our physical and mental health is only just beginning to be understood, along with the realisation that our diet, environment and emotions can greatly affect the diversity of the microbiome.

The aim was to develop a kitchen appliance that would enable the user to monitor acid, salt and/or sugar concentration, and temperature changes in homemade fermented food and drink, which all vary depending on the type of ferment you are making, and personal taste/health preferences. [200]
Home fermentation can be as simple as the right ratio of salt, water, vegetables and a vessel. The idea being to create conditions which – along with warmth, oxygen and time – encourage lactobacillus bacteria and its friends to eat the sugars in the vegetable material and produce lactic acid, making an environment too acidic for spoilage bacteria to thrive. Happily, at the same time, creating other delicious compounds. I wanted to explore the possibility of a device that would help with some of the main barriers to home fermentation: fear and disgust of unpleasant smells, textures, tastes; an aversion to unknown moulds and bacteria whether passed down as a cultural taboo or learned through experience (the impulse to chemically sterilise everything is strong). It is also difficult for beginners to know when a ferment is working, when it's ready, or has gone too far. The tool could lead to new embodied knowledge of how materials and microbes interact and what that tastes like, not to mention educating our gut-brain-immune communication system when we metabolise the fermented food.

The tool would enable these groups to reliably make fermented food and drink to their taste at home for reasons of flavour, health, and recreation. I undertook on market and consumer research at the British Library which confirmed these were all upcoming trends in UK food preferences. To go ahead with the idea, the team needed me to produce a *use case*, (left) and a design and development brief and plan of the methods I would use to achieve this. Surveying up-to-date research to get an understanding of changes in culture, markets, and other brand approaches, helped to target the right users, and draft a use case more effectively than any small sample I might be able to supply. (Appendix B p. 182)

As the year ended, and we headed into 2020, Natasha moved on to work elsewhere, and Antonio took over the management of the project. I embarked on fermentation research in 2020 with gusto, alongside teaching experiments with young medics and east Londoners. Our first workshop DIY Cultures engaged Jelena Belgrave, a fermentation educator, who took beginners through the process of making a basic kraut-style ferment, as I facilitated the note-taking process on the index cards. (Appendix A p. 150)

I proposed two fermentation device ideas to the Beko team for development - a 'toolkit' and a 'smart shelf'. (left) However, in March 2020, the Covid-19 pandemic and the UK lockdowns meant that this PhD had to take a different direction.

200. Fermentation is when bacteria and fungus break down starches to make sugars, which they and other types of microbes then transform or ferment by eating, and excreting gases and acids or alcohols, which other microbes then turn to vinegar, or age into different forms which can be delicious, nutritious, useful and sometimes fizzy.

Online Fermentalong, 2020.
Appendix A p.152

Research on appliances during UK lockdown 2020.

R&D IN A PANDEMIC

Beko and their teams redirected their efforts into the manufacture of hospital ventilators, I had to interrupt the project for health reasons, and when we met again to continue the project remotely, pursuing a home fermentation tool seemed even more timely. For those in the UK who were shielded from the worst effects of the virus, there was an increased desire for connection with natural ecosystems, and increased awareness of the potential effects of microbes on our health and wellbeing. I was interested in how the body's ecosystem could include extra-sensory tools – extending perception and thought process in a time of limited touch and microbial anxiety, and a consequent need for increased immune health.

During the enforced lockdowns in the UK, the consumption of natural, probiotic-containing food was suggested as beneficial for improving gut health and, consequently, overall health. Social media such as Instagram and TikTok pushed international fermented foods into more UK home cooks' feeds. People were making a great deal of sourdough bread in the UK community, and trying their hand at other types of fermentation, while discussing immune health and self-sufficiency online. Food systems and supply chains faltered during Covid. Stockpiling and isolation were coupled with the desire to sanitise shopping and ourselves with substances claiming to kill 99.9% of bacteria (while not addressing viral transmission). We wondered what the longer-term effects of this blanket anti-microbial drive would be.

R&D processes continued via video calls and online archives, and people's priorities changed. I held a jolly online 'fermentalong' with the team and their families, to help them understand the principles and pleasures of fermenting at home and asked them to track and taste the progress of their ferments. This further convinced them that they would benefit from an appliance to help them understand what was going on in the jar. Physically working through the processes enabled us to identify and analyse any difficulties or uncertainties and their feelings about them, rather than guessing or assuming things about our users. This created a more accurate use case, enabling us to specify what our appliance offers and compare it with other tools on the market.

The team decided they wanted to pursue an all-in-one fermentation chamber which would fit into their existing small domestic appliance (SDA) range. I dubbed it the PicklePal, to inject some humour into the R&D process as we were all working under adverse conditions. They first asked me to produce a proof of technology document, technical research into the variables we needed to control for optimal fermentation, and research on the sensors currently available, before embarking on design (the how-it-works before the how-it-looks). Pinpointing exactly what a tool needs to measure, and what variables, ratios and ranges are appropriate for the tool's use case helped us streamline a brief, to measure only what we needed. If we know what our users want, our designs can focus on specific functionality within the range of aesthetics and functionalities indicated in our DIY Cultures workshop.







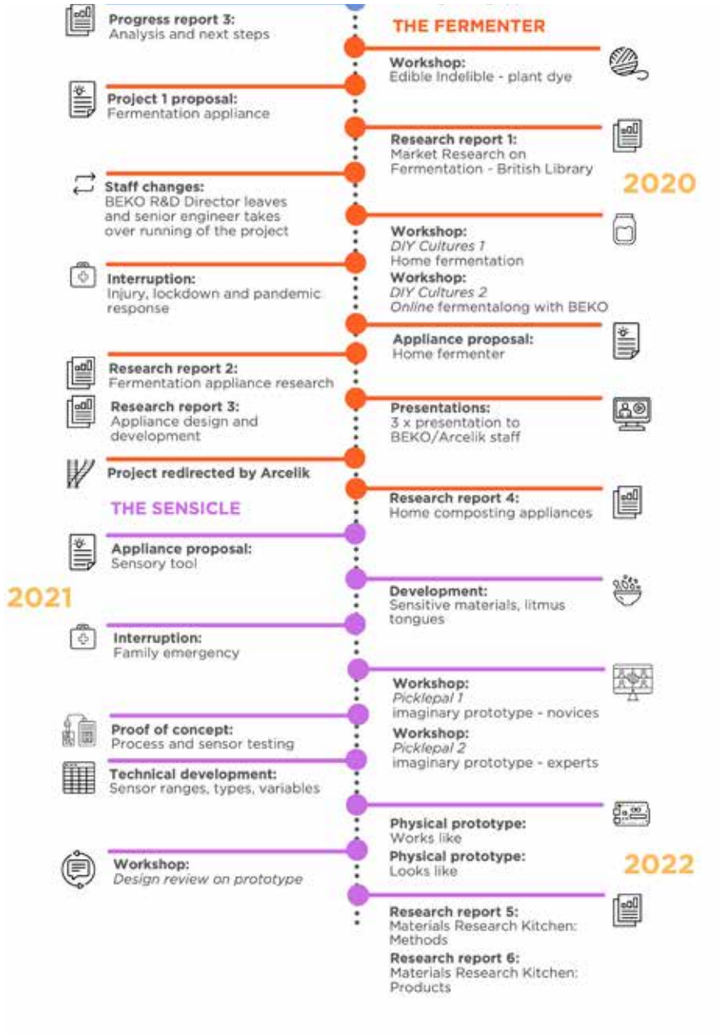
CAD designs by Beko R&D intern Owen Griffiths, 2020

I wanted these variables to work together and – in researching how the chamber might work, look and feel to use – I chose to look for sensory indicators rather than digital readouts, to allow for a more intuitive use of material transformations, favouring more analogue 'sensing', and biodegradable forms of measuring our variables – for example I found papers presenting the invention of colour changing polymers to indicate acidity using the pH or potential Hydrogen scale - a measurement for determining the concentration of hydrogen ions in a substance.

Another approach I investigated was the use of materials that refracted light differently to indicate the correct salinity. I experimented with transparent plastics of different densities which would disappear when immersed in a jar full of brine of the correct salinity for pickling different vegetables - perhaps to be used to make a pickle fork or salt spoon. Antonio showed me an interesting project which used beetroot and paper in a pregnancy test indicator, and a novel wound dressing which changes colour if an infection is present, based on pH changes.[201]

In the end the team asked for a more conventional-looking appliance to present to the wider team at Beko and Arçelik A.S., and I worked with Beko intern Owen Griffiths using CAD, rendering drawings to present to the company online. My freehand drawing and improvised modelmaking helped communicate ideas to our team who were able to narrow the designs down to a final form: a benchtop all-in-one appliance. Owen identified and came up with several solutions to the problem of the plunger lid not fitting in the machine (for example by making the stick detachable and the pickle weight lockable). The CAD drawings helped senior staff to imagine the idea sitting alongside other appliances in their range. (Appendix A P. 155)

201. Fraunhofer-Gesellschaft. "New bandages change colour if infections arise." ScienceDaily, 16 November 2010. www.sciencedaily.com/releases/2010/11/101116093821.htm



REDIRECTION

At the end of Summer 2020 we presented the idea on three occasions to different executives at Beko, but on presenting to the wider Arçelik A.S. team, it was revealed that although they liked the idea – no matter what the design – they would never go ahead with developing a home fermentation concept, as they had already conducted research which indicated that it would not sell well in the UK market.

They also indicated that they would be bringing out a more specific yoghurt maker for the Turkish market the next year with temperature and time control, and pH 'flavour sensor', allowing sweet/normal/sour yoghurt options, connected to their home wiz app.[202] This is where the cultural differences in food really became apparent – Turkish, middle eastern and east Asian home fermentation traditions are still largely alive and mainstream, unlike in many western European households where live fermented foods are treated with more suspicion.

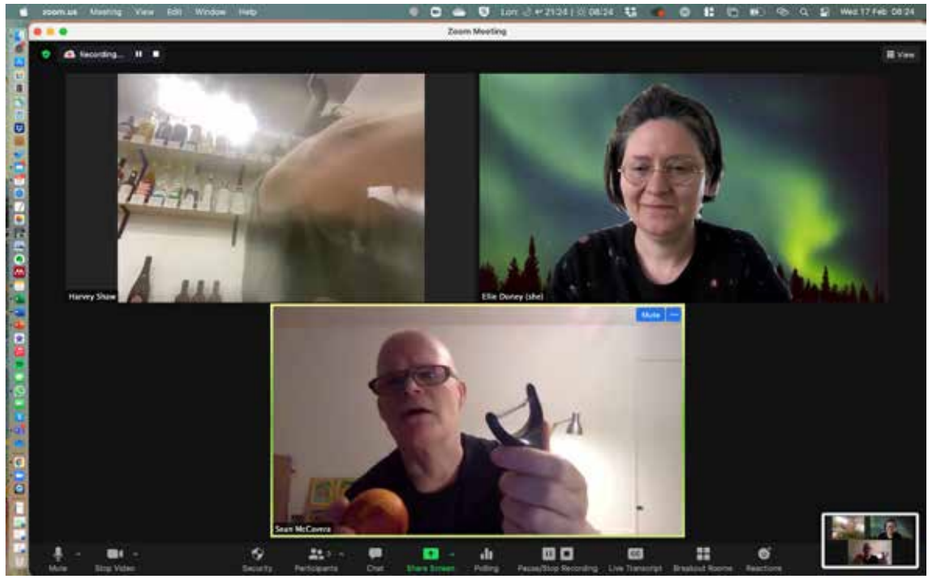
Although the market research pointed to fermented foods as a growing trend, UK respondents turned out to be disparaging in their attitude to the use of an appliance to achieve this.

It is still largely taboo to tend microbes or deal with visible mould (aside from bought cheese). Even though our daily staples are products of fermentation, like tea, coffee, cheese, yoghurt, bread, chocolate, and beer, the UK doesn't have any well-known live brine (lactobacillus) fermenting traditions of its own, preferring to pickle things in vinegar.

This was disappointing to our team, as we had spent a year developing it, but they admitted that the communication inside the organisation could have been better when working out what ideas the wider company were already pursuing.[203]

202. iF Design Awards 2022, Arçelik A.S. Gurme Yogurt Maker: UX https://ifdesign.com/en/winner-ranking/project/arcelik-gurme-yogurt-maker/347860.

203. Once this video call was over, our team decided to change tack, and we agreed that I begin research on a home composter which would mesh with UCL's Big Compost Experiment by the Plastic Waste Hub: Danielle Purkiss et al., 'The Big Compost Experiment: Using Citizen Science to Assess the Impact and Effectiveness of Biodegradable and Compostable Plastics in UK Home Composting', Frontiers in Sustainability 3 (2022), https://www.frontiersin.org/articles/10.3389/frsus.2022.942724. This avenue also turned out to be something that Arçelik A.S. had rejected!



Imaginary Prototype workshops with beginner and expert fermenters, 2020. Appendix A p.160

The Sensicle

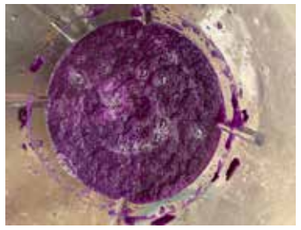
After big changes at Beko due to Covid and staff restructuring, the R&D team suggested they assist me in the development and prototyping of an idea that went further in the direction of my own aims, and to continue to develop our specific methods together.

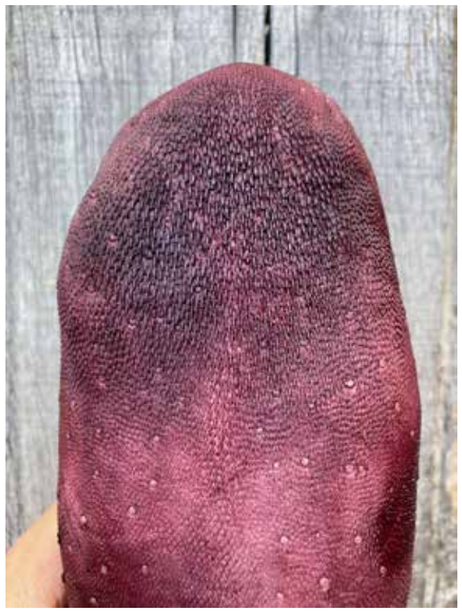
Following the thread of something that could tell us about our health and wellbeing as connected people – and also contingent on our surroundings – would allow the research team to use our existing research on fermentation to prototype a speculative sensory tasting tool, more versatile than the appliance we had designed initially for fermented foods/ We were looking at something which could sense changes in a range of materials related to the actions of microbes, in a wider range of environments than the benchtop appliance would allow.

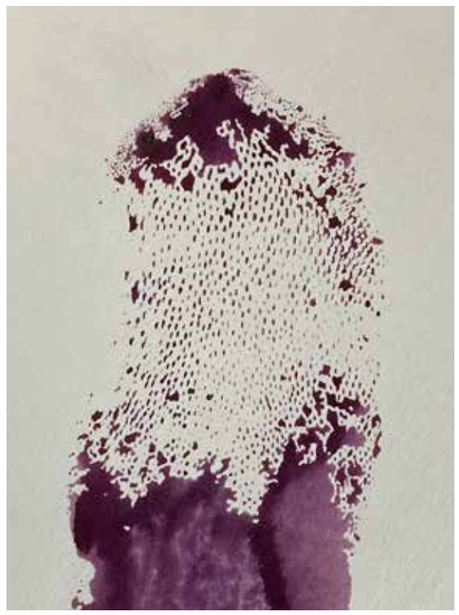
This tool would address the questions I had set for this PhD, and I decided to apply the MRK methods to the next round of participatory workshops to gauge how people might use such a sensory tool, what it would need to sense and tell you about the process, and what form it might take. The idea of 'imaginary prototyping' came from a conversation with roboticist Richard Sewell, who recalled a workshop he was part of where the protype ideas were imagined and described to iterate and play with ideas quickly, to avoid resource heavy ideation processes, which we needed in our remote situation.

We decided to hold a series of exploratory online workshops about fermentation tools, inviting first novices and then more experienced or professional fermenters to consult on a direction for our technical research. We found that beginners understood the concept of pH less than other variables, and wanted something fun to use, whereas the experts needed reliable pH measurements but favoured robustness, longevity and simplicity. No one designed a tool with a numerical readout indicating that for a home tool, people wanted something different – more sensory – than a traditional pH sensor.

We began with quick drawn designs, and after five minutes I presented different ways of sensing and knowing through tools and materials. After this extra information everyone rethought their ideas to imagine speculative tools that could be used to ferment vegetables and solve the problems that beginners have with fermenting. Surveying the ideas and imaginations of both beginner and more experienced users helped us to understand both what a user would want, and – once they had gained more experience of the process – what they would need. (Appendix B p. 206)







SENSITIVE MATERIALS

In my earlier work with Beko, I asked if instruments might just replace our senses, desensitising us to the changes in materials and our environment, or could we work together to educate our senses. As I did when working on the Picklepal, I wanted to be able to make invisible transformation processes tangible, and intuitively read by the beginner user. I wanted to do this using more sensory ways of knowing, and getting back to trusting our senses, connecting more with our own tacit knowledge rather than translating this to numbers and LCD screens.

I looked at materials that could sense or 'taste' acidity, saltiness, or warmth, using their properties as sensors. Litmus paper, the first scientific pH indicator product, was originally made from lichen, a tree moss and a symbiotic community of fungi and algae, which turns red in acid and is restored to blue by alkalis. Humans have collected them for use as dyes, medicine, food, perfume, and poison for hundreds of years.

The word lichen is Latin, which was from Greek leichen,[204] originally "what eats around itself," probably from leichein "to lick"- tasting the tree it lives on.[205]

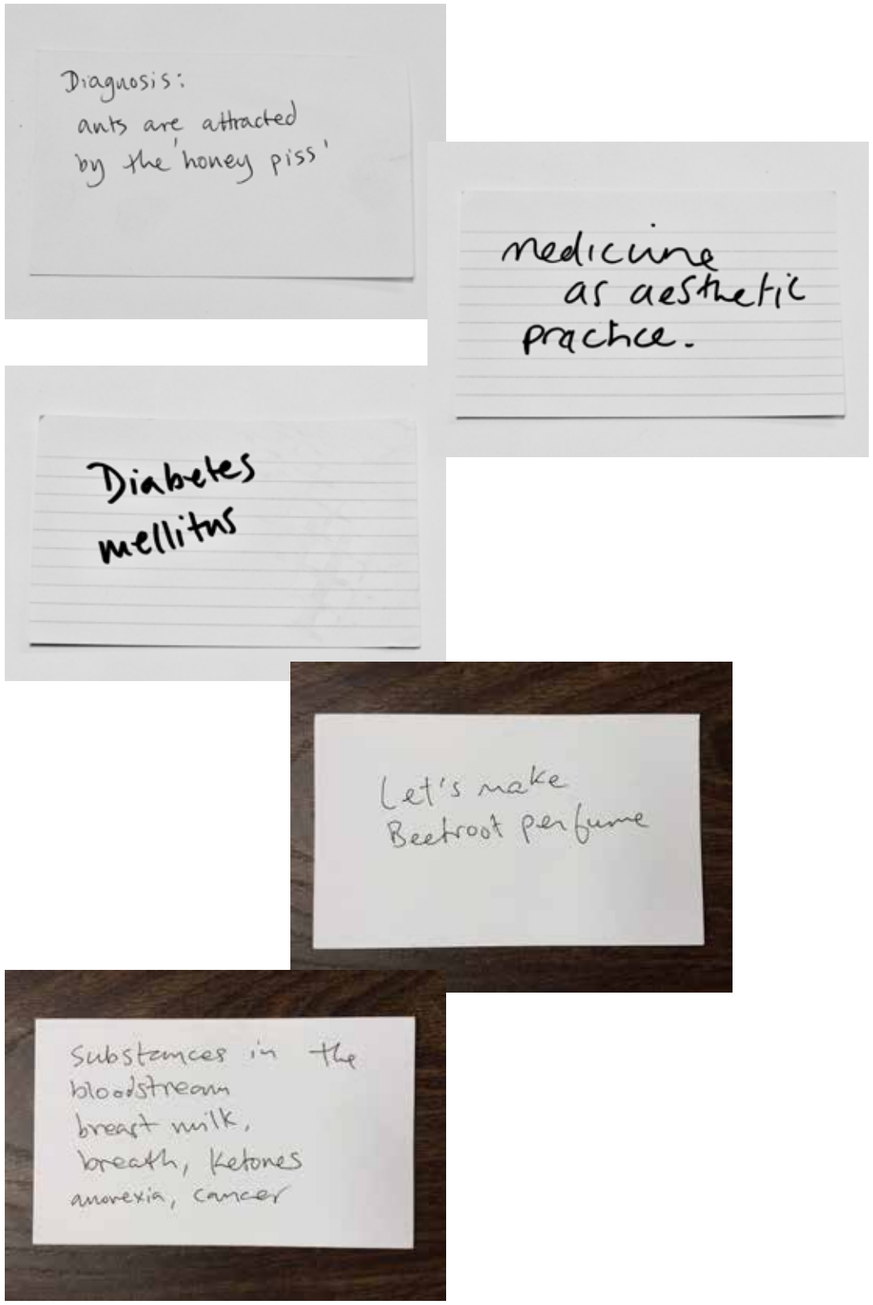
Alongside the process of developing the sensory tool with Beko I wanted to further understand the relationship between taste and tasing, liking and likeness, and materials, foodstuff and our bodies as chemical sensors.

At home during the UK lockdown period, I made pH indicator paper using red cabbage or turmeric and paper to react as visual pH 'tasters'. I made a series of tongues sculpted from a home-made papier-mâché indicator paper, blending raw red cabbage with my sketchbooks, moulding the resulting paste into tongues, and drying them out. These tongues are tools to extend our senses and detect acidity, the metabolisation of microbes. A cabbage tasting itself, tracking its own transformation from raw to 'cooked'.

My mum had been successfully making her own inks using materials from the landscape surrounding their house in Suffolk. I had bought a cow's tongue from the butcher, so we experimented with printing the tastebuds using her barberry ink, another pH indicator.

204. Douglas Harper. "Etymology of lichen." Online Etymology Dictionary, https://www.etymonline.com/word/lichen. Accessed 16 September, 2023.

205. For more on humans, lichens and our relationhips see: Griffiths, 'Queer Theory for Lichens'.



TASTING MATERIAL BODIES

I conceptualised the device as an extra-sensory tasting tool – something that could allow us to understand the conditions of things via heat, salinity and acidity, properties that the human tongue - a sophisticated electrochemical sensor - is ordinarily very good at detecting. It could be a teacher, tasting our fermented foods, finding when it's ready to become part of us.

By this time, public tasting had become part of my methodology.[206] (Appendix A p. 126)

Deliberate sensing of (edible) materials using the tongue, an interior part of the body, is about entering into an intimate knowledge relationship with it. It is a matter of experiencing tastes and flavours that convey information and have the potential for pleasure and a whole host of different positive and negative feelings, as well as risking harm.

As I continued to develop ideas, I realised that, as my Roving Microscope colleagues were finding out through their compost adventures, temperature, salinity and pH readings of soil and compost can help us understand the microbial action within, keeping it healthy, and monitoring it for different growing needs, tracking its taste, temperature, temper, terroir.

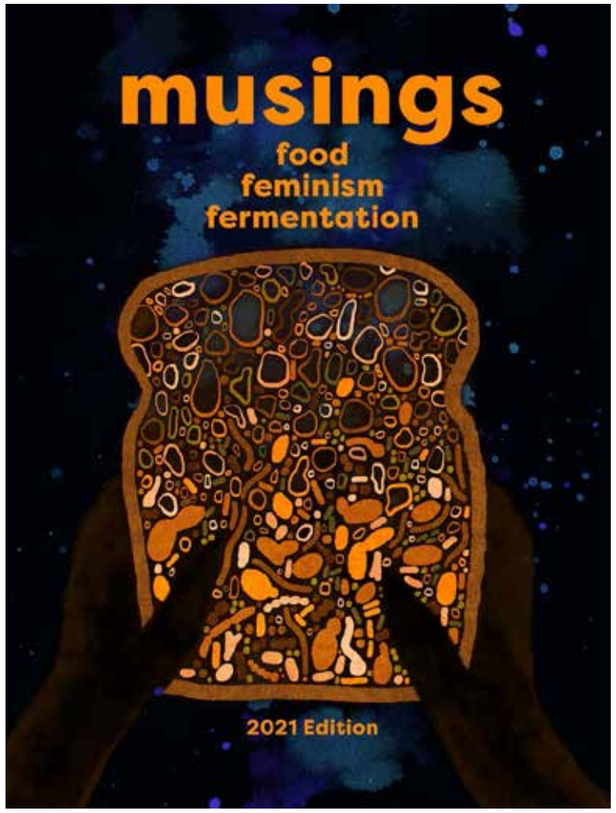
Because of the risks of ingesting harmful materials, and the safety laws that accompany them, older practices of tasting for soil quality in agriculture, tasting of bodily fluids in medicine, and tasting your work in the lab-based sciences are now seen as dangerous, or at best taboo.[207] Tools and instruments have now largely replaced bodily senses.[208]

In my work with Beko I asked if instruments could replace the senses, or if they could work together? Could they educate our senses? Can we get sensuality back into our food tools?
I wondered if by extending our tastebuds into a multi-tool, it might allow us to understand material changes in ourselves, our food, and our environment in a more embodied, holistic way.

206. I had planned to further explore the form of the public tasting in Spring 2020 in collaboration with artist and academic Dr. Hannah Drayson entitled Does This Taste Funny? exploring the ingestion of ideas and our sense of taste as a way of knowing the world, when the pandemic stopped the action.

207. "Aspartame was invented in 1965 by James M. Schlatter. Schlatter obtained this compound as part of research into antiulcer drugs. He discovered the sweetness completely by accident, after licking it off his finger, against work safety regulations." Czarnecka, K., Pilarz, A., Rogut, A., Maj, P., Szymańska, J., Olejnik, Ł., & Szymański, P. (2021). Aspartame-True or False? Narrative Review of Safety Analysis of General Use in Products. Nutrients, 13(6), 1957.

208. …even in diagnosis by the smell of farts: Daniel K Chan, Cadman L Leggett, and Kenneth K Wang, 'Diagnosing Gastrointestinal Illnesses Using Fecal Headspace Volatile Organic Compounds.', World Journal of Gastroenterology 22, no. 4 (28 January 2016): 1639–49.



fff musings, an ABC book, 2021

An abecedary, or ABC book, with words common to food, feminism, and fermentation. "The goal was to find a shared lexicon that connects (the contributors) s as scholars, foodmakers, artists, scientists, and journalists engaging with/in these three domains. With international and cross-sector perspectives, and over 30 contributors."
Cover design by Eliza Wolfson

See V is for Vagina, Emily Wissel, page 89-91, in:
http://www.foodfeminismfermentation.com/p/musings-2019-edition.html

In conversation with a medic friend Dr Mary Davies about the sensors I was using, I learnt that monitoring vaginal pH and temperature changes can help with the tracking of hormone cycles and fluctuations, and as markers of bacterial infections, to better understand their effects on fertility, mental and physical health, wellbeing, stress, and energy levels. Sensing these variables could help monitor and maintain the health of our microbiome - understanding the balance of flora needed to keep us well. The vaginal microbiome is a slightly acidic environment, ideally between 3.8 and 4.5 on the pH scale. It is commonly made up of more than 70% lactobacillus (the same microbe responsible for sauerkraut, kimchi etc.) which metabolise the glycogen in our diet, producing lactic acid and protecting against infection, inflammation, and disease. However, the microbiome and thus pH can change due to various factors including stress, fluctuation of hormones in perimenopause or gender affirming treatments, diet, and social determinants.[209]

A personal sensory tool could enable people who may be excluded, alienated, or priced out of health systems to gain a level of bodily autonomy, in order to help make informed decisions and care for their own health and wellbeing. Uncoupling venereal, reproductive and vaginal health from the context of the family unit and linking our cycles and systems to our environment could help us see our changing conditions as linked to care of our changing surroundings and each other.

If this device measures pH, salinity, and temperature in biological environments, might we have a multitool that could track microbial transformations and help us understand the health of our soils, our bodies, and our food, and how they interrelate? Hari Byles, my Roving Microscope collaborator, proposed its name: *The Sensicle*.

During the summer of 2020 there were many online fermentation community events, and I excitedly discovered Dr Maya Hey's doctoral work on fermentation and feminism, and her essays exploring how certain forms of power and kinds of knowledge are privileged over others, along with writing by Dr Emily Wissel who studies transformations in the vaginal microbiome population and their links with mental health.[209]

The microbiomes of the human mouth and intestines have been relatively well studied when compared to the vagina, which is sadly too common a pattern within knowledge production. I realised that this prototype tool could be a queer ecofeminist idea, allowing us to take control of our own bodies, through powerful knowledge, and through embracing ourselves as symbiotic communities rather than individuals, whose vaginal health is not necessarily tied to reproduction, gender constructs and patriarchal interests, and whose health is connected to our environment.

209. Emily Wissel, Alexis Dunn, and Anne Dunlop, 'A Narrative Review on Factors Shaping the Vaginal Microbiome: Role of Health Behaviors, Clinical Treatments, and Social Factors', preprint (Preprints, 5 October 2020).
Subrat Panda et al., 'Vaginal pH: A Marker for Menopause', Journal of Mid-Life Health 5, no. 1 (2014): 34.
Patents already exist for devices that can track ovulation through pH fluctuation https://patents.google.com/patent/WO2006026581A2/en

210. http://www.foodfeminismfermentation.com/
https://heymayahey.com/writings/

Pond-clay ouroboros, The Shed, Bethnal
Green Nature Reserve.
Appendix A p.8

Talking about these ideas with others as I thought them through, revealed interrelated taboos and uncomfortable feelings around bodies, and the relationships with soil and food, specifically with discussing the nature of vaginas and vulvas, the possibility of countenancing mucus and blood, bacterial and yeast infections, hair, as well as the way they taste and smell. Shame about the dirtiness and excitement of 'carnal knowledge', self-touch and queer desires were all factors. This was akin to the discomfort fear and taboo I encountered around soil, and the actions of microbes, decomposing or fermenting foods. There are paradoxical, cyclical images involved here such as decay and death vs fertility and fecundity, pleasure and disgust, humus as human, dirt, and the origin of food: the taste of materials, materials tasting us, materials tasting for us, tasting ourselves.

Working with a by-now all-male engineering team at Beko, I didn't communicate these thoughts easily, but they were open to my concept and willing to assist with the technical aspects of making a working tool. We then began to test the technologies. (Appendix A p.166)

Design review workshop, with fermentation and soil professionals, giving feedback on the prototypes, 2021.
Appendix A p.174

Technical Prototype to confirm the functionality of the tool with help from Beko's Gavin Summers.
Appendix A p.168

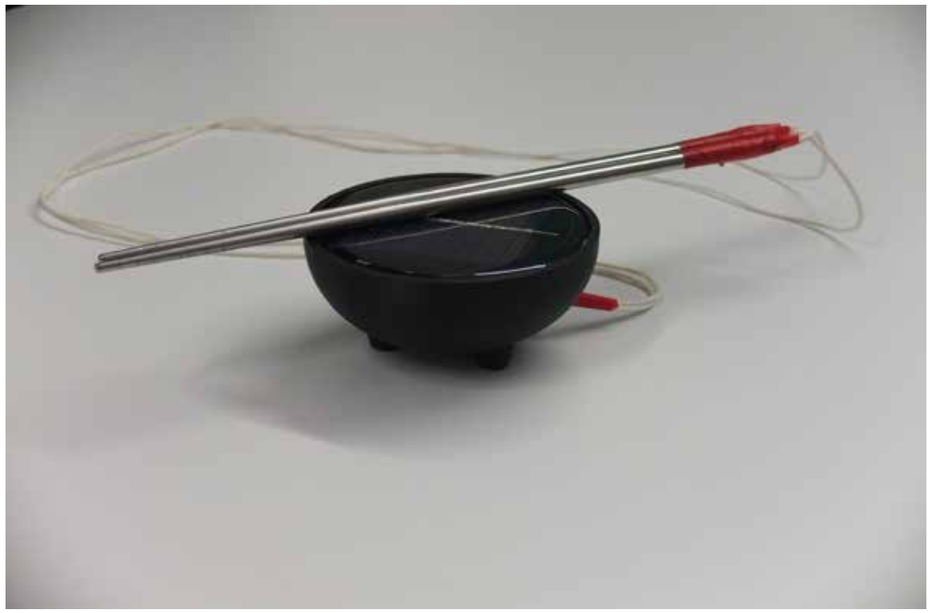
TRANSFORMATIVE TOOLS

We then began a collaborative period of prototyping: beginning in a similar way to the PicklePal process, first producing a proof of technology document, undertaking technical research into the variables we needed to control for optimal fermentation, and research on the sensors currently available, before embarking on design (the how-it-works before the how-it-looks, in Antonio's words - Beko were still schooling me in the process of industrial R&D).

I selected robust food-safe sensors and got them working with an Arduino microprocessor. Then at Beko R&D centre we linked it to a small OLED screen powered by a solar panel and rechargeable battery. I wanted to make sensory indicators, but we first needed accurate readouts from the sensors for our proof of technology. Making an outsize prototype using individual components helped us to understand the possibilities and problems with sensory device design and enabled us to be more realistic in our modelmaking.

I prototyped the design of the multi-tool in plasticene and sticks, moving on to mouldable thermo-soft plastic, and then silicone putty. Beko R&D staff designed and 3D printed components from my drawings in the weeks before I had arranged a group for a 'design review'. Physical materials would allow the reviewers to gain an understanding of what a tool might feel like in the hand as well as look like – a factor we identified as important during the imaginary prototype stage. This stage allowed for rapid design iteration and better imagination of how a tool might interact with the materials being tested, and how it might be cleaned, stored, used, giving us three clear models for the participants in the feedback process.

Seven professionals from relevant fields gathered and presented an example of a kitchen tool they liked or disliked to a show-and-tell session, to begin our design review. We had one working prototype and three models of how the tool could look and feel, and they gave feedback on post-it notes in four sections: Likes, Problems, Questions, and Ideas. Bringing a tool helped people to start thinking and talking about how they feel about kitchen tools – expert users allowed us to gauge reactions from people who could really imagine using these tools day-to-day. Working with targeted feedback on post-it notes allowed us to keep feedback relevant, and to see patterns in the responses.



3D printed prototypes with solar cells.
Appendix A p.173

Through prototyping and drawing, I had explored different forms the tool could take, informed by different aspects of the Materials Research Kitchen workshops over the years:

THE SOLAR BOWL

The form of the vessel recalls our discussions during Bags o' Mystery, the archetypal tool for gathering, keeping, cooking, and thinking longer term about providing for our future.
The vessel is full to the brim, mirroring the sun as it charges its solar panel, and the moon as it reflects the energy back at night.

CHOPSTICKS

These cooking and eating tools have been used for over three millennia, originating in China. It was agreed the most versatile and elegant tool by my imaginary prototype research group, although as there are many different cultural etiquettes and customs relating to their use throughout East and South-East Asia, this may be an unsuitable form.

THE STAFF

The stick or staff has grounding in agriculture and care for livestock. It is also a knowledge and power signifier, a staff of office held by leaders or officials. It can be a phallus, a weapon, or a tool for control. It can be a pilgrim's travelling staff. It is used as support by elders and has come to signify wisdom and respect due. A rod conducts lightening, or magic as a wizard's staff or wand. It gestures towards connectivity with two ends – one at the body, one at the other, grounding or linking us. It is the most conventional form for sensing soft materials: a probe.

THE DIVINING ROD

Divining rods are tools for extending our practical knowledge of our surroundings by mysterious extra-sensory means: searchers and finders of movement and flow. Divination is not a system of telling us what is, or what is to come, but a process of conversation and co-construction of yourself in relation to the materials of the world – a 'reading' of your mirror image in materials, or in art. Interpretation can mean interoception, getting in touch with how you are feeling inside, emotionally, physically, and metaphorically.

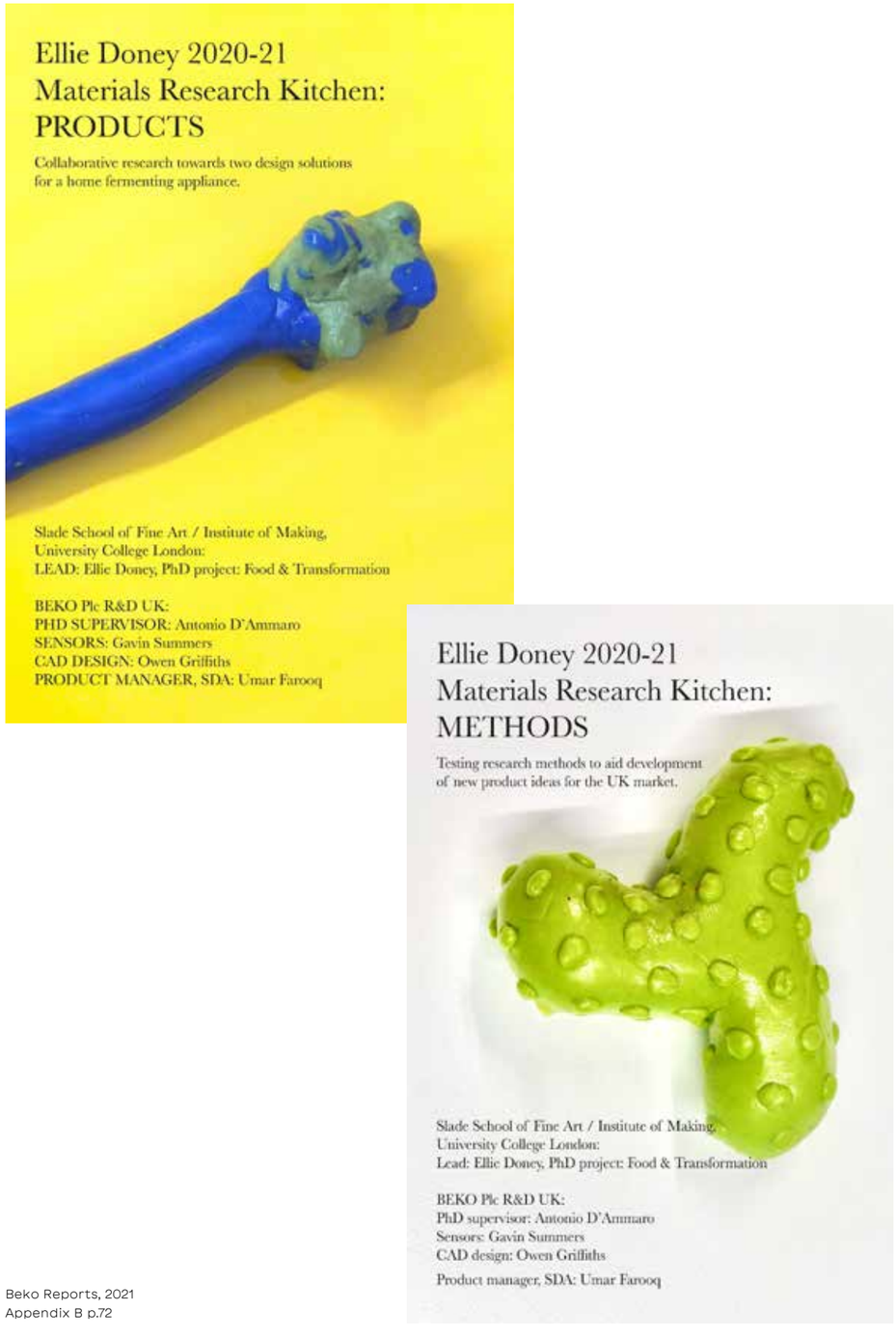
Physical prototyping of forms with wire, plasticene, thermoplastics, spoons and sticks.
Appendix A p.170

Physical prototyping of forms with platinum-cured silicone compound.
Appendix A p.176

THE OUROBOROS

Connect the ends together, and the organism tastes itself, divines itself in biofeedback, in individuation. But we are not individuals, we are multiplicious, we can transindividuate. We are delightfully various throughout our lives, living in constant transformation of our composition, our understanding, our abilities, our environment, our health, and our connections.

The prototype tasting tool acts as a metaphor for the importance of transdisciplinary research and interconnected thinking through material bodies, exemplifying the thesis. Extending our selves through using tools, into the material of food via cooking together, allows us to see that our bodies, environment, and foods are part of the same ecosystem, the same matter. These are tools for knowledge and care, tools for divining our intra-active relationships with materials. Through our curiosity and sensory awareness of connected transformations, we can treat ourselves and materials with care as part of our web of being.



Beko Reports, 2021
Appendix B p.72

The Delivery

The project's official conclusion came with the delivery of a report on 'Products', in which I detailed the research and development of the Picklepal and Sensicle. (Appendix B p.152)

Once that was in, the Beko team requested a second report on 'Methods', which detailed the methodological and physical tools I used to develop the two product prototypes. (Appendix B p.132)

I presented the reports to the team online. I asked the attendees to fill out a post-project assessment questionnaire which indicated whether, and if so, how they had found the project's processes and outcomes useful (Appendix B p.214).

The project took many twists and turns, taking place during the global, personal, and political upheavals of 2020 onwards, alongside changes to my supervisory team both at Beko and UCL, and multiple moves of our studio spaces, lockdowns, and changes of direction. Beko invested in me to allow the experimentation to happen and the research to progress despite this, and the project eventually came full-circle with the Ouroboros-like Sensicle.

There are elements of MRK methods ready for direct use: urban mudlarking, 'listening' to materials through close looking, tasting, and cooking and writing, imaginary and creative prototyping, translating across disciplines through food. This is not a singular method, something I could package up as an all-purpose tool, as every collaborative group would be different, but this PhD-Practice created learning points from art thinking, and art making. These are the tools that support my practice as an artist to generate more research and learning with others. I am looking forward to putting the MRK learnings into practice further as a collaborative artist and researcher, facilitator, and teacher.

CONCLUSION

- Questions
- Learnings
- Future Work
- Summary

Questions

Here I discuss how the thesis of practice addresses my research questions. I then discuss further learnings from the work, and offer directions for further research, before summarising the PhD practice findings, and its contribution to knowledge.

> *Does using foodstuffs as research method and metaphor show how materials become embodied, in not only our physical but also in our cognitive being?*

The work of this thesis demonstrates that food is a unique and powerful method for exploring the nature of material embodiment. Its use as a shared sensory field of investigation through the Materials Research Kitchen translates disciplinary and cultural ways of speaking and doing research to enable greater communication. Food as a metaphor, and the figure of the Ouroboros Sausage provides a relatable way into the questioning of long-held assumptions about hierarchies of matter, and taxonomical rules. Unveiling our use of cognitive metaphors around food and the body allows researchers to connect the thinking process to their subject, and to implicate us more fully as part of material ecosystems as evidenced in the index cards.

> *Can embodied and extended knowledge practices of cooking and eating together stimulate curiosity and care for past and future incarnations of materials, and reveal how much is at stake in their exploitation?*

The workshops and experiments undertaken as part of this doctoral research – involving the transforming of materials together as part of a thoughtful embodied practice – has shown that doing is a form of knowing. A close attention to materials as they transform allows a mirroring of our own nature in that of edible materials, and an understanding of our connectedness, for example through *Close Writing*, and *Ecologies of Art & Making*.

> *How can this art research practice be a generative tool for exploring human-material relationships through making and facilitating usable, transdisciplinary knowledge together?*

Situating this work in sites of research and learning, in higher education, industry, and public realm food-growing projects has shown its efficacy as a tool for generating new knowledge and further work. Its insights transcend disciplines and may be used as the basis of collaborative work, extending what is counted as legitimate research.

> *How does my work with Beko drive and exemplify this thesis of practice, revealing likeness in human-material ecologies, towards self and environment care?*

Developing and testing the MRK with a company who make tools that are used every day is an important grounding part of the thesis: using the language of food and cooking was a way to develop a method that worked on several different levels, for different disciplines.

Developing a fermenting appliance with the team, I noticed the way the Beko team embraced the change in process, directly engaging in the materials and tools that they were designing for. This was evidence that my hypothesis was on the right track. The feedback I received after the end of the collaborative part of the project indicates that we achieved our collaborative aims, and that they would employ aspects of the MRK methods in future projects. (Appendix B p214)

The concept of the Sensicle exemplifies the thesis more directly, as a tool that reveals likeness between our food, material ecosystems and ourselves, mediated by microbes. Its final form as the Ouroboros completes the cycle of the project, in that the Sensicle allows the body to taste its extended self, including materials, microbes and foodstuffs in consubstantiation. It acts as a method and metaphor for self and material curiosity leading to self and material knowledge linked to self and material care.

Learnings

Over the course of this project, I held various simultaneous positions as student, artist, researcher, lecturer, project lead and technician, as well as my self-appointed role as communard. I could appear as both insider and outsider to participants at different times.

This multifaceted positionality is sometimes advantageous, and sometimes a hindrance to a participatory action research approach. My aim is to collaborate on knowledge-making with participants. However, I became aware early on that my positionality and enthusiasm for leading sessions could be limiting outcomes – listening and going with ideas as they unfolded by standing back ended up being a better approach.

I am aware that I usually present as a confident and educated white cisgender middle-aged woman, which enables me to navigate the research world, funding and access to resources with relative ease. I understand that many would face barriers to this access, and thus find it difficult to replicate these methods. This is the beginning of an enquiry into broadening the definition of research. This thesis suggests that situating the enquiry in cooking, community growing, and everyday domestic technologies has the potential to turn research, traditionally quite an exclusive world, outwards, enabling more porosity with other disciplines and modes of expression, a broader cross-section of participants, and opening the possibility of change. There is more to do here.

I also learned that food helps to attract, and retain both research participants and collaborators, and the people I want to communicate ideas with. MRK, the Ouroboros Sausage, and the rest of the thesis of practice outlined in this report takes collaborative making seriously as methodology without precluding the communal joy and adventure of food and hands-on material experience. This is an area of practice research taking place between people over food that is underexplored at this level.

Post COVID-19 Pandemic, the territory has changed, as have we all in different ways. This project took a unique and unexpected trajectory, which became all the richer (despite the difficulties), in its relation to self, environmental and communal care, the importance of our senses and physical relationships, and the significance of understanding and respecting our material-microbial connections. Despite the unexpected journey, I achieved my own aims. (p. 31)

Interesting areas for future investigations could be generated by use of the results of this doctoral research. For example:

- The use of the index cards in games and exercises for idea generation as part of interdisciplinary research.
- Further development of the MRK in the specific context of the Institute of Making's recently built Experimental Kitchen
- Further network building to form co-research teams to study material relationships through cooking and eating as research; engaging and expanding UCL's existing food-related research hubs to include faculty food providers and sustainability networks; and connect with practitioners from urban food and growing organisations local to UCL East.
- The development of the Sensicle as an open-source tool.

Summary

Embodied knowledge is experientially learned, ingrained in the muscles and habitual movements of the body, which knows how to act in certain situations, often subconsciously. It is highly personal and situated, and must be transmitted person-to-person, involving our cognitive biome.

The practicing of knowledge embodied and extended through tools, situates intellectual and theoretical insights within the material world and celebrates the complexity involved in knowledge production. It is routinely seen in Arts and Humanities research, but it is also vital to parts of Science, Engineering, and Medicine for example, if we are to ground research ethically in the effects it has on people's lives.

Using the MRK as a tool broadens ways of knowing in higher education to encourage a valuing of the knowledges found in amateur, technical, working class, indigenous and specific cultural knowledge practices, not included in the white patriarchal canon of university hierarchies of value. It foregrounds individual sensory experience which – when shared in a group setting – enables cross-cultural and cross-disciplinary perspective sharing. Academic and industrial knowledge systems cannot assimilate diverse everyday and intergenerational knowledges, risking homogeneity, whitewash; it must change structurally to reflect its populations, to grow in difference, to become a pluriversity.

This kind of thoughtful practice – the sort of everyday knowing we can generate in the kitchen – aids in something akin to Jung's individuation, where aspects of the unconscious are brought into consciousness, developing the Self. An examination of the thinking that happens at the body-material-consciousness interface reveals important bodily knowledge about materials and their transformations, examining how we feel about ourselves in relation to material which have the potential to become us. This kind of close attention to materials focuses not just on face-value properties but is receptive to hidden properties and qualities, ecosystems and environment, past and future incarnations – an ethical proposition which includes our own fate.

This method develops the idea of the self as ecologically linked to other animals, materials, and microbes, through thoughtful and curious ingestion and metaphor, and the concept of the Sensicle: a tool for sensing transformation and revealing likeness in human-soil-microbe-food interactions.

Renewed material awareness is increasingly important in an era of rapid ecological, social, and technological change, and growing climate crisis. Knowing the ethical and political dimensions of a material's past and future changes its aesthetic qualities too. The idea of beauty or appropriateness in material is changed if you know it is mined by enslaved or exploited people, used to make a single-use tool that will go straight to landfill, or is coated with endocrine disrupting or biocidal forever chemicals that will go into the soil food web. Perhaps this realisation could create a contemporary change in taboo.

The conceptual and physical use of the tools generated by this PhD such as the Activated Works and the Sensicle, further expand the Self by extending our cognition into our environment. This thesis demonstrates a way of practicing self-knowledge and self-care linked to ecological knowledge and care, through my methods.

Using the methodological tools involved in the MRK workshops, enables an enacted cognition. This contributes to transdisciplinary outcomes in research, through collaborative food workshops that lead to a kind of transindividuation in the thoughtful practice of cooking and eating together we all become the same matter.

This is an art practice which is generative and metabolises through other disciplines to become useful in many ways.

Contributors

Many minds, hands and bodies helped co-create this research, including:

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Bibliography

KEYWORDS

Epistemology of practice, facilitating transdisciplinary research, applied disciplines, foodstuff, cooking, fermentation, ingestion, symbiotic transformation, holobiont, 4E (embodied, extended, embedded, enacted) cognition, cognitive biome, cognitive metaphor theory, likeness, togetherness, individuation, trans-individuation, senseoaesthetics, listening to materials, aesthetic curiosity and care, Useful Art, art as utensil, workshops, Materials Research Kitchen, Activated Works, Ouroboros Sausage.

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For a record of further research in the form of exhibitions, conferences, residencies, training and workshops, see Vol. Two: Appendix B p. 8.