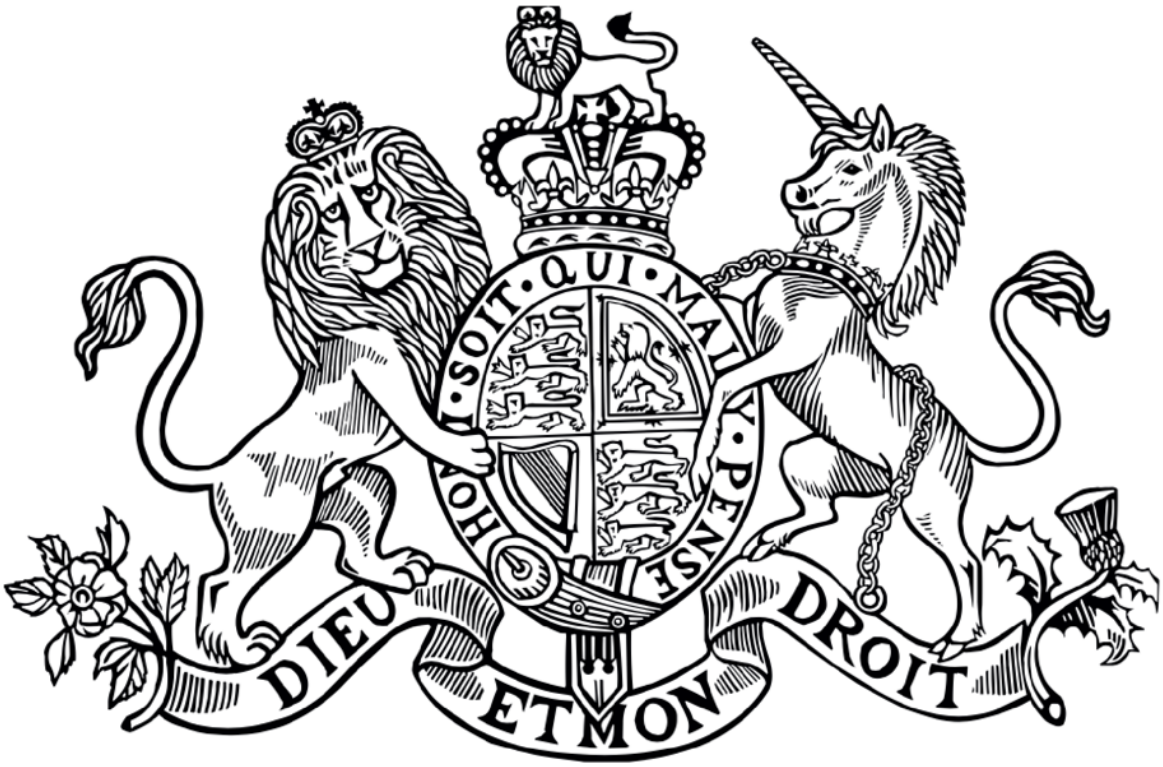

Storytelling and Material Interferences: Practice-led Research between Puppetry and Textiles

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Storytelling and Material Interferences

Practice-Led Research between Puppetry and Textiles

- ABSTRACT

The thesis discusses how researching ‘weird materials’ to design puppetry performances may support textile designers in their creative journey and research process.

On the one hand, textile designers are interested in emulating liveliness between the functional and the aesthetic qualities of their artefacts. Material-driven researchers investigate methods to translate the enactment of their materials’ fluid and ambiguous nature for a human audience. On the other, puppetry explores materials through their potential for ‘liveliness’ and their ability to translate the human and non-human nature of the puppet. During a performance, the puppet oscillates between being an object, a symbol, and a character. The audience resolves the uncertainty of the puppet’s ontological status by producing a narrative.

The research examined the relationship between puppetry and textile design and their shared interest in the liveliness of materials. Through a series of action-research activities, the practice produced fertile ground for the development of puppet characters and engaged in a dialogue with textile designers and researchers about character design and storytelling in puppetry. The design of puppetry systems with thermochromic and bio-based materials through textile processes generated a series of stop-motion animations, short video recordings, still images, and textile artifacts that reflect the evolution of the practice. Ultimately, the research will provide textile designers with new tools for translating the ‘weird’ life of their materials into their creative practice and research.

Keywords: diffraction, material-driven, puppetry, practice-led research, storytelling, textiles, weird materials

AUTHOR'S DECLARATION

This thesis represents partial submission for the degree of Doctor of Philosophy at the Royal College of Art. I confirm that the work presented here is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

During the period of registered study in which this thesis was prepared the author has not been registered for any other academic award or qualification. The material included in this thesis has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

Sabrina Recoules Quang

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ABSTRACT

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HOW TO READ

THE DIFFERENT VOICES IN THE TEXT

Traditionally, puppeteers undertake different roles in their creative process. These include devising, making, performing the puppets and reflecting as the first audience for the puppets' performances. In this study, I embodied different perspectives as a maker, performer and researcher. The thesis is therefore mostly written in the first-person singular to reflect the artistic nature of the enquiry and my personal entanglement as a researcher with the researched.

GLOSSARY OF TERMS

The Appendices (p.219) contain a glossary of the technical terms I borrowed from the textile field and diffractive methodologies. It also includes the specific vocabulary I developed in the translation of my tacit knowledge into an explicit knowledge and in my reflective practice. The glossary supports the reader in becoming familiar with the new terminology developed in this thesis.

By 'tacit knowledge', I refer to the knowledge developed through practice and embodied in "the designer's action and experience of creating an artefact as well as in the artefact itself "[1].

[1] Nithikul Nimkulrat, 'Voice of Material in Transforming Meaning of Artefacts', in *Proceedings of the Design Research Society Conference (DRS 2012), Chulalongkorn University, Bangkok, Thailand, 1 – 5 July 2012* (DRS, 2012)

THE LIST OF FIGURES

THE LIST OF VIDEOS

The videos are interludes, moments of *'Breath'* from the writing, placed at the beginning of chapters and before their analysis in the following pages. The reader is invited to watch and listen to the animated works by clicking on the round vignettes, or on the links provided in the footnotes on the same page.

Chapter 1

BEGINNINGS

“Breath “

Video 1-1 'My name is...”, a physical theatre, puppetry performance and animated projections with mask performing Showcase “My Name Is” Physical Theatre with Active Participation of the Audience , Video Projections and Puppetry ., dir. by Sabrina Recoules Quang, 2016 <https://vimeo.com/186472390> [accessed 13 May 2024]

Video 1-2 "Working girl goes to motherhood”, puppetry performance and physical theatre and live interaction with the audience (Working Girl Goes to Motherhood, dir. by Sabrina Recoules Quang, 2013,Vimeo <https://vimeo.com/78587530> [accessed 13 May 2024])

"The art of the puppet has very little to do with what we want, and everything to do with what we allow ourselves to discover, support, and follow."[2]

Between Textiles & Puppetry

WHAT IS PUPPETRY ?

This question was always in the background during the research journey as I performed puppetry as research with unknown materials and introduced my practice to unfamiliar territory, textile researchers and academics in textile design. This section introduces how I defined puppetry at the beginning of my research journey. It is an honest account of my practical knowledge as a maker, performer, and avid spectator of puppetry performances. I also refer to theoretical knowledge written not only by other puppeteers, but also by theatre practitioners and academics who have taken an interest in puppetry.

In this research...

Puppetry is a form of theatre, a performing art form that brings an inanimate

[2] Eric Bass, 'The Myths of Puppet Theater', *HowlRound Theatre Commons*, 2014 <https://howlround.com/myths-puppet-theater> [accessed 3 November 2020].

object to life.[3] The puppeteer's knowledge of designing artefacts that emulate emotional connections with a human audience has attracted much attention from roboticists[4] and interaction designers.[5] As a performative art form, puppetry is characterised by designing and performing uncanny,[6] but nonetheless likeable, characters. Puppets perform as mediators of human emotions. [7] Puppetry is firmly rooted in the puppets' ambivalence. They engage with an audience through their dual nature[8] as both a dead object and a lively character.

Previously, the puppetry system was defined as a 'soft system',[9] in which puppets perform their findings about our world through a process of storytelling.[10] The puppets, the puppeteers and their audience are entangled in the production of a story. In this system, the distance between the puppet and the puppeteer gives the puppet the autonomy it needs to seem alone in the desert. At the same time, the visible connections between puppet and puppeteers give the puppet its liveliness'. [11] Hence the ability of the audience to follow the puppet-object's gaze will contribute to its liveliness, as 'the gaze

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[3] JaneTaylor, 'Introduction', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), p. 19

[4] Ruairi Glynn, 'The Irresistible Animacy of Lively Artefacts' (unpublished PhD Thesis, University College London, 2019).

[5] Kensho Miyoshi, 'Puppetry as an Alternative Approach to Designing Kinesthetic Movements', in *Proceedings of the 4th Research Through Design Conference, 2019 (RTD 2019)* < https://www.diva-portal.org/smash/get/diva2:1683555/FULLTEXT01.pdf> [Accessed 9 May 2024]

[6] John Bell, 'Playing with the Eternal Uncanny', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.51.

[7] Robert Pulley, 'Theatre of the Imagination: Exploring a Pedagogic Toolkit for Creative Development and Global Learning in Primary Education.' (unpublished PhD thesis, Royal College of Art, 2019)

[8] Kenneth Gross, *Puppet: An Essay on Uncanny Life* (University of Chicago Press, 2011).

[9] Peter Checkland, 'Soft Systems Methodology: A Thirty-Year Retrospective', *Systems Research and Behavioral Science*, 17.S1 (2000), S11–58, doi:10.1002/1099-1743(200011)17:1+<:AID-SRES374>3.0.CO;2-O

[10] Sabrina Recoules Quang, 'Tension and Materiality in a Textile System; A Puppetry Perspective', *Journal of Textile Design Research and Practice*, 9.2 (2021), p.255 doi:10.1080/20511787.2021.1923201

[11] Eric Bass, 'Visual Dramaturgy, Some Thoughts for Puppet Theatre -Makers', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.56

is [conceptually] integral to systems of power, and [to] ideas about knowledge', and 'to practice the gaze is to enter a personal relationship with the person being looked at'.[12] When watching a puppetry performance, the audience 'looks at things — so that finally one cannot say if it is the look or if it is the things that command'.[13]

With the appearance of the human puppeteer alongside the puppet object, the puppeteer operates as an extension of the puppet and the audience momentarily grasps the previously unseen liveliness of the puppet. The performing object benefits from our tendency to scan for signs of life and acknowledge the puppet's metaphorical character. It is important to note that although puppeteers are seeking to support the lively expressions of the puppets, it is not their goal. Instead, their aim is for the audience to read the puppets as characters. Overall, the puppet's liveliness is phenomenological and grounded in the interactions between human and non- human materialities. On stage, the puppets and the puppeteers perform a series of transformations in their metaphorical expressions in response to each other's impulses.

Sean Myatt describes the first meeting of the puppet and its puppeteer as an exploration of the puppet's 'potential in the development of a narrative through movement and characterization'.[14] The puppeteer discovers the puppet object and learns 'to adapt to the puppet, discovering how it moves, giving it needs, becoming sensitive to when to let things evolve and when to give the next impulse'.[15] In addition, the ability of the puppeteer to enter into a dialogue with the object they are manipulating will reveal the liveliness of the

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[12] Marita Sturken and Lisa Cartwright, *Practices of Looking: An Introduction to Visual Culture* (Oxford University Press, 2009).

[13] Maurice Merleau-Ponty, *The Visible and the Invisible*, trans. by Alphonso Lingis (Northwestern University Press, 1969)

[14] Sean Myatt, 'Instinctive Objects Ramblings', in *Theatre Materials: What Is Theatre Made Of?* ed. by Eleanor Margolies (London: The Royal Central School of Speech and Drama, 2009), p. 34.

[15] Rene Baker, "The Puppet as Teacher of Acting", In Margolies, Eleanor, *Theatre Materials: What Is Theatre Made Of?* (Centre for Excellence in Training for Theatre, Central School of Speech and Drama, University of London, 2009).

puppet.[16] During the performance, the puppeteer relies on the embodied cognition initiated by the aesthetic of the puppet, the physical impulse they will receive, as, like physical theatre practitioners, they rely on their body to perceive things the mind does not know about.[17] Unlike robots and animatronics, which explore the reproduction of natural and anthropomorphic aesthetics and behaviours, puppetry focuses on the metaphorical character emerging from the material and the structure of the performing object. The spectator experiences the coexistence of, and interactions between, the bodies of two subjects, the puppeteer and the puppet, and the awareness that one of them is a dead object.[18]

During their first encounters, puppeteers, like other craft practitioners, look for a way to engage physically and emotionally with their materials. To create a puppet character, the puppeteer selects the material in relation to the quality of movement required by the story and to the way the puppeteer will relate physically to the puppet. Will the puppet dance awkwardly or elegantly? Will it be a long string or a shadow puppet? When choosing the material for the puppet, they 'listen to their particular materials, sensing their physical properties and potential for movement or metaphorical deployment'.[19] Furthermore, as a theatre director would do when casting human actors, the puppeteer devises the story the puppet can tell, as it is 'speaking volumes by its materials, by its role as part of a stage picture, by its relationship to objects, even by its physical limitations'.[20] In other words, puppetry designers, like material-driven designers (MDDs), study the complexity of the materials and

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[16] Dassia N. Posner, 'Contemporary Investigations and Hybridizations (Introduction)', *in The Routledge Companion to Puppetry and Material* Performance, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell, (Routledge, 2015), p. 226.

[17] Jacques Lecoq, Jean-Gabriel Carasso, and Jean-Claude Lallias, *The Moving Body: Teaching Creative Theatre* (Routledge, 2001).

[18] Paul Piris, 'The Co-Presence and the Ontological Ambiguity of the Puppet', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.37.

[19] Eleanor Margolies, 'Return to the Mound: Animating Infinite Potential in Clay, Food, and Compost', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell, (Routledge, 2015), p.323.

[20] Bass, 'Visual Dramaturgy, Some Thoughts for Puppet Theatre-Makers', p.55.

'allow them to have their say in the structures'[21] they create.

Moreover, they arrange the materials surrounding the puppet on the theatrical stage and script their interactions with each other. For instance, Zavé Paré reports how marionettes appear to have a character as they enact their environment in a choreography designed by the '*metteur en scène*' (stage director).[22] Overall, puppetry makers provide an environment that reveals the puppet's character and semiotic nature.[23]

Finally, it is important to note that in this research I focus on the first phases of designing a puppetry performance, before the puppeteers introduce the puppets to an external audience. In this phase, the puppeteer is alone, face to face with the puppet in the making, and acts as a maker, a performer, and an audience.

Contemporary Puppetry

In the past decade, alongside traditional forms of puppetry performances such as 'shadow theatre' (Figure 1-1) and 'group puppetry' [24] [25] (Figure 1-2), where more than one puppeteer operates one single puppet, live performances have also emerged in which puppeteers create symbolic characters with raw materials[26] and found objects[27] [28]in front of an audience. Traditionally, puppetry designers have responded to the emergence of new technology by creating

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[21] Manuel De Landa, 'Material Complexity', in *Digital Tectonics*, ed. by Neil Leach, David Turnbull, and Chris Williams (Wiley-Academy, 2004), pp. 14–21.

[22] Zaven Paré, 'La Marionette Électronique', in *Personnage Virtuel et Corps Performatif : Effets de Présence*, ed. By Louise Poissant and Renée Bourassa, Collection Esthétique (Presses de l'Université du Québec, 2013),p.155

[23] Henryk Jurkowski, *Aspects of Puppet Theatre*, ed. by Penny Francis, 2nd Edition (Palgrave Macmillan, 2013) pp. 46-48.

[24] Mark Down, *Practical Guide to Puppetry* (The Crowood Press, 2022) pp.129-140

[25] Adrienne Sichel, 'Escaping the Puppet Ghetto', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), p.170.

[26] Phelim McDermott, '70 Hill Lane', *Improbable,* 1997 <https://www.improbable.co.uk/past-projects/70-hill-lane> [accessed 17 June 2018].

[27] Martina Leeker, 'Performing (the) Digital.: Positions of Critique in Digital Cultures', in *Performing the Digital*, Performance Studies and Performances in Digital Cultures (Transcript Verlag, 2017), pp. 21–60.

[28] Rene Baker, 'The Puppet as a Teacher of Acting', in *Theatre Materials: What Is Theatre Made Of?* ed. By Eleanor Margolies (Centre for Excellence in Training for Theatre, 2009), pp. 51–53

specific forms of puppetry, such as stop-motion films, digital manipulation[29] or virtual puppets.[30] Nevertheless, even though textile designers have demonstrated that responsive and sentient materials have brought new aesthetic and symbolic expression, we have yet to see a visible account of their performance on a puppetry stage.

Figure 1-1 Extract from the puppetry performance "Working girl goes to motherhood' (Working Girl Goes to Motherhood, dir. by Sabrina Recoules Quang, 2013 <https://vimeo.com/78587530> [accessed 13 May 2024])

[29] Stephen Kaplin, 'A Puppet Tree, A Model for the Field of Puppet Theatre', in *Puppets, Masks, and Performing Objects*, ed. by John Bell (TDR Books; The MIT Press, 2001), pp. 18–25.

[30] Steve Tillis, 'The Art of Puppetry in the Age of Media Production', *TDR (1988-),* 43.3 (1999), p.192.

Figure 1-2 Three puppeteers operating one puppet Cie Philippe Genty (Zycopolis, 'Philippe Genty - Lands End', Zycopolis, 2016 <https://zycopolis.com/philippe-genty/> [accessed 25 January 2024])

'WEIRDNESS'

Textiles in this research

There are similarities between puppetry and material-driven textile thinking. They both rely on tacit knowledge and both design material experiences. Textiles have always been present in the puppet theatre and have often taken the lead in creating puppet characters. In glove puppetry, the textiles collaborate with the manipulator's hand to perform a range of behaviours. In shadow puppetry, the fabric screen defines the scale and forms the puppet's silhouettes will appear in.

As a puppeteer, I am interested in exploring the 'ambiguous relationship to textiles that we experience as neither object nor subject, but as the threshold between'.[31] The review of textile practitioners' work and research into setting up the terms of their conversation with weird materialities responded to my interest in developing new puppetry based on technical materials and led to the exploration of thermochromic textiles. Furthermore, the review of textile designers' work indicated there might be a space of intervention between puppetry and textile systems based on tension and materiality that would invite textile designers to develop a world of interconnected and ambiguous agencies within a textile system.[32]

Weird materialness ('weirdness')

Recent material innovations and a focus on sustainability have led textile practitioners to develop strategies to emotionally engage with the fluid and ambiguous nature of materials born out of the manipulation of the boundaries between the digital and the analogue, the manufactured and the natural, and between the human and the non-human. These 'weird materials' are neither human nor 'entirely material because they are mixed with human and non-

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[31] Claire Pajaczkowska, 'On Stuff and Nonsense: The Complexity of Cloth', *TEXTILE*, 3.3 (2005), p.220, doi:10.2752/147597505778052495

[32] Sabrina Recoules Quang, 'Tension and Materiality in a Textile System; A Puppetry Perspective', *Journal of Textile Design Research and Practice*, 9.2 (2021), p.272, doi:10.1080/20511787.2021.1923201

human actors.[33] In a puppet theatre, the audience reads the puppet and the puppeteer as an ensemble, performing a weird material expressivity that sits between the human puppeteer and the puppet object.

The thesis uses the term 'weirdness'[34]to reflect the ability of a specific material, through its physical qualities, to express the oscillations between lively and dead matter in the context of a puppetry performance. It bridges the puppetry concept of liveliness and the concept of 'materialness' described by textile artist and researcher Nithikul Nimkulrat.[35] Reflecting on her artistic practice with paper, Nimkulrat introduced the concept to illustrate how materials may generate new meanings beyond their aesthetic or functional values. Materialness is 'the ability of a specific material to express or to convey meaning through its physical qualities'[36] and 'the totality of the textile creation rooted in a material that includes the elements of form, content, context and time for the artefact'.[37] In theories of posthumanism, the concept echoes the posthumanist philosophy of New Materialism[38] that considers the vitality of the matter[39] and the production of knowledge in the materials. and how the puppet-makers position the materials as in control from within the structure they belong to. The puppeteer performs the weird materialness of the puppets while evoking 'the unseen liveliness of matter by making visible material qualities such as weight, acoustic potentials, and elasticity'.[40]

From my review of current research themes by textile academics and

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[33] Jeremy Hunsinger, 'Reflections From the Field of Communications: Weird Materiality', in *The Oxford Handbook of Social Media and Music Learning*, ed. by Janice L. Waldron, Stephanie Horsley, and Kari K. Veblen (Oxford University Press, 2020), pp. 502–9 doi:10.1093/oxfordhb/9780190660772.013.40

[34] The thesis may use the expression 'weird materialness' alternatively to 'weirdness'

[35] Nithikul Nimkulrat, 'Paperness: Expressive Material in Textile Art from an Artist's Viewpoint' (unpublished PhD Thesis, Aalto University, 2009)

[36] Nimkulrat, 'Paperness', p.170

[37] Nithikul Nimkulrat, 'Voice of material in transforming meaning of artefacts.' In *Proceedings of the Design Research Society Conference (DRS 2012), Chulalongkorn University, Bangkok, Thailand, 1 – 5 July 2012* (DRS, 2012)

[38] See Glossary

[39] Jane, Bennett, *Vibrant Matter: A Political Ecology of Things* (Duke University Press, 2010)

[40] Eleanor, Margolies, 'Return to the Mound', p.322

practitioners, I extracted two kinds of 'weird materials'[41]: smart textile materials and bio-based materials.[42] Furthermore, the literature identified 'weird textile designers' – MDDs who promote liveliness in producing animated textiles and textiles with bio-based materials.

The first category of materials are ones that can change their appearance in response to external stimuli, such as the ozone level,[43] sound,[44] internal stimuli such as light-emitting material[45] or electronic circuitry embedded in thermochromic materials (Figure 1-3).[46] [47] [48] These materials enact autonomous behaviours in a more than human way.[49] These are woven smart materials,[50]

[41] See Glossary

[42] See Glossary

[43] Lauren Bowker, 'C H O R O P L E T H', *The Unseen*, 2018 <https://seetheunseen.co.uk/about> [accessed 4 December 2022].

[44] Amy Winters, 'Why Does Soft Matter? Exploring the Design Space of Soft Robotic Materials and Programmable Machines' (unpublished PhD Thesis, Royal College of Art, 2017) <http://researchonline.rca.ac.uk/2842/> [accessed 2 October 2018].

[45] Barbara Jansen, 'Composing over Time, Temporal Patterns: *In Textile Design'* (University of Borås, 2013)

[46] Hanna Landin, Anna Vallgårda, and Linda Worbin, 'A Wall Hanging as an Organic Interface', in *OUI Workshop at TEI 2011* (presented at the TEI 2011, Funchal, Portugal, 2011)

[47]Linnéa Nilsson, and others, 'Understanding the Complexity of Designing Dynamic Textile Patterns' (presented at the *AMBIENCE 2011*, Borås, Sweden, 2011) <http://www.akav.dk/publications/complexity_of_designing_dynamic.pdf>[accessed 2 June 2020]

[48] Sara Robertson, 'An Investigation of the Design Potential of Thermochromic Textiles Used with Electronic Heat-Profiling Circuitry' (unpublished PhD thesis, Heriot-Watt University, 2011) <https://www.ros.hw.ac.uk/handle/10399/2451> [accessed 5 January 2020]

[49] Joanna Berzowska, 'Programming Materiality', in *Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction*, Kingston Ontario Canada (ACM, 2012), pp. 23–24 doi:10.1145/2148131.2148136.

[50] Lynn Tandler, 'The Role of Weaving in Smart Material Systems' (unpublished PhD Thesis, Northumbria University, 2016)

'smart' computational composites,[51][52] electronically enhanced garments,[53] animated textiles[54] and performative wearables.[55] [56] The second category of

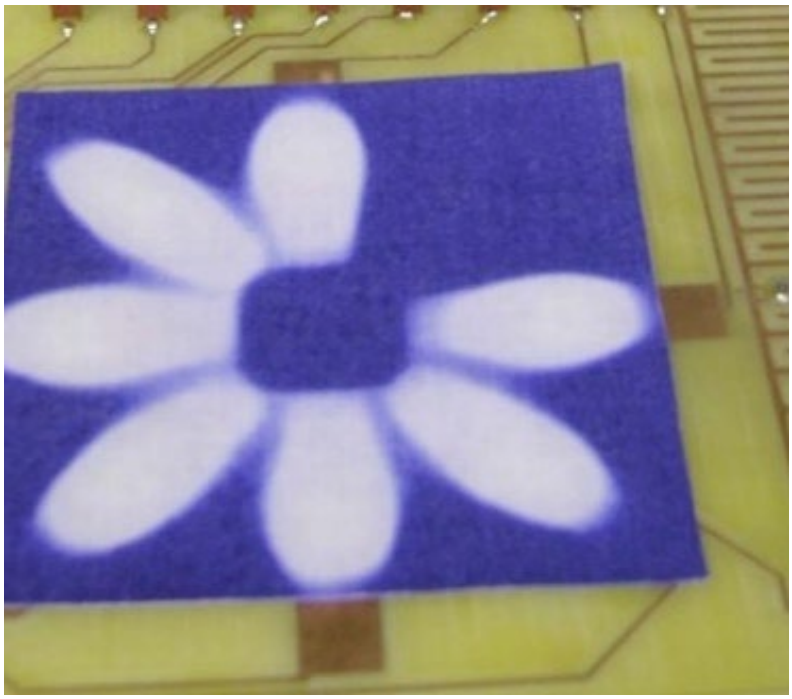

Figure 1-3 Heat-sink circuit with thermochromic sample showing a flower like heat-profile (Sara, Robertson, 'An Investigation of the Design Potential of Thermochromic Textiles Used with Electronic Heat-Profiling Circuitry' (unpublished PhD thesis, Heriot-Watt University,2011,p60)

[51] Md Syduzzaman and Sarif Ullah Patwary, 'Smart Textiles and Nano-Technology: A General Overview', *Journal of Textile Science & Engineering*, 05.01 (2015) doi:10.4172/2165-8064.1000181

[52] Anna, Vallgårda, and Johan Redström, 'Computational Composites', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '07 (ACM, 2007), pp. 513–22 doi:10.1145/1240624.1240706

[53] Joanna Berzowska and Marcelo Coelho, 'Memory-Rich Clothing', in *Proceedings of 2006 Conference on Human Factors in Computing Systems, CHI 2006, Montréal, Québec,* (ACM, 2006),pp. 275–278 doi:10.1145/1125451.1125511

[54] Alice Buso and others, The Unfolding of Textileness in Animated Textiles: An Exploration of Woven Textile-Forms', *in Proceedings of DRS Biennial Conference Series, Bilbao, Spain* ed. by D. Lockton and others (DRS, 2022), doi:10.21606/drs.2022.612

[55] Tsai-Chun Huang, 'In-between Pleats: Pleats, Pleating and 'Pliable Logic'' (unpublished PhD thesis, Royal College of Art, 2020).

[56] Valérie Lamontagne, 'Performative Wearables: Bodies, Fashion and Technology' (unpublished PhD thesis, Concordia University, 2017)

materials is bio-based. Bio-based materials[57] demonstrate their weirdness as their shape changes in response to heat, humidity, time,[58] or both[59] (Figure 1-4).

Figure 1-4 Storm Dress (Winters, Amy, 'Why Does Soft Matter? Exploring the Design Space of Soft Robotic Materials and Programmable Machines' (unpublished PhD thesis, Royal College of Art, 2017)

The research locates the initial site of enquiry in the weirdness of textiles embedded with responsive materials. In relation to the research question, the practice explores the transition of these materials into the performance of lively

[57] See Glossary

[58] Jane Scott, 'Responsive Knit: The Evolution of a Programmable Material System', in Proceedings *of Design as a Catalyst for change - DRS International Conference 2018, Limerick, Ireland, 2018* (Design Research Society, 2018) doi:10.21606/drs.2018.566

[59] *Living Cotton,* dir. by Anna Neklesa, Vimeo <https://vimeo.com/220382454> [accessed 28 November 2020]

characters in a puppetry system. It investigates weird materials between their materialness and liveliness and identifies the metaphorical correspondences they perform in a puppetry system compared to traditional materials[60].

Weird textile designers

Material-driven designers (MDDs) and textile designers have expressed their need for experimental methods for designing materials that use an

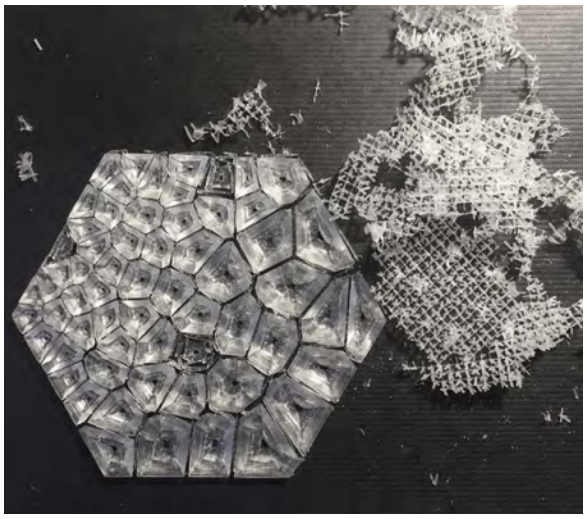

Figure 1-5 Lin, Mingjing, 'Interfashionality: Body-Oriented Parametric Design and Parametric Thinking 2.0 for 3D-Printed Textiles and Fashion' (unpublished PhD thesis, Royal College of Art, 2020), p123

unpredictable environment.[61] In this context, they promote the integration of a performative perspective in their design process to reveal the latent affordances of the material at 'the boundaries between human and nonhuman performances'.[62] Mingjing Lin [63] used parametric tools to design textile units (Figure 1-5.) that she assembled into costumes for dancers. In other words, they

[60] The term "traditional materials" in the thesis refers to materials made with natural or synthetic fibre, silicon, resin, or wood. The term does not include bio-based materials, parametric or programmable materials.

[61] Jenny Bergström and others, 'Becoming Materials: Material Forms and Forms of Practice', *Digital Creativity*, 21.3 (2010), p.168 doi:10.1080/14626268.2010.502235

[62] Bahareh Barati, Elisa Giaccardi, and Elvin Karana, 'The Making of Performativity in Designing [with] Smart Material Composites', in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems Montreal, Canada* (ACM, 2018), pp. 1–2 doi:10.1145/3173574.3173579

[63] Mingjing Lin, 'Interfashionality: Body-Oriented Parametric Design and Parametric Thinking 2.0 for 3D-Printed Textiles and Fashion' (unpublished PhD thesis, Royal College of Art, 2020)

navigate the fluid nature of their materials[64] while updating their experiential knowledge.[65]

Drawing from Nimkulrat's concept of materialness, MDDs explore new tools and 'way[s] of thinking about materials towards more unpredictable, non-linear, and open design'.[66] Academics and practitioners in textile and material design investigate methods to enact the fluid and ambiguous nature of weird materials in their garments. The material-driven textile design (MDTD) method[67] invites textile designers to follow the material to create forms rather than imposing a shape or a pattern on it. They support their research with transdisciplinary strategies.[68] They craft the ambiguity and unpredictability of their materials to account for the tensions in and with the textile structure.[69] Indeed, their interest in working with the fluid nature of the weird textiles evokes the work of puppeteers performing the 'opalescence'[70] and the uncanniness of their puppets.

MDDs advocate an ecological approach to design, one where the material provides the initial insight to the designer. Although their position in relation to materials appears similar, puppetry and textile designers have different expectations. Puppeteers focus on the symbolic correspondences the materials

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[64] Elaine Igoe, 'Change Matters: Theories of Postdigital Textiles and Material Design', in *Proceedings of DRS 2018 International Conference: Catalyst*, *Limerick, Ireland* ed. by C Storni, and others (Design Research Society 2018), p.1791 <http://www.drs2018limerick.org/participation/proceedings> [accessed 31 March 2020].

[65] Elvin Karana and others, 'Material Driven Design (MDD): A Method to Design for Material Experiences', *International Journal of Design*, 9.2 (2015), pp.35–54.

[66] Elvin Karana and others, 'Alive. Active. Adaptive: Experiential Knowledge and Emerging Materials', *International Journal of Design,* 13.2 (2019), p.3

[67] Miriam Ribul, Kate Goldsworthy, and Carole Collet, 'Material-Driven Textile Design (MDTD): A Methodology for Designing Circular Material-Driven Fabrication and Finishing Processes in the Materials Science Laboratory', *Sustainability*, 13.3 (2021) doi:10.3390/su13031268.

[68] Miriam Ribul, Kate Goldsworthy, and Carole Collet, 'Material-Driven Textile Design (MDTD): A Methodology for Designing Circular Material-Driven Fabrication and Finishing Processes in the Materials Science Laboratory', *Sustainability,* 13.3 (2021), p.14 doi: 10.3390/su13031268.

[69] Recoules Quang, 'Tension and Materiality', p.261

[70] See Appendices/ Glossary, p246.

may provide rather than aiming at 'mastery of the material world'.[71] In contrast, MDTDs work towards developing new textile fabrication processes while mastering the materials [72] to provide new haptic and visual textile properties.[73]

RESEARCH QUESTIONS

Research gap

The research reads puppetry as a collaboration between human and non-human activity, producing knowledge through non-verbal storytelling. The art of puppetry has already demonstrated its potential in transdisciplinary research in other design fields, such as product design.[74] Designers in HCI and robotics[75]refer to puppetry knowledge in relation to producing movement-based liveliness. There are also many examples of transdisciplinary research between art and textile and fashion design: textile practitioners investigate artistic and/or performative methods: Tsai-Chun Huang,[76] for instance, collaborated with performing arts practitioners to evaluate his costume design work and Lin[77] used live performance as a research method.

In summary, puppeteers share a common interest with textile and material designers in emulating liveliness in their artefacts and communicating the liveliness of their materials through storytelling methods. [78]

Nevertheless, transdisciplinary research between puppeteers and material and textile designers is yet to be developed. Moreover, to the best of my

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[71] John Bell 'Playing with the Eternal Uncanny: The Persistent Life of Lifeless Objects', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.50.

[72] Ribul, Goldsworthy, and Collet, 'Material-Driven Textile Design (MDTD)', p.6

[73] Ribul, Goldsworthy, and Collet, 'Material-Driven Textile Design (MDTD)'p.12

[74]Kensho Miyoshi, 'Puppetry as an Alternative Approach to Designing Kinesthetic Movements', *RTD Conference*, 2019, doi:10.6084/M9.FIGSHARE.7855802.V2

[75] Elizabeth Jochum and others, 'Robotic Puppets and the Engineering of Autonomous Theater', in *Controls and Art,* ed. by Amy LaViers and Magnus Egerstedt (Springer International Publishing, 2014), pp. 107–28 doi:10.1007/978-3-319-03904-6_5

[76] Huang, 'In-between Pleats: Pleats, Pleating and 'Pliable Logic'', p. 283

[77] Lin, 'Interfashionality: Body-Oriented Parametric Design and Parametric Thinking', pp.69-74

[78] Julie Arkes, 'New Digital Narratives for Living Textiles', (unpublished Master's thesis, Delft University of Technology, 2021)

knowledge, to date there has been no academic contribution from puppetry to textile design.

In summary, there is a gap in the literature for an account of transdisciplinary research between puppetry and textile design. With the study, I propose to

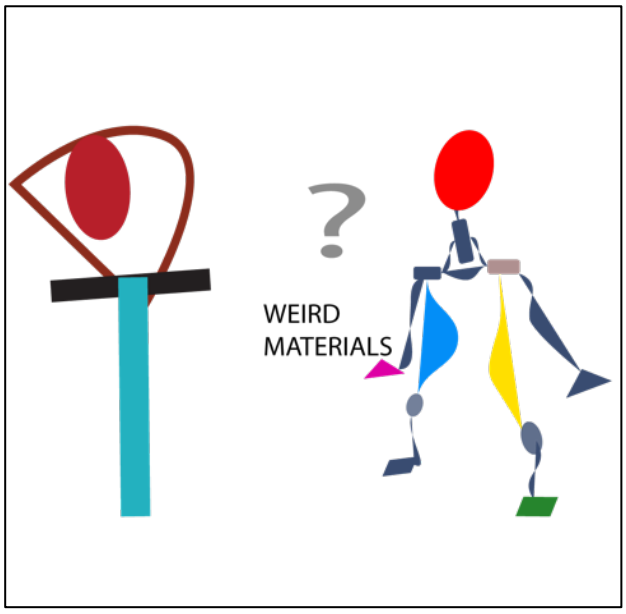

Figure 1-6 Research Gap

situate a source of knowledge in weird materials. These set the stage for the quest for knowledge and are the site where puppetry and textile design can perform practice-led research.

Figure 1-6 above represents the gap between  puppetry and textile design  and the focus on weird materials as a vehicle for practice-led research.

Transdisciplinary methods

In this study, the term "transdisciplinary research" encompasses creating a space where alternative ways of knowing can emerge, a method promoted by the feminist theorist, Rosi Braidotti[79].

[79] Rosi, Braidotti, 'Transformations,' in *Transpositions*, ed. by Michael Schwab, (Leuven University Press, 2018), pp. 23–31.

Further on in the exegesis in the Chapter 3 (p.65), I discuss the different approaches to transdisciplinary research that support the enquiry. I am developing the reasons that made me select Kirkkopelto 's model of transposition[80] over the translation model applied by textile designers; Ribul, Goldsworthy, and Collet[81] in their transdisciplinary research with scientists.

The transdisciplinary character of the research draws from the exploration of textile thinking and practice through the art of puppetry and the design of transposition activities based on puppet and puppetry performance making. It refers to my collaboration with participants from textile and design research fields in the design of a research method that can support both my practice and theirs.

Research Questions

On this basis, the main research question emerged as the following enquiry:

"Can using weird materials to design puppetry performances support textile designers in their creative journey and research process?"

with the following secondary questions:

"How can weird materials be used in puppetry performance to enhance storytelling and characterisation?"

"How can puppetry performance be used as a research method?

The research question locates the enquiry at the intersection of puppetry, textiles, and research design. It challenges my knowledge of puppetry design and my ability to transpose my expertise in the art of storytelling with physical materials to textile researchers.

Nature of the research

[80] Kirkkopelto, 'Abandoning Art in the Name of Art', pp. 35-8

[81] Miriam Ribul, Kate Goldsworthy, and Carole Collet, 'Material-Driven Textile Design (MDTD): A Methodology for Designing Circular Material-Driven Fabrication and Finishing Processes in the Materials Science Laboratory', *Sustainability*, 13.3 (2021), doi: 10.3390/su13031268

The research is practice led[82] [83] [84] and artistic.[85] [86] The research evaluates the process of the art of puppetry and how learning occurs.[87]

More precisely, the research paradigm is performative,[88] as it privileges material outcomes and practice in evaluating the research contribution. In other words, the research values the subjectivity that emerges throughout the artistic practice and interprets knowledge as a 'liquid form of understanding'.[89] As non-scientific research, the study does not frame the practice in a controlled environment and in isolation. Instead, it maintains a space between free, playful exploration and containing boundaries, [90] where the artistic practice may become innovative when combined with theoretical perspectives. [91]

RESEARCH MATERIALS

Aims and Objectives

This study aims to expand the list of tools available for designers to research

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[82] Trygve Faste and Haakon Faste, 'Demystifying 'Design Research': Design is not Research, Research is Design', in *ISDA Education Symposium, Boston, 2012* <https://www.idsa.org/wp-content/uploads/Faste.pdf> [accessed 8 April 2020]

[83] Christopher Frayling, 'Research in Art and Design' (Royal College of Art Research Papers, Vol 1, No 1, 1993/4)' (Royal College of Art, 1993) <https://researchonline.rca.ac.uk/384/> [accessed 19 November 2020]

[84] Carole Gray, 'Inquiry through Practice: Developing Appropriate Research Strategies', paper presented at *No Guru, No Method? Discussions on Art and Design Research, Helsinki, Finland* (Helsinki University of Art & Design, 1998), pp. 82–95.

[85] Carole Gray and Julian Malins, *Visualizing Research: A Guide to the Research Process in Art and Design* (Ashgate, 2004).

[86] Robin Nelson, *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances* (Palgrave Macmillan, 2013) p.113.

[87] Jean McNiff, *Action Research: Principles and Practice*, 3rd ed (Routledge, 2013) p.24 doi:10.4324/9780203112755

[88] Brad Haseman, 'A Manifesto for Performative Research', *Media International Australia*, 118.1 (2006), p.102, doi:10.1177/1329878X0611800113

[89] Graeme Sullivan, 'Art Practice as Research', in *Art Practice as Research: Inquiry in Visual Arts*, ed. by Graeme Sullivan, 2nd edn. (Sage Publications, 2010), p.102

[90] Rachel Philpott, 'Engineering Opportunities for Originality and Invention: The Importance of Playful Making as Developmental Method in Practice-Led Design Research', *Studies in Material Thinking*, 9 (2007), <https://materialthinking.aut.ac.nz/sites/default/files/papers/SMT_V9_05_Rachel_Philpott.pdf> [accessed 13 May 2024]

[91] Robin Nelson, 'Practice-as-Research and the Problem of Knowledge', *Performance Research,* 11.4 (2006), pp.113, doi:10.1080/13528160701363556

materials they consider 'co-performers'[92] while understanding how to add weird materials to the list of materials available to me in my puppetry practice.

The practice-led enquiry

- evaluates the potential of bio-based and thermochromic materials in the design of puppetry performances,
- designs puppetry performances for activating the weird materialness of textile artefacts.,
- designs a research method that generates impulses to textile and material-driven researchers in their research journey.

The practice-led research planned material experiences to evaluate the value of the transposition of puppetry into textile design and textile design into puppetry.

Methods and Methodology

This transdisciplinary study engaged with the transposition model[93] proposed by the performing artist and researcher Esa Kirkkopelto [94] and staged the puppetry practice in the specific framework of a research enquiry into the textile research design field. The puppetry-led research was framed by action research methodology,[95] intertwined with diffraction philosophy[96] [97] [98] [99] into an 'agential transposition in action'.

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[92] Elvin Karana and others, 'The Tuning of Materials: A Designer's Journey', in *Proceedings of the 2016 ACM Conference on Designing Interactive Systems,* DIS '16 (New York, NY, USA: Association for Computing Machinery, 2016), p. 620 doi:10.1145/2901790.2901909

[93] See Appendices/ Glossary, p.

[94] Esa Kirkkopelto, 'Abandoning Art in the Name of Art' in *Transpositions: Aesthetico-Epistemic Operators in Artistic Research,* ed. by Michael Schwab (Leuven University Press, 2018), pp. 33–40.

[95] Wilfred Carr and Stephen Kemmis, *Becoming Critical: Education Knowledge and Action Research* (Routledge, 2003), doi:10.4324/9780203496626

[96] Karen Barad, 'Diffracting Diffraction: Cutting Together-Apart', *Parallax*, 20.3 (2014), pp.168–87, doi:10.1080/13534645.2014.927623>

[97] Donna Haraway, *The Haraway Reader,* (Routledge, 2004)

[98] Trinh T. Minh-Ha, 'Not You/Like You', in *Dangerous Liaisons: Gender, Nation, and Postcolonial Perspectives*, ed. by Anne McClintock, Aamir Mufti, and Ella Shohat (University of Minnesota Press, 1997), pp. 415–19

[99] Kathrin Thiele, 'Ethos of Diffraction: New Paradigms for a (Post)Humanist Ethics', *Parallax*, 20.3 (2014), pp.202–16 doi:10.1080/13534645.2014.927627

The thesis followed Barad's dynamic understanding of diffraction that defines an ethic where knowledge is not situated but performed, and where making knowledge is to make worlds.[100] Diffraction rejects binary thinking [101] and argues that beings cannot exist independently from their relationships[102] [103] In summary, diffraction focuses on which differences matter, how they matter and for whom they matter, rather than how the differences are produced or what they are.[104]

Therefore, reading the transdisciplinary research through diffraction methodology is to acknowledge the similarities and differences between puppetry and textiles and puppetry and design research.

The transposition activities of devising, sharing, and staging were directly exported from my practice as a researcher. As the researcher, I devised puppetry performances and shared puppetry storytelling methods with researchers in design and early-career textile researchers. These sessions contributed to the design of a method for supporting designers in their research process. Moreover, the activity of documenting supports both the artistic research[105] and the dissemination of the research.[106] Overall, the material-driven activities generate the research data, collectively termed the 'messy area'[107] in reference to the multiple perspectives the activities provided and how they contribute to the rigour of the action research process.

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[100] Barad, *Meeting the Universe Halfway,* p.91.

[101] Karen Barad 'Diffracting Diffraction: Cutting Together-Apart', *Parallax,* 20.3 (2014), p.168, doi:10.1080/13534645.2014.927623&gt.

[102] Ibid., p.140

[103] Thiele, 'Ethos of Diffraction', p.206

[104] Barad, *Meeting the Universe Halfway,* p.177.

[105] Maarit, Mäkelä, and Nithikul Nimkulrat, 'Reflection and Documentation in Practice-Led Design Research', in *Making Design Matter, Nordic Design Research Conference 4 , 2011, Helsinki* (Nordic Design Research, 2011*)* https://archive.nordes.org/index.php/n13/issue/view/7

[106] William Gaver, 'What Should We Expect From Research Through Design?', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Austin, Texas, May 2012,* (ACM, 2012) doi:10.1145/2207676.2208538

[107] Tina Cook, 'The Purpose of Mess in Action Research: Building Rigour Though a Messy Turn,' *Educational Action Research*, 17.2 (2009), pp.277–91, doi:10.1080/09650790902914241&gt.

The reflective practice occurred through puppetry evaluation and a diffractive analysis of the messy area, and the writings reflect on the agential transposition through the journey of the research as a puppetry system. On the one hand, the puppetry evaluations interrogate the material activity in relation to different puppetry styles and the potential of the materials to perform in a puppetry system. On the other, the diffractive analysis identifies the potential for the bio-based and chromic materials to show a weirdness that traditional materials, used in the same textile process, would not. In particular, the analysis reviews how staging them in a puppetry system reveals new metaphorical properties. Moreover, the data analysis reviews the effect of the material experiences on the entanglement between the researcher and the research.

Outcomes

The creative work includes a set of textiles and bio-based artefacts and a series of diagrams, still images and short animations combining puppetry improvisations with weird materials. The research outcomes demonstrate the potential of weird textile materials to perform in a puppetry system and the evolution of the practice from devising a textile character to interference-making with natural elements. The thesis title, 'Storytelling and Material Interferences: Practice-led Research Between Puppetry and Textiles' refers to the outcome from the material and storytelling experiences and the transdisciplinary character of the research. From designing opalescence with thermochromic textiles emerged a new awareness about the environment and how it could fulfil different roles in a puppetry system. The environment acted as an impulse input, an interference, switching between being a manipulator and an actor. As a puppet-maker, it has inspired me to become more sustainable in my practice while balancing technology and craft, sustainability and functionality: 'design between puppetry and textiles' refers to the outcome from the material and storytelling experiences and the transdisciplinary character of the research.

RESEARCH CONTRIBUTIONS

Research design

The main argument of the thesis is that the transposition of puppetry practice into a research method based on material interferences offers original ways to support textile designers in their creative and research process. The thesis argues for the original contribution to knowledge by my research in the following areas:

A. A research method that recognises interferences as a source of knowledge for evaluating new materials and provides an effective stage for devising research with other designers. The method informs the qualitative evaluation of new materials, based on the activity of staging and devising material interferences. It supports the communication of the research through physical materials. The method has been applied to the improvisation of characters and storylines by textile researchers and researchers in design.

B. An original perspective that maps the research system to a puppetry system in which the researcher is a puppeteer and the research a marionette. The arguments are developed through the exegesis, using the metaphor of the research as a marionette and the researcher as its puppeteer to illustrate the dynamic relationship between the researcher and the research in a transdisciplinary study.

C. A new reading of puppetry through textiles, and textiles through puppetry, which has led to a new style of puppetry based on textile processes with thermochromic and bio-based materials.

Challenges and opportunities

The research has not only the potential to produce creative solutions, but also the limitations of an artistic practice performed in an academic context. Puppetry is described in this thesis and evaluated through my personal history in puppetry and physical theatre and may not reflect the experiences of other

puppeteers. Nelson[108] pointed out in relation to performing practice as research (PaR) that she experienced hurdles while researching how to undertake her puppetry practice as research. It was challenging to transpose the fluidity of the puppetry practice into design thinking. As an artist more used to visual than verbal communication, I faced difficulty in translating my tacit knowledge into the right terms and making it explicit for designers. However, the impulse to unwrap my practice to allow its transposition into textile research gave me a new understanding about puppetry systems.

As a French native, in writing the thesis I wrestled with the English language while looking for clarity and adequacy and reflecting on my practice. Nevertheless, it generated the space to ponder the choice of terms: for example, between impulse, stimulus, and interference. On another level, I became familiar with the textile vocabulary and textile thinking through natural language utterances to become familiar with the keywords I collected from my transposition into the textile community.

It is important to note that the research is not about the audience's cognitive experience of a puppetry performance. Rather, it is about incorporating weird materials into a puppetry system. For that reason, the limitations in sharing the real experience of puppet-makers with their materials may be overcome by including additional research materials such as a set of thermochromic and textile artefacts, portable stages for testing their thermochromic character, documentation made of still images of the textile artefacts, and stop-motion animations.

The research considers the potential of textile design through the forms of puppetry I practice, which are limited to shadow theatre, object theatre, "tabletop puppetry"[109], marionettes, and stop-motion puppetry. I kept the size of the puppets small enough to fit into a suitcase. My very limited knowledge

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[108] Robin Nelson, *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances* (Palgrave Macmillan, 2013) p..43

[109] 'Tabletop Puppetry', *World Encyclopedia of Puppetry Arts,* 2016 <https://wepa.unima.org/en/tabletop-puppetry/> [accessed 8 May 2024]

of textile processes at the beginning of the research gave way to a 'willful naïveté, a deliberate unawareness of the rules, to widen the possibilities of discovery.'[110] Finally, the research journey and the practice have been hugely impacted by more than two years of physical restrictions due to the Covid-19 pandemic. Although it was indeed an overwhelming period, these external events found their way into the research and my processes of becoming.

Nevertheless, the research context generated a new awareness about how the surrounding environment could fill different roles in a puppetry system. During the research journey, the environment acted as an impulse input, an interference, switching between being a manipulator and an actor. It gave me a strong desire to include elements of sustainability along with low-technology solutions in future projects.

Thesis Structure

General overview

I integrate my creative work with the text through diagrams, drawings, still images and links to short videos. The theoretical context and the case studies provide a background for the creative practice. The chapter titles illustrate the different cycles of the research activities and an invitation to focus on the process of the puppetry practice becoming research rather than exploring what puppetry is. After this chapter ('Beginnings'), that locates my research between puppetry and textiles and gives a general overview of the exegesis, Chapter 2 reflects on the activity of 'Unwrapping' my tacit knowledge as the researcher. Chapter 3 reviews the methods and methodologies included or omitted from the 'Research Script'. The practice chapters, 4 ('Character Improvisations') and

[110] Ian Lambert, Improvisation: Autonomy, Heteronomy and Wilful Naïveté', in *EKSIG 2019: Knowing Together – Experiential Knowledge and Collaboration DRS Special Interest Group, Estonian Academy of Arts, 2019* <https://eksig.org/EKSIG2019.html> [accessed 8 December 2022] p. 7.

5 ('Devising a Story'), cover the evaluation of other practitioners' work with weird materials and the analysis of my creative work. The chapters document what became (in)visible during the practice and critically discuss the outcome of the transposition activities in relation to the research question. Chapter 6, "Wrapping up", concludes with the answers that the practice provided and the directions in which the material and textile designers might apply them to support their creative journey and research process. It also reflects on how the study changed my perspective on textiles and puppetry practice and what new directions I will take. The Appendices follow the main content of the exegesis.

CHAPTERS OUTLINE

Chapter 1- 'Beginnings'

This chapter locates the beginning of the research journey between textiles and puppetry and the initial site of enquiry in the weird materialness of textiles embedded with responsive materials. The term is at the confluence of the concepts of 'liveliness' and 'materialness'. I began the research journey with my tacit knowledge of puppetry design, improvisation techniques with physical materials and my previous experiences with textile automata. The section includes the presentation of the research timeline that serves as a support for organising the writing into chapters and for reading the research going on and off the 'research stages' over five years. The research reads puppetry as a collaboration between human and non-human activities, producing knowledge through non-verbal storytelling. The following chapter ('Unwrapping') delves into my practice and tacit knowledge, which I used to explore the design of puppetry performances with weird materials.

Chapter 2 'Unwrapping'

The chapter presents the research context and the initial stage of the study between puppetry, textile, and research design. It unwraps the puppetry and textile research discipline. On the one hand, the section introduces my background and how it brought me as a puppeteer to the research stage. It unwraps my puppetry practice to extract the tacit knowledge that could be explicit for the textile researchers. The chapter establishes the research as a

puppetry system, in which I perform a series of activities on a research stage connected to the research question. The stage provides the starting point for the messy area that will grow from the research data. The chapter introduces the key terms 'opalescence', 'breathed stillness' and 'double vision' that support the design of puppetry systems.

At the same time, the section also unwraps the explicit knowledge of textile designers and researchers to extract what could become transformational knowledge for designing puppetry systems in my research. The chapter elaborates on how reading my background through the exploration of weird materials through textile processes led to the choice of thermochromic materials over other smart textile materials.

Finally, the chapter critically reflects on which of the similarities and differences between the two disciplines the research chose to focus on initially for designing a research script. It elaborates on how reading the work of material-driven researchers through a puppetry perspective led me to investigate 'materialness', a term coined by Dr Nithikul Nimkulrat (2009) in relation to the puppetry concept of 'liveliness', in which the puppetry system is organised around its centre of gravity (COG).[111] At the confluence of the two disciplines, the research proposes the term 'weirdness' or 'the weird life of the materials', through which I investigate the production of new knowledge through the research script.

Chapter 3-'Designing a script'

The chapter describes how the entanglement between tacit knowledge in puppetry and the textile researcher's explicit knowledge generated a script for the research. It reviews the methods and methodologies included or omitted in the research script and discusses different models for reading the transdisciplinary character of the study. The study wove action research methodology and diffraction philosophy together into an 'agential transposition in action' to provide a useful framework for the transposition of

[111] See Appendices/Glossary, p.239

puppetry into research and textile design. The specific framework of a research enquiry staged the practice outside of its initial field of puppetry into the textile research design field. The section reflects on agential transposition through the journey of the research as a system. It then details the transposition activities of devising, sharing, and staging that were directly exported from my practice. Moreover, the chapter introduces the reflective practice that occurred through puppetry evaluation and diffractive analysis of the messy area. The chapter ends with a discussion of the challenges and opportunities of puppetry-led research that was both artistic and constructed from the entanglement of theory and practice in the research.

Chapter 4 'Improvising characters'

The chapter presents the first cycle of activities that I carried out on the research stage. The first part of the cycle, 'Non-human', initiated the transposition of the researcher's practice by improvising a series of puppet characters. On the one hand, the practice evaluated a variety of non-human materials in different puppetry styles and textile processes. Their analysis prompted an investigation of which type of stage and textile structure would reveal their weird materialness.

As the puppeteer I also invited researchers in design to use the manipulation of physical materials to communicate their research. During the sharing sessions, the designers were prompted to explore the expressivity of found objects and other non-human materials. They were invited to use their findings to improvise a series of symbolic moves and to support a non-verbal presentation of their research theme. The material experiences provided the designers with a basis for performing their research as a metaphorical character that expressed their relationship to their research.

More specifically, with soft systems researchers and textile design students the author explored the possibility of including mask- and puppet-making as an additional tool in their evaluation of their materials. Instead of inviting them to 'make' with the material, I invited the textile researchers to focus on the metaphorical correspondences between the material physical properties and

an abstract concept or an emotion.

The second and third part of the first cycle of the transposition activities concern the improvisations of puppet characters with thermochromic and bio-based materials. The progressive entanglement between puppet-making, textile processes, and traditional and weird materials provided a series of characters. The puppetry audit and diffractive readings of the transposition activities provided the information that I needed to consider colour change as the COG in puppetry systems and to select thermochromic materials over bio-based materials. It also led me to identify heat as a character in puppetry systems based on thermochromic materials.

In summary, the first cycle of activities validated the potential for thermochromic materials to perform puppet characters. They stirred the agential transposition into creating material-driven characters performing in metaphorical systems rather than making puppets. Moreover, the studies validated the method for exploring the abstract idea of a research theme with tangible materials, but not as a method for communicating the research process.

Alternatively, they provided a solid ground for reading material expressivity through character-making. The aim of designing a tool for supporting researchers in their communication of their research prompted me to pursue the transposition with a focus on telling stories about a main character based on its material expressivity.

Finally, the experience of watching the researchers manipulating their materials to communicate their concepts enabled me to consider my research as a marionette and the research system as a puppetry system, where the researcher-puppeteer is entangled with her research-marionette, with the research question as the COG of the system.

Chapter 5 ' Devising stories'

The chapter explores storytelling as research. After a brief introduction to traditional storytelling methods, it reviews how other puppeteers perform material-driven stories and how storytelling with physical materials has been implemented in academia. The chapter then presents practical storytelling cases with smart textile materials from other practitioners' work. The first part of this cycle of activities focuses on material transformation as a site of story production while exploring thermochromic materials and performing sharing sessions with textile researchers about their research themes.

The second part of the storytelling cycle, 'material interferences', reports on the disruptions to the research context by the global Covid-19 pandemic. It reflects on the transformations and transpositions of the research stage. The analysis of the puppetry system's adaptations to external interferences highlighted the importance of the sites of conversation, whether online, in a classroom, in a studio, or in the garden. In this new context, 'Zoom theatre'; a new category of puppetry performance with an original grammar, emerged. How the research responded to the pandemic and family events that became internal from being external to the research context illustrates Checkland's (2000) theory about research as a soft system. In this model, the research responds to external inputs by absorbing them and explores their impact on the relationships between the researcher and the researched.

In the second part of this storytelling cycle, the entry of interferences onto the research stage prompted me to consider material interferences as an input in our design of puppetry systems and as a purpose for the physical improvisations with materials in the sharing sessions with researchers. Reading the existing documentation through the concept of interference generated new interpretations of my previous experiences with materials. In addition, while the practice devised and staged material interferences, I explored a new structure for sharing puppetry as a research method with textile researchers. Instead of focusing on material transformations, sessions explored how

material interferences can induce different material transformations and how staging them in sequence could develop into a story. Finally, staging thermochromic materials in natural environments prompted me to acknowledge the environment as a co-puppeteer in my work with thermochromic puppets.

In summary, this part of the second cycle considered material interferences as an element of design in puppetry performances with thermochromics and the sharing sessions with the researchers.

Chapter 6 'Wrapping up'

The final chapter wraps up the performative research in a one-dimensional document, reflecting on the evolution of my tacit knowledge and the transformational knowledge that emerged from my study. It summarises the practical and theoretical findings and argues for their significance for textile designers and design researchers who are interested in qualitative tools for supporting and sharing their research. The conclusion chapter recapitulates the research journey, focusing on the research questions and reflecting on the centre of gravity of the marionette-research that shifted from material expressivity to material interferences. During the research journey, a material-driven research method that weaves material transformations and interferences emerged as a visual tool for communicating a story. Sharing my process of telling stories with physical materials to textile researchers and researchers in design changed my understanding of my practice of designing puppetry performances. Moreover, through the process of investigating the weirdness of the thermochromic and bio-based materials, the research initiated a new style of puppetry, in which nature is a co-puppeteer.

Finally, the chapter recalls how there was more than one storyteller in this research and how the tensions between them contributed dynamically to the research journey and to my journey from being a puppeteer to being a researcher. It acknowledges the challenges for the puppeteer-researcher in keeping the connection with the research alive and negotiating with the marionette-research and other storytellers in and out of the research system. I

learned how to read the enforced period of stillness as a space for engaging with the character of the marionette-research and find the impulses they both need to go forward again.

Chapter 2

UNWRAPPING

"Breath "

Video 2-1 "Look at the other", a performance piece that explores otherness in a realm that mixes the real and the virtual. Using a mask that divides the artist's face in half, the work forces its audience to see their own augmented self-image projected onto the mask.*(Look at the Other*, dir. by Sabrina Recoules Quang, 2017, Vimeo <https://vimeo.com/234081110> [accessed 13 May 2024]*)*

Video 2-2 "The Code is a shadow bubble", an installation that explores the otherness of electronic and paper thread puppets through sonic and visual interactions(The Code Is a Shadow Bubble, dir. by Sabrina Recoules Quang, 2018 , Vimeo, <https://vimeo.com/29020834> [accessed 13 May 2024]*)*

Puppeteer in Textile Design

Figure 2-1 Sculpting a Wooden marionette (Recoules Quang 2012)

I bring to the research my personal experience as a puppeteer and improvisational practitioner. I devise, design, and perform puppet characters between human and non-human materialities in live performances or in stop-motion animation. It is important to note that, like many other puppeteers, I am at once a maker (Figure 2-1) and a performer (Figure 2-2).

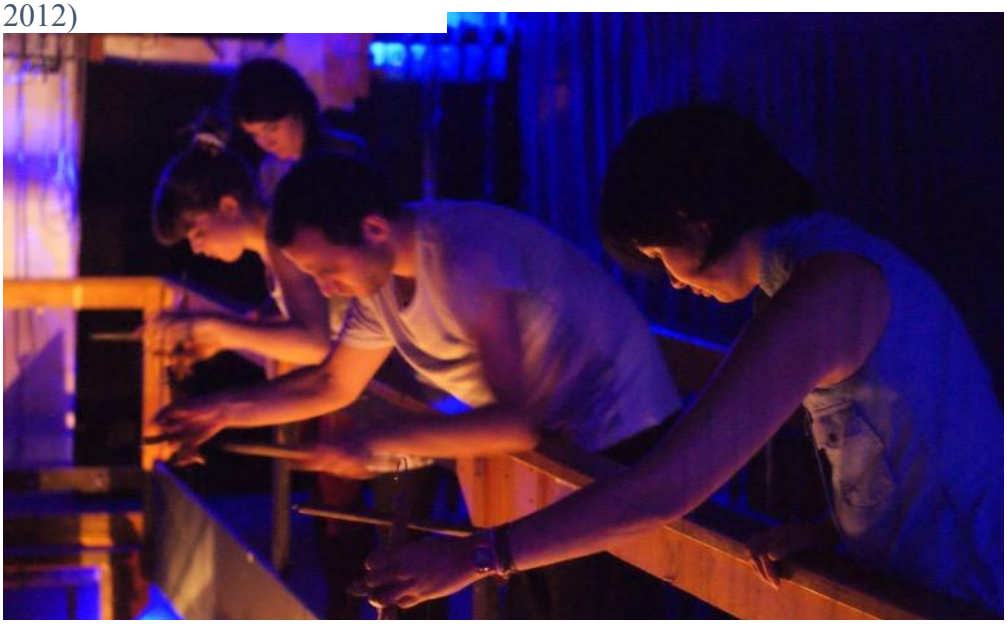

Figure 2-2 The author performing Long string marionettes at the Little Angel theatre, London (2014)

This duality was embodied in my research practice and reflective analysis. It prompted me to consider the research as a puppetry system in which the research is a marionette and the researcher is a puppeteer and where 'opalescence', 'breathed stillness' and 'double vision'[112] support the design of research systems. The transdisciplinary nature of the study stages my activity in the specific framework of a research enquiry outside of my original field, in

[112] See Chapter 2, 'UNWRAPPING'p.51 and see Glossary p.238

the textile research design field.

As a practitioner I engage with new materials and tools and make meanings through the design of puppetry experiences. My interest in, and curiosity about, the concept of 'in-betweenness' started to develop when I began to make and perform puppetry in 2012. During my performance, the puppets create a space filled with oscillations between the un-homely and the homely, between life and death. From these in-between spaces, the 'other than human' actors make meanings for a human audience. Following my interest, I have explored a series of in-between spaces born out of my experiences with materials and processes available in the analogue and digital worlds and experimented with the puppets coming to life in these spaces. During my Integral Movement and Performance training in 2015, travelling to Berlin hidden behind a neutral mask (Figure 2-3),

Figure 2-3 The Author performing a neutral mask.

I developed physical improvisation techniques based on embodiment, founded on those created by Jacques Lecoq.[113] Through this training, I devised the spaces between my emotional, social, and performing self. Between 2016 and 2018 I pursued an MFA in computational art at Goldsmiths, University of London, where I explored the space between the analogue and the digital.

While exploring computation as a new tool at Goldsmiths, I programmed visual and sonic spaces to support physical characters made of traditional materials in conversation with digital or

[113] Jacques Lecoq, Jean-Gabriel Carasso, and Jean-Claude Lallias. *The Moving Body: Teaching Creative Theatre* (Routledge, 2001)

electronic characters.

The responsive installations aimed to transcend the aesthetic provided by the

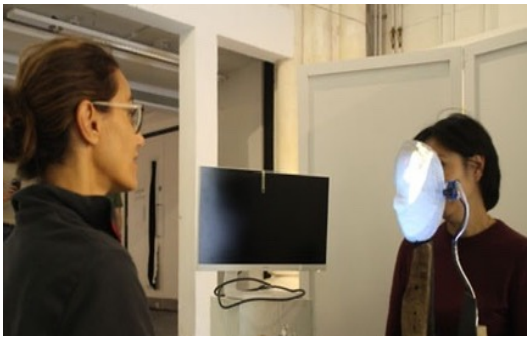

Figure 2-4 'Look at the Other' installation controlled by the face of the visitor (Sabrina Recoules Quang, 2016)

computer and bridge digital and analogue material expressivities. *Look at the Other* (Figure 2-4) is a mask installation that the viewer could control with their face. This speculative work read the space between network nodes[114] from a

[114] Ulises Ali Mejias, *Off the Network: Disrupting the Digital World*, Electronic Mediations, volume 41 (University of Minnesota Press, 2013) p.153

puppetry perspective in the light of theatrical mask theory.

In the responsive installation *The Code is a Shadow Bubble*, I assembled

Figure 2-5 Staging a poetic conversation generated by code and responding to the presence of the listeners facing textile and electronic puppets (Sabrina Recoules Quang 2018)

electronic puppets with bodies cast in paper thread and heads made of small motors. The textile automata were manipulated by code and sensors to interact with a human audience. (Figure 2-5) The process of working with paper threads made me curious about the work of textile designers and craftspeople working with smart materials.

I subsequently participated in the 2017 Etextile Summer Camp at the Paillard Centre d'Art, France, in the workshop led by Mika Satomi, Hannah Perner-

Wilson, Pauline Vierne and Ingo Randolf.[115] Their explorations of technological tools combined with textile craft encouraged me to explore the study of technological materials embedded in crafted structures. From this, taking the opportunity to investigate smart textiles as a programmable matter processed through textile practices as a doctoral study at the Royal College of Art seemed a natural move.

Hence, I came to the thesis with a clear orientation towards designing puppetry experiences with textile artefacts embedded with electronics as an entry point into textile thinking. The research reads puppetry as a collaboration between human and non-human activities, producing knowledge through non-verbal storytelling. In summary, I brought to the research, my tacit knowledge embedded in the improvisation of puppetry characters and telling stories with physical materials.

Initially, I devised various textile processes to become familiar with textile language. Following up my last researched work at Goldsmiths University, I explored the possibility of giving textile electronic artefacts a poetic discourse with code.[116]However, reflecting on the key themes around the relationships between natural and technological materials that research students[117] and textile academics were focusing on fuelled my interest in sustainable and ethical design solutions. It guided my selection process towards a smart material that reduces the use of electronic components as much as possible.

Various other influences also appeared during the research process, which were intimately related to my ongoing artistic working processes. The pandemic pushed the practice outside of a studio setting into the kitchen and the garden. I travelled with my family and the textile puppets to unfamiliar

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[115] 'Summer Camp – Summer of Etextiles' <https://etextile-summercamp.org/2017/summerof/summercamp/> [accessed 8 January 2024]

[116] I performed computational poetry via Natural Language Processing, a process I used in my installation Dada Automata that I will analyse in more detail later in this chapter.

[117] 'Soft Systems 2021' <https://2021.rca.ac.uk/programmes/soft-systems> [accessed 3 January 2023]

indoor settings and other outdoor environments. Furthermore, I could not always separate my production from a domestic environment. This context forced me to reconsider hands-on, environmentally safe, low-tech and portable solutions for designing and staging the characters performing in puppetry systems.

Puppetry Systems

I previously[118] described puppetry as a system with human and non-human elements that perform lively characters on a theatrical stage. In this section I elaborate on the functioning of the puppetry system.

The puppeteer performs the weird liveliness of the materials. Puppet-makers engage with the materials for their potential to perform liveliness. They organise the tensions between the materials in the system[119] and enter into a devising process and a 'constant negotiation back and forth with it [the material].'[120] It is important to note that the coexistence of the human puppeteer and non-human materialities on the same stage is key to the puppets' liveliness.[121] Overall, liveliness in puppetry systems relates not only to the physical transformations of the puppet, but also to the concepts of opalescence, double vision and breathed stillness. .

Opalescence

On stage, we, as an audience, experience the puppet's duality and the different ontological statuses of the puppet and the puppeteer.[122] The term 'opalescence' in a puppetry context was first used by Henryk Jurkowski in reference to the ontological oscillation of the puppet between its lively

[118] Reference to the section 'Between Textile & Puppetry, What is puppetry?' in the thesis

[119] Recoules Quang, 'Tension and Materiality', p.258

[120] Bell, 'Playing with the Eternal Uncanny', p. 50

[121] Bass,'Visual Dramaturgy, Some Thoughts for Puppet Theatre -Makers', p.62

[122] Piris, 'The Co-Presence and the Ontological Ambiguity of the Puppet', p.41

character and dead matter.[123] In the puppetry performances, opalescence occurs when the puppet's duality is performed. Puppet bodies generate opalescence through constant oscillation between inanimate forms and live performances: 'once it (the puppet) enters into performance it is constantly re-formed by its changing semiotic and gestural context, and so its form arguably never actually settles'.[124] The oscillations create and maintain a space from where the puppet's character and the potential narratives emerge. When selecting the materials, the puppet designers evaluate their potential to contribute to these oscillations. In their design, they provide the puppet with a COG that the audience's gaze can follow and from where the puppet's physical changes appear to originate. While seeking to preserve the inanimate nature of the material, the practitioners embed in the puppet the potential for the materials to show lively activity.

BREATHED STILLNESS

> 'Only when the puppet is still and just perceived to be breathing is the audience able to read its thoughts and emotions. So paradoxically, even in motionlessness, there exists a "text"-the text of thought.'[125]

In actor-network theory, Bruno Latour describes the in-between spaces between network elements as voids with agency. In contrast, feminist theorist Karen Barad considers that the spaces in between entities are filled by their diffractive activities.[126] In puppetry, the audience reads the ensemble puppet and puppeteer and fills the space between each movement with meanings.[127]

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[123]Henryk Jurkowski, *Aspects of Puppet Theatre*, ed. by Penny Francis, (Puppet Centre Trust, 1988) p.78

[124] Gerhard Marx,'A Matter of Life and Death: The Function of Malfunction in the Work of Handspring Puppet Company', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), p. 240.

[125] Basil Jones, 'Puppetry, Authorship, and the UR-Narrative', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.66

[126] Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. (Duke University Press, 2007), p.80.

[127] Jones, 'Puppetry, Authorship, and the UR-Narrative', p.65

We perceive the puppet's liveliness through its motion and 'breathed stillness'. The puppetry performance is a choreography of moments of breathed stillness and physical changes in the puppetry system.

In my apprenticeship with master puppeteers Ronnie Le Drew and Stephen Mottram, I explored the nuances between setting a puppet object in motion and performing a lively character. It is not a series of movements that create the sense of life: rather, it is in the gap between each movement that the spectator acknowledges the visible connections between the puppeteers and the puppet that give the puppet ensemble its liveliness.[128] In their training, a group of puppeteers who collaborate on the manipulation of one puppet learn how to breathe as one while suspending their actions.[129] In doing so, they simulate the puppet's breath and generate enough space for the audience to contemplate the emergence of the metaphorical character. Only then can the spectators connect with the puppet and grant the object thoughts and emotions.[130]

DOUBLE VISION

> The 'deployment [by the puppet] of abstracted signs creates an illusion of life that the audience knows is not real will generate a concept called "double-vision", which postulates that an audience sees the puppet in two ways at one time: as perceived object and as an imagined life'.[131]

This concept relates to how the audience reads the oscillations between the puppet's functional and aesthetic qualities and the relationships between the puppeteer, the puppets and their surroundings on stage. At a cognitive level, the spectators use their 'double vision' to see the puppet simultaneously as an inanimate object and a lively character, and experience uncanniness. The puppet-puppeteer ensemble and the audience momentarily resolve the

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[128] Bass ,'Visual Dramaturgy, Some Thoughts for Puppet Theatre -Makers', p. 57

[129] Adrian Kohler, 'Thinking through Puppets', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), p. 99.

[130] Jones, 'Puppetry, Authorship, and the UR-Narrative', p 66

[131] Steve Tillis, *Toward an Aesthetics of the Puppet: Puppetry as a Theatrical Art (Contributions in Drama and Theatre Studies, no. 47)* (Greenwood Press, 1992) p.62

epistemological and ontological tensions at a mechanical and phenomenological level by producing a narrative. In this framework, weird textiles are perceived and performed as both a textile artefact and a scenic character.

Metaphorical Thinking

CENTRE OF GRAVITY (COG)

In a marionette system, the puppet character goes through physical transformations that are visual and mainly movement based. The system is physically organised around the COG of the marionette located somewhere between the marionette and its manipulator. The location of the COG may change during the performance. Any of these changes will have an impact on the movements of the puppet. .[132] Through hand manipulation, the puppeteer tunes the location of the COG in relation to the weight distribution in the system while devising with the physical limitations of the materials and the puppet's structure. The quest goes beyond the idea of directing the viewer's gaze here or there, as in robotic art, [133]or situating the vitality in the matter or the object. Instead, it relates to the establishment of the puppets in the same physical reality as the human audience. In other words, the process aims to establish that the puppet is also subject to the force of gravity. Whether the marionette walks or flies, it appears to live in the same world as us, as the speed of change in the weight distribution follows natural logic as we know it.[134]

METAPHORICAL THINKING THROUGH COLOUR CHANGE

While a mechanical approach to liveliness emphasises movement for showing signs of liveliness, Nature tells us something else. Colour change is an aspect of a tree's life cycle, a manifestation of fear in an octopus or a sign of adaptation to danger in a chameleon. In their paper 'Design Concepts for a Temperature-

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[132] Sichel, 'Escaping the Puppet Ghetto', p.163.

[133] Glynn, 'The Irresistible Animacy of Lively Artefacts', pp.156-159

[134] The author has acquired this tacit knowledge during her puppetry training with Ronnie Le Drew and Stephen Mottram.

sensitive Environment Using Thermochromic Colour Change',[135] material-driven textile designers advocate for the aesthetic and functional potential of dynamic colour alteration in a piece of fabric when it is possible to control this change. Colour is indeed 'the most immediately visible aspect of textile design and is thus an essential design consideration, for many designers the principal aesthetic concern'. Soft systems designer Amy Winters has created dresses that change colour with the rain, and Lauren Bowker used chromic materials to perform the disappearance of a British flag in response to London's pollution levels. In general, colour change and chromic materials have been investigated in textile design in terms of patterns, visual effects, interaction design, and architecture.[136] In shadow theatre, colour changes translate the language of light into coloured silhouettes or dark shadows. In this form of puppetry, colour translates the language of light into characters. The puppeteer operates the light in front of and behind the screen to perform metaphorical correspondences between the coloured silhouettes and the shadows. Notwithstanding this interest in colour change to perform uncanny characters, to the best of my knowledge puppet-makers, unlike textile designers, have yet to attempt to explore chromic materials in their work.

The research process took cues from textile designers' work to initiate a body of practice from the oscillations of the thermochromic colour between the visible and the invisible.[137] [138] The literature review shows extensive

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[135] Robert M Christie, Sara Robertson, and Sarah Taylor, 'Design Concepts for a Temperature-Sensitive Environment Using Thermochromic Colour Change', *JAIC - Journal of the International Colour Association*, 1 (2012)

[136] Delia Dumitrescu, 'Relational Textiles: Surface Expressions in Space Design' (unpublished PhD Thesis, University of Borås, 2013), doi:10.13140/RG.2.1.2429.8723.

[137] Barbara Jansen and Marie Ledendal, 'Light and Shadow Play : The Sun as an Aesthetic Trigger for Urban Textiles', *Ambience 2011, Borås, Sweden*, 2011 <https://urn.kb.se/resolve?urn=urn:nbn:se:hb:diva-5339> [accessed 13 May 2024].

[138] Barbara, Jansen, 'Composing over Time, Temporal Patterns: In Textile Design' (unpublished PhD thesis, University of Borås, 2013)

documentation of designing with thermochromic materials.[139] [140] [141][142]My choice of leuco-dye pigments over liquid crystals was motivated by the wider colour palette available and manipulation that requires less care in terms of the formulation and technical limitations when applying them to textile layers.[143] In conclusion, the thermochromic material's potential to perform moments of breathed stillness through aesthetic changes that do not necessarily imply movement supports the choice of chromic materials over other smart textile materials with a movement-based response to their environment.

METAPHORS[144] IN PUPPETRY AND TEXTILE DESIGN

Elsewhere I have discussed how puppeteers investigate the metaphorical potential of the tension between the physical and functional properties of the material.[145] In addition to performing metaphorical characters that are lively, puppetry offers the possibility for audiences to visualise interactions at scales beyond ordinary human perception, to participate in events they could not otherwise perceive either emotionally or intellectually, such as climate change.[146] Puppeteers deploy the metaphorical correspondences through their hand manipulations of materials in front of an audience. The liveliness of the material acts as a metaphorical tool.

Interestingly, Claire Pajaczkowska's association of the loom with a portal refers

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[139] I. Cabral, and others, 'Exploring Dynamic Lighting, Colour and Form with Smart Textiles', *IOP Conference Series: Materials Science and Engineering*, 254.7 (2017), 072005, doi:10.1088/1757-899X/254/7/072005

[140] Marinella Ferrara, and Murat Bengisu, 'Materials That Change Color', in *Materials That Change Color - Smart Materials, Intelligent Design*, ed. by Marinella Ferrara and Murat Bengisu (Springer, 2014), pp. 9-60.

[141] Marjan Kooroshnia, 'Challenging Current Colour Theory and Practice Using Thermochromic and Photochromic Inks in Textile Design' (unpublished PhD thesis, University of Borås, 2017)

[142] Sara Robertson, 'An Investigation of the Design Potential of Thermochromic Textiles Used with Electronic Heat-Profiling Circuitry' (unpublished PhD thesis, Heriot-Watt University, 2011) <https://www.ros.hw.ac.uk/handle/10399/2451> [accessed 5 January 2020]

[143] Christie, Robertson, and Taylor 2012, 7

[144] In this research I refer to Lakoff's definition of a metaphor as system of correspondences between an abstract concept and a set of physical materials. George Lakoff, 'The Contemporary Theory of Metaphor', in *Metaphor and Thought*, ed. by Andrew Ortony, 2nd edn (Cambridge: Cambridge University Press, 1993), pp. 202–51, doi:10.1017/CBO9781139173865.013)

[145] Recoules Quang 'Tension and Materiality', p.258

[146] Margolies, 'Return to the Mound', pp.324-325.

to textile as performing as 'neither object nor subject, but as the threshold between',[147] echoing the definition of the performance of a puppet. Additionally, the metaphorical power of textiles is well documented, not only in the textile community[148] [149] [150]but also in storytelling,[151] philosophy[152] and fiction.[153] In textile pedagogy, Nimkulrat suggests that we should think metaphorically to 'find ways or techniques of making art or design works from the newly chosen materials. [154] In MDD, Karana and others. investigate a method for supporting material researchers in finding the metaphorical correspondences between their materials and feelings such as 'melancholia' and 'sad-tisfaction'.[155] Moreover, visual art researchers are familiar with metaphor as a tool with which to perceive and reveal the connections and relationships in their research outcome.[156] Hence, reading the textile design literature and research practice through puppetry gave me an objective to support the metaphorical thinking of textile designers.

Unwrapping my tacit knowledge between textile and puppetry led me to begin the research journey with the transposition of my methods for testing materials in my puppet-making from my previous experiences with textile automata. My

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[147] Pajaczkowska,'On Stuff and Nonsense: The Complexity of Cloth', p.229

[148] Catherine Dormor, 'The Event of a Stitch: The Seamstress, the Traveller, and the Storyteller,' *Textile,* 16.3 (2018), pp.301–10, doi:10.1080/14759756.2018.1432144&gt.

[149] Bruna Petreca and others, 'Radically Relational: Using Textiles As A Platform To Develop Methods For Embodied Design Processes', in *Proceedings of Alive. Active. Adaptive. International Conference 2017 of the Design Research Society Special Interest Group on Experiential Knowledge* Delft University, Netherlands: (EKSIG, 2017), pp. 261–74 <http://www.eksig2017.com/proceedings/>

[150] Rachel Philpott and Faith Kane, 'Textile Thinking for Sustainable Materials', *Making Futures Journal*, 2013 <https://makingfutures-journal.org.uk/index.php/mfj/article/view/174> [accessed 12 May 2024]

[151] Leanne Prain, *Strange Material: Storytelling through Textiles* (Arsenal Pulp Press, 2014)

[152] Tim Ingold, 'The Textility of Making', *Cambridge Journal of Economics*, 34.1 (2009), pp.91–102 doi:10.1093/cje/bep042

[153] Diana Thomas, 'Textiles in Text: Synaesthesia, Metaphor and Affect in Fiction', (unpublished PhD thesis, University of Wollongong, 2014) <https://ro.uow.edu.au/theses/4135>

[154] Nimkulrat, 'Paperness', p.190

[155] Elvin Karana, Elisa Giaccardi, Niels Stamhuis, and Jasper Goossensen, 'The Tuning of Materials: A Designer's Journey', in *Proceedings of the 2016 ACM Conference on Designing Interactive Systems, DIS '16* (ACM, 2016), p. 623 doi:10.1145/2901790.2901909

[156] Graeme Sullivan, 'Art Practice as Research', in *Art Practice as Research: Inquiry in Visual Arts,* ed. by Graeme Sullivan, 2nd ed (Sage Publications, 2010), p.102

focus became the ability of the materials to produce symbolic characters in various puppetry styles.

Reflections about Unwrapping

My own background and context brought me to the research stage with my tacit knowledge about the design of puppetry systems that perform visual stories with lively characters. The research began with the unwrapping of my practical knowledge as a puppeteer and the literature research to articulate the puppetry theories that I had been intuitively applying in my practice until then. I then wrapped it up again after selecting the salient elements of the puppetry practice that were relevant for designing the research. The key terms ‘opalescence’, ‘breathed stillness’ and ‘double vision’ define the performance of a puppetry system that is physically organised around its centre of gravity. The unwrapping activity read my tacit knowledge through a review of textile research design. It led me to focus on how to deploy metaphorical thinking between textile and puppetry design with colour-changing materials. In other words, I read my tacit knowledge through research design to generate explicit knowledge for textile researchers.

I performed the activity of unwrapping as a novice in design and textile theory and practice from an artistic perspective. The time I took to explore textile practices and textile thinking helped me to identify which part of my practice could be useful to researchers.

It is important to note that the activity of unwrapping supported my transposition from the beginning to the end of the research journey. It was not

a one-off process. I returned to the activity of unwrapping during my reflective process during my period of breathed stillness. Between research activities, I reevaluated my knowledge regarding the practice outcomes. Moreover, during the research journey, I introduced my research to design researchers and textile researchers and received a series of questions and feedback. In response to these initiatives, I continuously reassessed the transposition of my methods for selecting and evaluating materials. Finally, unwrapping as I went forward with the research was influenced by my activity with other puppeteers who faced the challenge of keeping their practice alive during the period of lockdown in 2021, when the puppetry community tried to resolve the impossibility of performing in front of a live audience and circumvent the obstacle of a screen.

In summary, the unwrapping activity did not take place on one occasion at the beginning of the research; instead, it continued throughout the research journey as I came back to my tacit knowledge to uncover the information I needed to go forward after reflecting on the data. It gave me the framework for scripting my research during the whole journey of the thesis and took the practice in its first direction for exploring the weird life of materials through mask- and puppet-making.

Chapter 3 Research

SCRIPTS

"Breath "

Video 3-1 'Messy area video that navigates through the visual documentation between 2018 and 2023 Sabrina Recoules Quang, 'Navigating the Messy Area ' Vimeo, 2024 <https://vimeo.com/938230464> [accessed 13 May 2024].

Video 3-2 Passionate Discourse (Dimensions of Dialogue). Jan Švankmajer, dir. by Jan Švankmajer, ear, YouTube,2020 https://www.youtube.com/watch?v=EbbNuGkHO_0

Transdisciplinary Methods

This chapter reviews the methods and methodologies that I included or omitted from the research script. The review of the research methods applied in material-driven design and textile design suggested two models for setting up the transdisciplinary research. The first model establishes transdisciplinary research as a translation of puppetry into textile designers' and researchers' working environments and how it may generate an original outcome for the researcher's practice. The second model follows a logic of transposition that focuses on the relationship between the practices as a major contribution to the research outcome. Finally, the section interrogates these models through the methodologies of action research and agential realism.

TRANSLATION

The diagram 'Transdisciplinary research as a translation' is a visual interpretation of cross-disciplinary research led by Ribul, Goldsworthy, and Collet[157]. Positioning material-driven designers (MDDs) in a laboratory among science researchers, design activities were devised that aimed to establish a new methodology and were situated in a laboratory. The outcome of applying these was the validation of the Material-Driven Textile Design (MDTD) methodology as an effective tool to support 'designers who wish to move into a scientific domain whilst retaining their core design knowledge'.[158] In other words, they translate material scientists' methods into MDD language. In their studio, the designers translate the research results back to the MDD language to extract value for MDD, rather than for material scientists. If this model

[157] Miriam Ribul, Kate Goldsworthy, and Carole Collet, 'Material-Driven Textile Design (MDTD): A Methodology for Designing Circular Material-Driven Fabrication and Finishing Processes in the Materials Science Laboratory', *Sustainability*, 13.3 (2021), doi: 10.3390/su13031268

[158] Ribul, Goldsworthy, and Collet, 2021, p. 14

adopts the idea of transformation, its primary focus is to provide functional meanings for material designers rather than scientists working in laboratories.

TRANSPOSITION

In contrast, the New Materialism theorist Rosi Braidotti defines transposition as a 'theory that stresses the experience of creative insight in engendering other, alternative ways of knowing',[159] with a focus on the transformation of the disciplines participating in the transdisciplinary research[160] and how they may 'produce a prolific in-between space' from where 'nomadic notions" might emerge.[161] She calls our attention to the 'creative links and zigzagging interconnections between discursive communities'[162] that evolve in the space between different disciplines.

Additionally, Kirkkopelto actively advocates transposition between artistic and non-artistic disciplines as a method to create 'knowledge of how different realities are constructed, about the way that different fields interact and penetrate each other implicitly'.[163]. For the artist-researcher, the research outcome, (the 'transponent'), emerges from the space between the 'transposed field' and the 'surrounding field'. In my research, I map the transposed field to puppetry and the surrounding field to textile design.

Kirkkopelto argues that the value of transposition is not in the research outcome, but in the effects on the communication between the different practices and the transformation of the transposed practitioner.[164]

In Kirkkopelto's transposition model of transdisciplinary research, I was also reassured that even if the grounding of my research in textile and research design was not successful, it would have initiated our exchange of information

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[159] Rosi Braidotti, 'Transformations,' in *Transpositions, ed. by Michael Schwab*, (Leuven University Press, 2018), p. 23

[160] Ibid., p.30

[161] Ibid., 'Transformations,' p.27

[162] Ibid., 'Transformations,' p.28

[163] Kirkkopelto, 'Abandoning Art in the Name of Art', p.38

[164] Ibid., p.35

which would begin to produce new types of relationships between the fields.[165] For example, during her transposition in a surgery unit at Imperial College in London, Fleur Oakes, a lace maker, produced a research outcome that was a box of textile layers representing the human body's anatomical structure.[166] The value of her transposition was situated not in this artefact but in how it changed the relationships between the textile practitioner and the surgeons. Oakes turned from being an observer to becoming a teacher, not of her craft practice but of something else at the intersection of craft and tactile intelligence.[167]

Similarly, I argue that the value of my research will emerge from my analysis of the dialogue that the practice initiated between the fields and from the transformation of my practice, and as a puppeteer who is evolving in a textile research design context.

In summary, transposition implies a transformation and creates new relations between fields. The transposition model differs from assimilation or a simple translation from one language to the other. Reading the effects of their differences[168] and the research as a transformative transposition is closer to Karen Barad's agential realism and her account of intra-actions, as we shall see in the next section.

Agential Transposition in action

[165] Ibid., p.39

[166] Roger Kneebone, Fleur Oakes, and Colin Bicknell, 'Reframing Surgical Simulation: The Textile Body as Metaphor', *The Lancet,* 393.10166 (2019), p.22 doi:10.1016/S0140-6736(18)33173-8.

[167] Ibid., p.23

[168] Barad, *Meeting the Universe Halfway,* p..89.

The nature of the research is artistic, and practice led. In my identification of a suitable framework to support my exploration of the weirdness of thermochromic and bio-based materials, I aimed to keep the research in an open environment where the practice, combined with theory, could generate new understandings. In other words, I researched a methodology that opened a space for the oscillations between improvisation and performance. I took cues from other practice-led designers and artistic researchers and followed an 'action research' path which involved 'learning in and through action and reflection, […] conducted in a variety of contexts'.[169] Moreover, I investigated a philosophical framework that would support the readings of my practice and reviewed theories of post-humanism related to the art of puppetry that focus on the relationship between human and non-human agencies.

ACTION RESEARCH

In my puppetry practice, I found similarities with other action researchers who see their research as a 'spiral of activity'[170] from where new understandings emerge.[171] Each cycle of action research begins with the evaluation of the

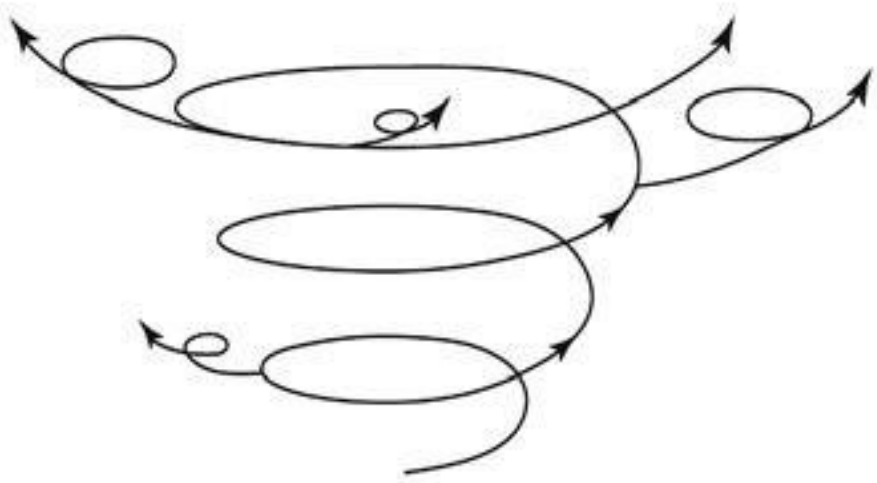

Figure 3-1 Jean McNiff, 'Figure 3.5 'A generative transformational evolutionary process' in Action Research: Principles and Practice, 3rd edn (London: Routledge, 2013) p.57 doi:10.4324/9780203112755

[169] McNiff, *Action Research: Principles and Practice*, p.24

[170] Carr and Kemmis, *Becoming Critical: Education Knowledge and Action Research*, p. 279

[171] McNiff, *Action Research: Principles and Practice*, p.29

practice through planning research activities, performing them and reflecting on their performance and outcomes. The reflective practice analyses the changes in the understanding and the conditions of the practice[172]. The diagram (Figure 3-1) 'A generative transformational evolutionary process'[173]underlines the never-ending process and the multiple paths that the action research approach opens for creating knowledge.

In my transdisciplinary study, the research is anchored between puppetry, textiles and research design. The action research evaluates how new knowledge about and through my puppetry practice could occur through a spiral of activities. The methodology positions me, the researcher, inside the research.[174] Moreover, it refers to the research as a learning system[175] that remains open to its environment and to the researcher's perception of the world during the research journey and what it brings into the research system.[176] Between each cycle of activities, the reflective practice evaluates the researcher's change in perspective towards the rest of the research system.

In that context, my reading of theories of post-humanism focused on finding a philosophy that accounts for the different perspectives of the worlds of the human and non-human materialities that are present in my practice.

AGENTIAL REALISM

Agential materialism reads the world as an outcome of the entanglement between material practices and acknowledges matter's dynamism.[177] Reading my puppetry practice through agential materialism is to read the outcome of the entanglement between the elements in the puppetry system: the puppet,

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173 McNiff, *Action Research: Principles and Practice*, figure 3.5, p.66

174 Ibid., p.25

175 Checkland, 'Soft Systems Methodology', S17

176 Ibid., S18

177 Barad, *Meeting the Universe Halfway,* pp.151-153.

the puppeteer and the audience. At the heart of a diffractive practice is the question about 'where the effects of [their]differences appear'[178] and how they become visible as patterns.

It invites the research to focus on what the puppet does rather than what it is. The philosophy also echoes the nature of puppetry in relation to the oscillations of the puppet and puppeteer ensemble between human and non-human materialities. Puppetry performances are about placing neither the vitality of the matter nor the agency here or there, as Jane Bennett[179] and Graham Harman assert.[180] Instead, it is about exploring the possibilities for change that the intra-actions between the elements of the puppetry systems reconfigure[181] and how they may perform shifts in agency on the puppetry stage.

Reading the transdisciplinary research through diffraction methodology is a way of not assimilating puppetry and textiles and puppetry and design research to each other.[182] Agential realism calls for a focus on how their outcomes might be different[183] and the observation of the effects of entanglement between the disciplines. Furthermore, using diffraction as a method for an action research study is to plan activities that generate a new set of 'boundaries, properties, and meanings'.[184] The reflective practice observes the effects of their entanglement and how they may 'intra-act' with each other in the sense of how they can transform each other.

Finally, diffraction methodology tells us that our transposition process works both ways. This is not only about the transposer who is creating a transponent,

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[178] Haraway, *The Haraway Reader* p.70

[179] Bennett, *Vibrant Matter*, p. 22

[180] Lucy Kimbell, 'The Object Strikes Back: An Interview with Graham Harman', *Design and Culture*, 5.1 (2013), p.112 doi:10.2752/175470813X13491105785703)

[181] Barad, *Meeting the Universe Halfway,* p.182.

[182] Trinh T. Minh-Ha, 'Not You/like You: Postcolonial Women and the Interlocking Questions of Identity and Difference', *Cultural Politics,* 11 (1997), pp.415–19

[183] Barad, *Meeting the Universe Halfway,* p.429.

[184] Ibid., p.148.

but also about the transposer who is affected by the transposition field. The site of transformation thus also includes my practice as the researcher who performed the transposition of textile thinking and practices. Taking this into consideration, I evaluate the transposition of my practice and 'the nature of the new kind of afterlife it initiates'.[185]

In summary, I performed an agential transposition in action that combined the planning and performing of transposed activities from my puppetry practices and their analysis through the perspective of agential realism. In the next section, I focus on how I read the research journey that spanned the research cycles in a diffractive way.

THE JOURNEY OF THE RESEARCH AS A SYSTEM

The research area evolved in the dynamic frame woven between action research methodology within a diffractive paradigm and through transposition activities. Each research cycle performed a 'research script' to collect new information about the weird life of the researched materials. The process contributes to the growth of the messy area in the entanglements of puppetry, textile research and design research. Between each research cycle, after analysing and reflecting on the data, I updated my research script for the next set of activities. Finally, I adapted the diagram introduced by McNiff[186] to visualise the spiral of activities that grows from the messy area of action research.[187] It is important to note that there is no real end to the action research spiral, only a timeframe within which the research is performed.

During the research journey, the research and I as the researcher performed two research scripts that reflected two main plots: 'improvising characters' and 'devising stories'. In the first of these, I focused on the production of a lively character and character-making as a research method.

The first research cycle focuses on the character improvisations that initiated

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[185] Kirkkopelto, 'Abandoning Art in the Name of Art', p.35

[186] Mc Niff, *Action Research: Principles and Practice*, pp.56-57

[187] Cook, 'The Purpose of Mess in Action Research', p.279

the messy area. It positions the puppeteer and the textile researchers with familiar and weird materials on stage. On the one hand, I devised, doodled, and improvised lively characters with the weird materials and textile processes to perform them in puppetry systems. I interrogated the weird life of the materials through shadow theatre and tabletop puppetry. On the other, I shared my tacit knowledge of producing masks and locating joints in a puppet. My first cycle of material explorations ended with a variety of characters that emerged from the series of prompts I received while devising and sharing.

The second cycle of activities focuses on the visual productions of stories with tangible materials. My puppetry explorations ended with a focus on the impulses I received from the material interferences and the interferences on my different stages. In my analysis, I evaluated their impact on the metaphorical correspondences delivered by the chromic and non-chromic characters.

Meanwhile, with the researchers, the script focused on the production of metaphorical correspondences with a system of characters improvised with different materials. The outcome from this activity generated a series of storylines in which physical characters performed metaphorical meanings based on their material interferences and transformations. In summary, I built the transposition of the puppetry practice through the design of material experiences to explore the ability of the weird materials to perform shifts in agency in a puppetry system when they are embedded in a textile structure and the value of puppetry in textile research design. The transposition is 'agential' in the sense that it enacts the boundaries[188] of textile design and puppetry. In these boundaries, the research activities do not investigate the artefacts that emerged from the entanglement between puppetry and textiles or the transposition activities with the textile researchers. Instead, they observe the difference that the research activities made to my practice of designing puppetry systems and what they revealed about the creative puppetry

[188] Karen Barad, 'Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter', *Signs*, 28.3 (2003), p.803, doi:/10.1086/345321

methods that were transposed for the textiles researchers.

Research Materials

MESSY AREA

"The messy area is simultaneously a method to generate and become a research tool to interpret data"[189].

The first research cycle began with the production of the 'messy area'. Cook argues that a messy area provides a setting for the clarification of what is already understood (explicit knowledge) and what is almost understood (implicit or tacit knowledge), which may initiate something original (transformational knowledge).[190] In my action research approach, the messy area is where my puppetry and tacit knowledge meet the explicit knowledge of textile practice. It is the point from which the spiral of action research cycles grows and where the rigour of the research is found. It provides 'experiential starting points from which' a new practice may follow.[191]

Practically, with the visualisation of the almost four thousand pictures and two hundred short videos and stop-motion animations made during the practice, I generated a multitude of possible combinations between textile materials and processes to design puppetry performances.

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[189] Cook, 'The Purpose of Mess in Action Research', p.286.

[190] Ibid., p282.

[191] Brad Haseman, 'A Manifesto for Performative Research', *Media International Australia*, 118.1 (2006), p.100 doi:10.1177/1329878X06118001132006.

The messy area video documents the visual data accumulated during the evaluations of the weird materialness. The still image of the messy area (Figure 3-2) shows the visual transitions between a patchwork of colours to the reduced thermochromic shade of the still pictures that fed the stop-motion animations. It accounts for the non-linear progression of the research and the process of selection between materials and textile processes.

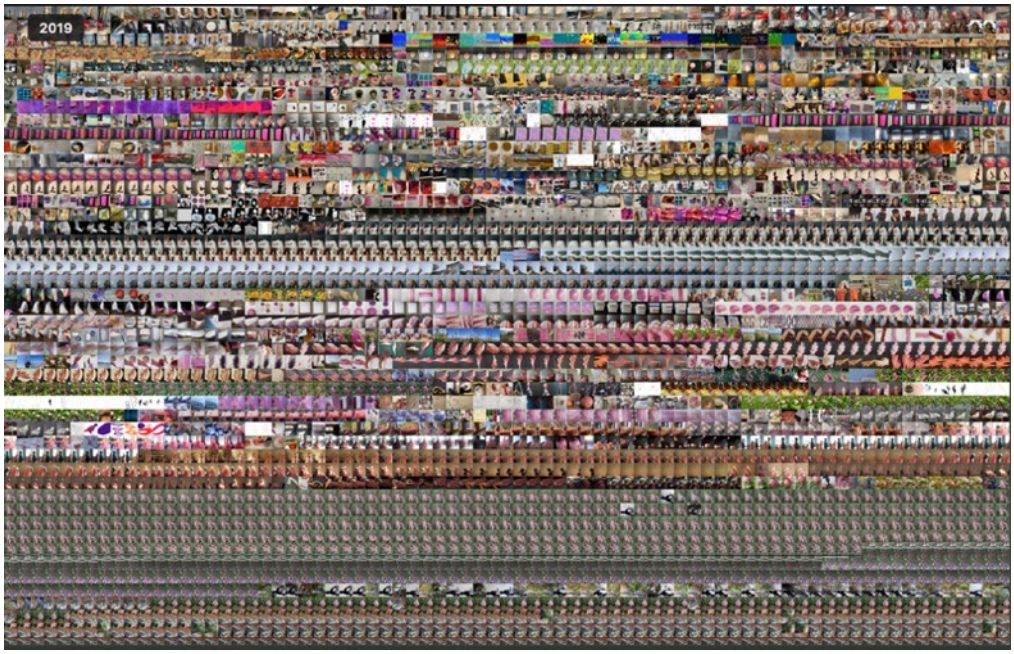

Figure 3-2 Messy Area Still Frame

I built the research documentation with a patchwork of various media, such as pictures, sketching, short films, and diagrams. It offers a visual diary of research data that supports the reading of the practice[192] that I present in more detail in Chapters 4 and 5. This body of evidence and critical observations connect the research activities to their context. On the research stage, the documentation activity is 'a research tool for capturing reflection on and in action'[193] and supports the discussion of the puppetry experiences.[194]

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[192] Carole Gray and Julian Malins, *Visualizing Research: A Guide to the Research Process in Art and Design* (Ashgate, 2004)

[193] Maarit Mäkeläand Nithikul Nimkulrat, 'Documentation as a Practice-Led Research Tool for Reflection on Experiential Knowledge', *FormAkademisk,* 11.2 (2018) p.14 doi:10.7577/formakademisk.1818

[194] Sofia Pantouvaki, Nithikul Nimkulrat and Nancy de Freitas, 'Experience, Materiality and Articulation in Art/ Design and Research Practices', *Studies in Material Thinking*, 2016, p.5

The activity of generating the documentation provided impulses from where the research moved forward.[195] Diffractively reading the 'puppets in action' through the eye of the camera provides different perspectives for me as a puppeteer. Throughout my documentation activity, I compared my perception of the artworks in analogue and digital settings. I looked at the different characters and stories that emerged from the same artwork through the direct observations of my hand manipulations, and indirect observations through live recording or stop-motion films and photo shoots. Reading one observation through the other extends the types of information I received from the materials in the puppet. It revealed metaphorical expressions that could not be seen with the naked eye and conveyed the power of images from which to find a direction or an impulse.[196]

To sum up, my research documentation is a tool related to the activity of staging and disseminating. It is at once a research method, a sharing activity and a reflective tool.

Hereafter, Figure 3-3 is an adaptation of Mc Niff's diagram of action research methodology (Figure 3-1). It proposes the messy area as the fertile ground from where the agential transposition in action grows. The figure shows how during its journey, the research iterated from the messy area and back, continuously pulling from the information already produced to open up new paths and producing new data that fed into the messy area.

[195] Nimkulrat, 'Paperness', p.45

[196] Bass, 'Visual Dramaturgy', p.56

TRANSPOSITION ACTIVITIES

In their practice, puppetry performance makers borrow from physical theatre

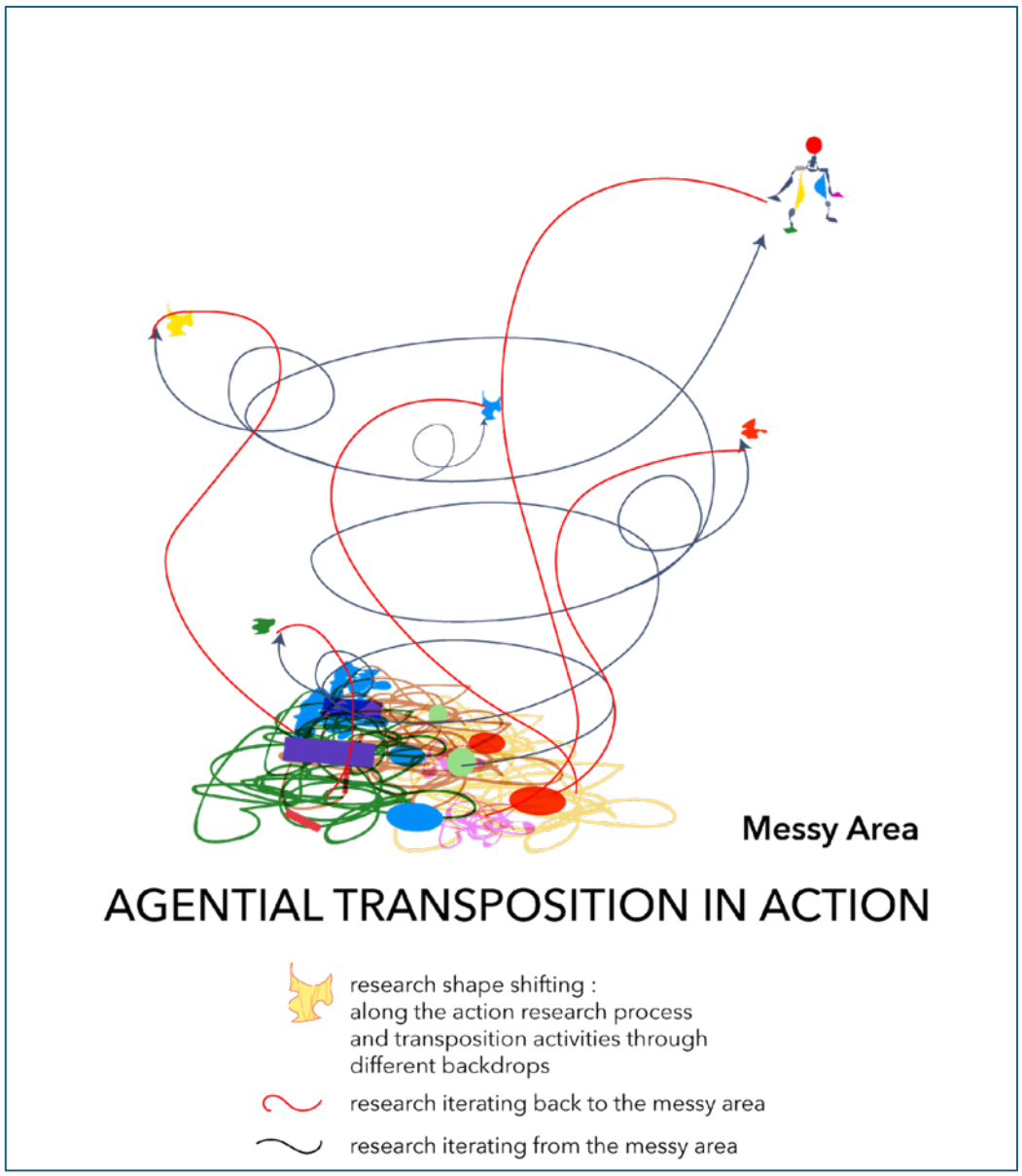

Figure 3-3 Diagram Agential transposition in action, adaptation of Mc Niff's action research diagram grounded into the messy area of the data collected by the research in action.

and craft practices. They explore the materialities present in the puppetry system and a performance of the findings through a process of storytelling.[197] Through two cycles of activities, the practice wove puppetry and textiles together through the making of four main forms of puppetry performances:

[197] Recoules Quang, 'Tension and Materiality', p.255

tabletop, shadow theatre, marionette, and stop-motion films.

Devising

In the process of making my characters, I devised with textile processes, chromic and bio-based materials. I improvised with the same freedom as in drawing doodles, free of a definitive purpose, which distinguishes this practice from prototyping.

Devising in a theatrical context is an activity that builds knowledge through improvisation.[198] The process is grounded in the certainty of a purpose: for example, finding a metaphorical character for a particular puppet. By contrast, the activity of devising the character does not follow a pre-determined script for how the puppet would enter and exit the stage. The absence of a script allows free experimentation of content and form: devising as a methodology is an open process,[199] a 'planned improvisation' that supports a constant emergence of new ideas and their exploration.[200]

The choice of one visual rather than another serves as a stimulus to act. For example, in puppet theatre and other physical theatre work, devising is used as a tool to find a character or a storyline and move forward through a series of prompts – for example, an image[201] or a text.[202]

The process of devising is related to physical improvisation techniques, where the performers test various embodiments of abstract concepts or characters. Puppet-makers improvise with non-human materials and take their impulse from 'the tension between the material and the tension between the physical and functional properties of the material and the metaphor they are able to

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[198] Tina Bicât and Chris Baldwin, eds., *Devised and Collaborative Theatre, a Practical Guide* (The Crowood Press, 2002) p.9

[199] Alex Mermikides, and Jackie Smart, eds., *Devising in Process* (Palgrave Macmillan UK, 2010), p.23

[200] Alison Oddey, *Devising Theatre: A Practical and Theoretical Handbook* (Routledge, 1994), p. 65.

[201] Oddey, *Devising Theatre,* p.17

[202] Bass,'Visual Dramaturgy', p.56

convey through structuring and performing'.[203] In my previous experiences with textile automata, I was prompted by the tensions between electronic and textile materials to design puppets that navigated the boundaries of their analogue and digital characters.

In the thesis, on the research stage, the devising activity investigates a consensus among the material and the textile perspectives instead of choosing one over the other and a 'cyclical and on-going and collaborative process based on relationships' [204] where no one has full control.[205] Hence, while exploring the weirdness of the thermochromic and bio-based materials in the design of puppetry systems, I give the material expressivity and the textile processes a similar importance to that of the puppeteer's hand in the production of meaning. For instance, devising puppet characters following the impulses given by the bio-based and chromic materials in cooperation with basket-weaving or casting, provided a base for selecting one material over the other. I found a similar approach in design research, where improvisation is contextual[206] and material driven. [207]

Sharing

Planning and reflecting

The activity of sharing included delivering lectures and workshops, publishing and participating in seminars and research groups in the design and textile communities. I performed my transposition into textile research design through the dissemination of my research journey at design research and textiles conferences. I initiated the transposition of puppetry practice and theory into the methods and repurposed my practice into the language of the textile

[203] Recoules Quang, 'Tension and Materiality', p.258

[204] Mermikides and Smart, *Devising in Process*, p.23

[205] Oddey, *Devising Theatre,* p.66

[206] Annika Frye; 'Improvisation in Design Processes', in *The Routledge Handbook of Philosophy and Improvisation in the Arts*, ed. by Alessandro Bertinetto and Marcello Ruta (Routledge, 2021) p649 doi:10.4324/9781003179443-50

[207] Frye, 'Improvisation in Design Process', p650

researchers.[208] While unwrapping the puppeteer's specific approach to materials, I extracted puppetry activities and transposed them for performing on the research stage.

Between 2019 and 2022, I conducted seventeen workshops with 122 participants from the RCA School of Design who joined the sessions voluntarily. The participants included 70 textile students ("T"), 41 early-stage researchers ("Mres"), and 11 PhD researchers ("PhD"). In my practice with the textiles research designers, I transposed my puppetry knowledge into explicit storytelling methods based on material expressivity, material transformations and finally material interferences.

Overall, the reflective analysis of the outcomes from the sharing activities led me to redesign the workshops between each cycle and reshape my practice. Moreover, planning the workshops made me delve deeper into the puppetry theory behind my tacit knowledge.

Workshop activities outline.

The Appendices contain[209] a detailed description about the workshop activities with their titles, aims, purposes, participant categories, the analysis of their outcome and the transition process between each of the three phases.

Hereafter is a summary of the workshop activities.

With the pandemic, I conducted the research activities in a hybrid format with most of the group sessions taking place online, while few of them occurred in a studio. Participants attended the workshops in front of their computer screens, physically separated from each other and from me. They manipulated the tangible materials on a physical stage while sharing their outcome on a virtual stage. The participants were MA students and researchers in textiles and other

[208] Brad Haseman and Daniel Mafe, 'Acquiring Know-How: Research Training for Practice-Led Researchers', in *Practice-Led Research, Research-Led Practice in the Creative Arts*, ed. by Hazel Smith and Roger T. Dean (Edinburgh University Press, 2009), pp. 212-213.

[209] See 'TABLE OUTLINING THE WORKSHOP ACTIVITIES' in the Appendices (p257).

design disciplines from the RCA and other institutions. While researchers and students in textiles were already familiar with physically manipulating tangible materials, this was not necessarily true for all the researchers from other design fields. Although the textile researchers and the non-textile researchers followed the same script when exploring their materials' expressivity, their different knowledge about manipulating tangible materials became evident. The non-textile researchers used the scripts to communicate about their research whereas the textile researchers engaged successfully in creating storytelling characters. In parallel to the workshop activities, I provided one to one tutorials. These sessions served as an extension of the group activities, providing an opportunity for more in-depth reflection on their projects from a storytelling perspective.

The first research cycle, "Researching material expressivity", investigated how materials could inspire new knowledge through a puppetry perspective. Both the researchers and students in textile and the early researchers in design performed the same research script. However, the outcomes show they approached the script differently. Textile designers focused on expanding their knowledge about creating storytelling characters from materials, whereas non-textile researchers focused primarily on acquiring a new tool for exploring their researched theme. The outcomes of the workshops demonstrated the ability of textile researchers to use their working environment to create storytelling characters, echoing my exploration of the environment for activating chromic materials. The activities highlighted the environment as a stage, a storytelling character, and an animator. This reflection led me to shift my focus toward the material transformations of the thermochromic textile characters in various environments. Simultaneously, researchers from other fields in design confirmed the potential of the research script as a tool for visually and metaphorically communicating about their researched themes.

In the first part of the second cycle, "Storytelling with material transformations", following the new script, the participants shifted their manipulations of tangible materials towards researching metaphorical correspondences between the transformations of the materials and their

researched theme. Instead of designing storytelling characters, the textile researchers aimed to tell stories with tangible materials. The outcomes confirmed the potential of mapping the material transformations to the evolution of a symbolic character. As my portfolio of thermochromic and textile artefacts expanded, new narratives emerged through staging their transformations and differences with natural elements and everyday materials in various environments. Moreover, new narratives emerged from observing the evolution of the different characters staged side by side instead of viewing the evolution of a single character in isolation. Therefore, in the second part of the second research cycle, "Storytelling with material interferences", the transposed activities evolved into researching metaphorical correspondences between a researched theme and a system of materials with different expressivities. The revised script delivered original narratives based on the visual transformations of different characters, staged side by side and interfering with one another.

Figure 3-4 below illustrates the timeline of the primary research activities, with vertical branches representing the timeline. The purpose was to iterate various versions of a research script to support the participants in their research and creative journey. Between 2020 and 2021, the aims of the research script shifted from exploring material transformations and expressivity to telling a story and bringing metaphors to life using the transformation of tangible materials. In 2022, the workshop activities followed the final design of the research script and delivered to the participants the impulse to create a

narrative based on material interferences.

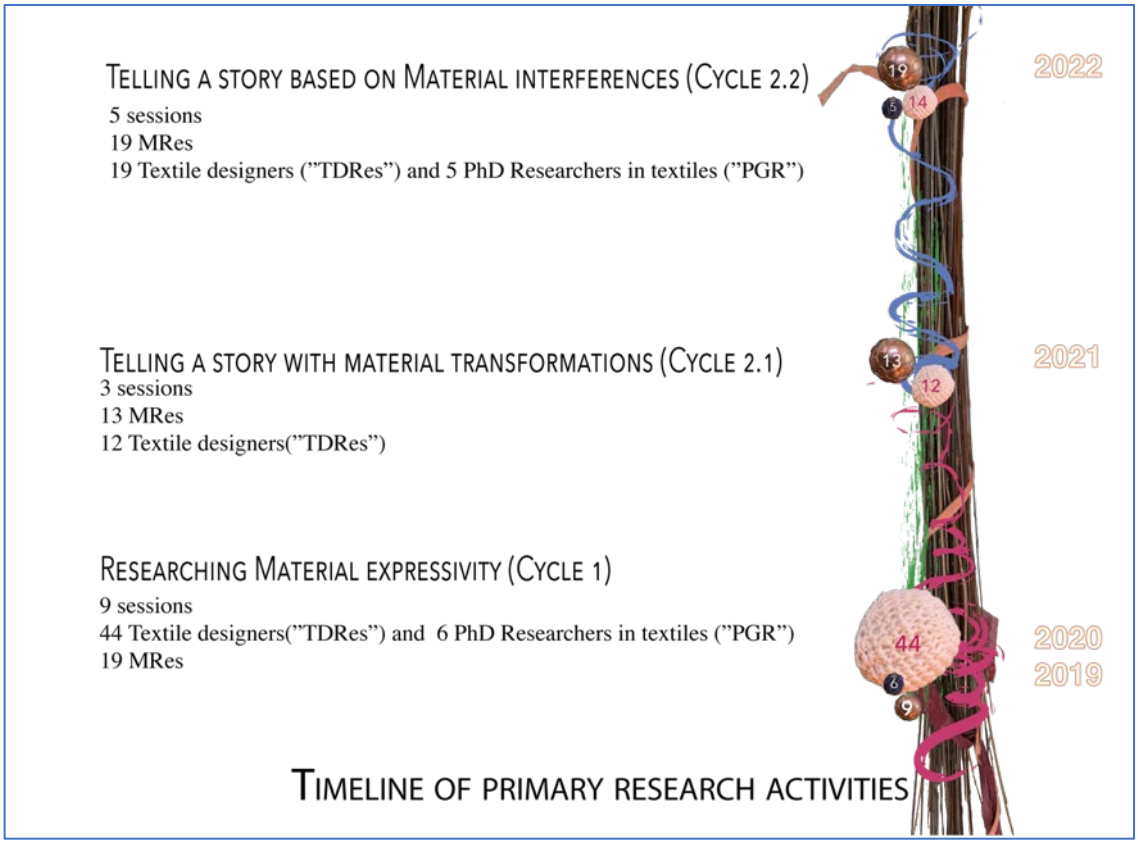

Figure 3-4 Primary research activities timeline with the Textile designer researchers ("TDRes"), the early-stage researchers ("MRes") and the PhD researchers in textile ("PGR")

The diagram presents the number of sessions and participants per year, the categories, and the purpose of the sessions for each cycle of the research in action. The textured oval shapes represent the different types of participants and the number of sessions per category. The red and blue threads wrapping the research activities timeline indicate the process of reflecting on the workshop's outcomes and integrating their analysis into the design of the workshop activities for each cycle of the agential transposition in action.

Staging

Different styles of puppetry call for different types of stage:[210] a shadow screen for shadow theatre and a flat surface for the table-top puppets. While improvising a puppet character, we take cues from the organisation of the

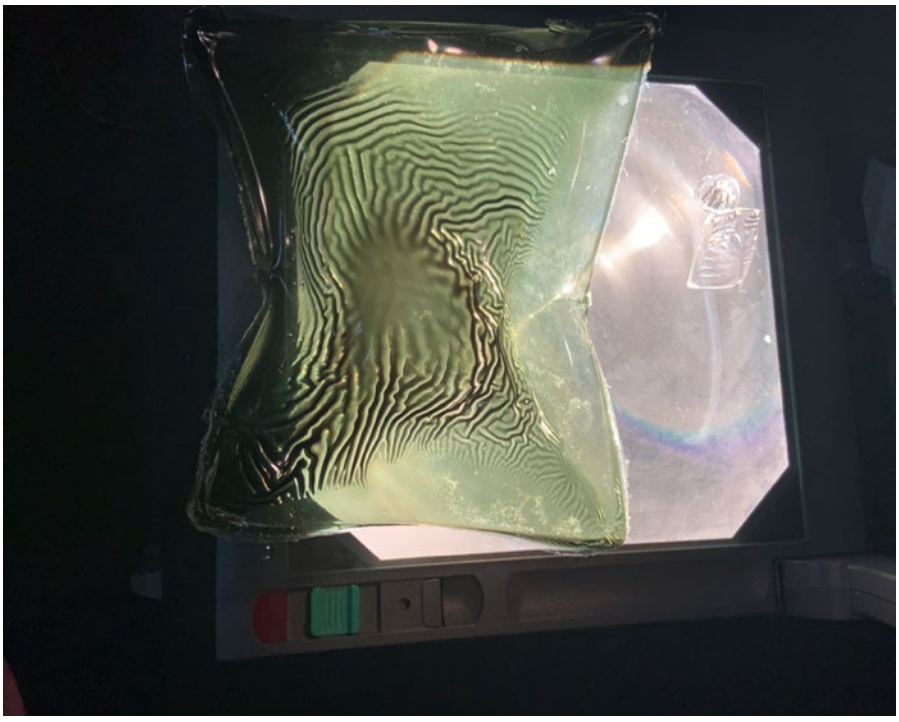

Figure 3-6 Staging a bioplastic sheet on an Over-Head Projector

stage,[211] as illustrated in the following figures (Figure 3-5 and Figure 3-6) that show two different stages for the same bioplastic sample.

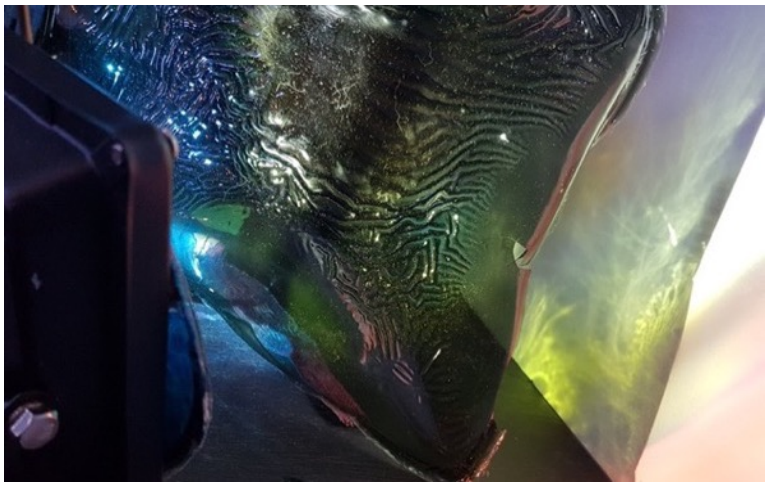

Figure 3-5 Staging a bioplastic sheet in front of a theatre stage light.

[210] Mark Down, *Practical Guide to Puppetry* (The Crowood Press, 2022), pp.155-159

[211] Oddey, *Devising Theatre,* p.17

The agential transposition covered three types of stages: indoor, outdoor, and online. The first cycle of research began with an exploration of puppet characters made of weird materials with the design of indoor stages[212] such as a crankie theatre[213] (Figure 3-7)and a portable shadow theatre.

Capture

Capturing a live performance is challenging When it comes to collecting

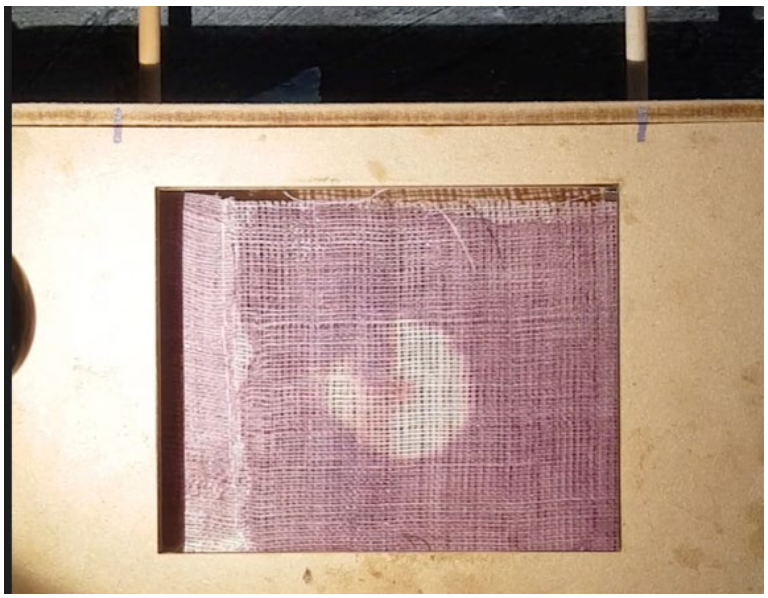

Figure 3-7 Staging a thermochromic screen in a crankie theatre device.

information on the materials and matter at work in puppetry performances, stop-motion animation offers the opportunity to capture the material oscillations between lively character and dead matter. As an audience for the short animations, we were able to watch the truthful translation of the materials' properties.[214] The work of filmmaker and artist Jan Švankmajer illustrates this statement perfectly (Video 3-2). In this stop-motion film, the materials escape from their utilitarian functions – and even human control – as they seem to pursue their own logic. In the process of capturing the lively character of our artefacts, an outcome of the research was short video and

[212] Ibid., p.18

[213] See Glossary

[214] Vicky Smith, 'Experimental Time-Lapse Animation and the Manifestation of Change and Agency in Objects', in *Experimental and Expanded Animation*, ed. by Vicky Smith and Nicky Hamlyn (Springer, 2018), p.82

stop-motion animations that I included in the documentation.

Review

The review of other material-driven practitioners' works in puppetry and textile design added to the series of impulses from my reflection about my material-driven practice.

The activity of building the documentation gave me the impetus for designing the environment of the case studies I performed in relation to the potential of weird materials in puppetry performances. The case study method provided the cues for selecting materials and textile processes in my devising process.

DATA EVALUATION AND ANALYSIS

Puppetry audit

As an interpretivist researcher,[215] I conducted an 'artistic audit' of the research outcomes[216] [217] and evaluated the research data in relation to the specific contexts from which they emerged.[218] I unwrapped my new tacit knowledge between each activity and uncovered the information I needed to revise my research script and go forward. Finally, at the end of each research cycle, I unwrapped my research outcomes to extract the materials that might constitute transformational knowledge. The reflective practices produced another dataset that I returned to the creative messy area. In the process, I updated my understanding of what constitutes my tacit knowledge.

I analysed the activities I shared with the textile researchers and researchers in design, in which I, as the puppeteer, devised a transposition of my tacit knowledge into explicit knowledge. It assessed the validity of my transposition as the designer, co-performer, and spectator of the entanglement between

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[215] Mark Saunders, Philip Lewis, Adrian Thornhill, and Alex Bristow, 'Understanding Research Philosophy and Approaches to Theory Development' in *Research Methods for Business Students*, 2019, p.151.

[216] Brad Haseman, 'A Manifesto for Performative Research', *Media International Australia*, 118.1 (2006), pp. 98doi:10.1177/1329878X0611800113

[217] Brad Haseman and Daniel Mafe, 'Acquiring Know-How: Research Training for Practice-Led Researchers', in *Practice-Led Research, Research-Led Practice in the Creative Arts,* ed. by Hazel Smith and Roger T. Dean (Edinburgh University Press, 2009), pp. 212-213

[218] Gray and Malins, *Visualizing Research*, p.131

researchers and their research.

Moreover, I analysed the data from my activity with weird materials, through the puppetry concepts of opalescence, breathed stillness, and COG. We evaluated the 'puppet-ability' of various traditional and weird materials in their raw forms and textile structures through character improvisation and story-making activities in different puppetry styles. Practically, I assessed the potential of their weird materialness and textility in the system to produce a COG and physical tensions which would contribute to my metaphorical deployments.

Diffractive analysis

Through repetitive diffractive readings of the documentation, in the study I reviewed the emergence of new boundaries for the relationships in the puppetry and the research systems. I reflected on the flow of my activities at different points in my research timeline. Multiplying the diffractive perspective of a reader, I looked for the differences that emerged between them. First, as the puppeteer I evaluated the stream of my interactions with the researched materials while filming or photographing to build the documentation. Second, after each activity ended, with the support of the documentation, I ran another puppetry evaluation as a spectator of the performance. Third, supported by the documentation, I framed my reflective practice in the research context and repeated my reading as a spectator of the transposition activity at a different time and in a different context from those in which I, as the puppeteer, had produced the images and films. Last, I reflected on the new research data and how it changed my focus in the transposition activities. In relation to the research question, I explored the differences between embedding weird materials and traditional materials. I analysed the data in a post-humanist framework and reflected on my aim of identifying how material objects and processes can be understood through the effects created by their difference, rather than observing what these differences are.[219]

[219] See Chapter "Stories", Table "Puppetry is"

Overall, the discussion about the data grew from the puppetry evaluations and the diffractive analysis of the research activities from different puppetry perspectives, as a maker, a puppeteer and a spectator.

Reflections on the Research Scripts

This chapter has introduced the research scripts, in which the research is a puppetry system devised by me, the researcher. The research scripts allow the emergence of the next steps that are already embedded in the research system. The chapter has established the nature of the research as a system performing an agential transposition in action, where methods of designing puppetry systems were transposed into research and reflecting activities. It put an emphasis on the messy area of data generated by the research activities and from where the research grew. The research toolkit includes the transposed puppetry activities of devising, staging, sharing, and filming. The activity of building the documentation together constitutes a research and reflective activity. At the end of every cycle of activities, I performed a puppetry evaluation and a diffractive analysis of the research materials. The reevaluation of outcomes from my puppetry explorations and of the workshops provided the ground for adjusting the ongoing research methodology.

The transposition of the puppetry practice occurs through the design of material experiences that investigate the weirdness of the researched materials. It explores their shifts in agency between a lively character and dead matter in a puppetry system where the materials are embedded in textile structures. The transposition is 'agential' in the sense that it enacts the boundaries[220] of textile design and puppetry. Within these boundaries, the cycles of activities do not investigate the result of what a hybrid practice would be; instead, they observe what the material experiences reveal or hide about the weird life of the materials embedded in textile structures and how they

[220] Barad, *Meeting the Universe Halfway*, p.337.

perform in puppetry systems. The action research process covered three types of environments – indoor, outdoor, and online – combined with three cycles of activity. The practice wove puppetry and textiles together through making four main forms of puppetry performances: material theatre, shadow theatre, marionettes, and stop-motion films.

Between each cycle of activity, the reassessment of my perspective and position towards the research as a puppeteer provided the impetus for revising the research script. Making meaning from the research and textile design literature in the language of puppetry supported my quest for a suitable theoretical framework. It helped to intertwine the diffractive theory and puppetry practice into a method for reviewing the research activities and other practitioners' work.

Here, I acknowledge the limitations of the qualitative research approach and the subjectivity in the choice I made among the material experiences I chose to analyse. Like the puppeteer who keeps the marionette upright with a system of strings to offset the force of gravity on the puppet's limbs, I provided some counterweight to the limitations of a research project led by a performative art practice. First, I looked at my creative process through reflection in action[221] and built-up extensive documentation, including diagrams, drawings, writings, and videos, to support the reflection and generate the next move for my research. Furthermore, I researched the same puppet character through different media and in different environments.[222] This provided many different outcomes to the diffractive reader seeking to reflect on what became visible or invisible between the material experiences. Moreover, the different angles and multiplicity of the reflective methods contribute to the rigour of the study.

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[221] Nimkulrat, 'Paperness', p.44

[222] See the exploration of the birds' character-driven improvisations on p.

Chapter 4 Improvising

CHARACTERS

(CYCLE 1)

"Breath "

Video 4-2 'Le Tardigrade Vorace' is a character improvisation with a boobin of ramie fibre (Le Tardigrade Vorace, dir. by Sabrina Recoules Quang, 2021 <https://vimeo.com/540235472> [accessed 13 May 2024]

Video 4-1 'le Hérisson', a puppet with a servo motor body covered by an origami pleats(Le Hérisson, dir. by Sabrina Recoules Quang, 2023 <https://vimeo.com/835816650> [accessed 13 May 2024])

[Non]Human (1.1)

In this section, I contrast my puppetry perspective on the extension of the expressivity of human bodies with the approach of textile designers. Then I introduce the first material improvisations with textile researchers and design researchers and my character explorations with weird materials.

Figure 4-1 Opening scene, 'breath', photo: Kiva Huang, dancers: Dancers Luke Crook and Waddah Sinada (Figure 88, Lin 2020, 130)

In his project 'The Little Girl inside me', Tsai-Chun Huang investigated the potential of cubic-pleated organza to extend dancers' expressivity. In this work, the focus remains on the human performers, and the character of the dancers remains mainly human, even though the costumes were designed to echo a non-human character in the form of a cube, who occupied the central piece of the scenography.[223] By contrast, in her design for the choreography for the dance performance 'Inter-fashionality', Mingjing Lin evoked the symbolism of her parametric design and used the dancer's body to deploy the metaphorical character of her innovative materials.[224] (Figure 4-1)

[223] Huang, 'In-between Pleats ', p. 200

[224] Lin, 'Interfashionality', p.138

Similarly, in Lucy McRae's 'living silhouettes' (Figure 4-2) the focus is on how material expressivity can be magnified by human bodies, although she went even further, to the extent of totally masking the human body with her non-anthropomorphic characters.[225]

Figure 4-2 Lucy Mc Rae, Living Silhouette exhibition Centre Pompidou 2010

Much like McRae's, my enquiry focuses on the weird materialness of non-human characters. But instead of locating the centre of gravity (COG) between the material and the body, in the design of my material and character improvisations I set the COG outside the human body, between the 'material+body' and the performing stage. Moreover, the character improvisations focused on the relationship between materialness and the non-human character's expressivity. The reflective practice then evaluated the puppet-ability of the material and the new boundaries that emerged between the material, the human performer and their audience, and between the puppetry systems and their environment.

[225] 'LucyandBart — World Renowned Sci Fi Artist and Body Architect', *Lucy McRae* <https://www.lucymcrae.net/lucyandbart> [accessed 13 May 2024]

MATERIAL IMPROVISATIONS WITH DESIGN AND TEXTILE RESEARCHERS

In the first cycle of activities, there were nine research activity sessions. I designed the workshops for the textile designers as a provocation to devise a character with their materials. The textile researchers investigated metaphorical systems about their research driven by the material composition of the elements they brought on stage. The textile students experimented with two different forms of puppetry: mask theatre and table-top theatre. I shared two puppetry methods for making joints and masks using paper.

Improvisation with familiar materials

While I initiated the messy area with textile materials and processes in my puppetry practice, I began my transposition activities with researchers in the field of design. In 2019, before the pandemic forced me to communicate and teach remotely, I introduced design researchers who were in the early stages of their projects to table-top puppetry as a tool for performing material expressivity to share their research concepts.

The researchers devised a presentation of their research with everyday materials. The participants transposed their making knowledge to create characters using their choice of materials. I provided a basic script for giving them the impulse to explore the physical changes in the material. First, I introduced a series of warm-up exercises and physical improvisations with paper for the researchers in design. Then I invited the designers to map a set of words to a movement by associating them with verbs expressing actions. For example, we found that ‘smartness’ was associated with eye movement, posture, smoking, stroking a beard, and ‘croissant’ with sniffing, spreading, baking, eating, and salivating. The exercise ended with the researchers mapping their research verbally to a set of actions. Finally, we sat around a table where materials usually found in a classroom, such as paper, tape, cardboard, scissors, and pencils, were laid out for the researchers. Each researcher devised a presentation of their research project using the same materials as those in the improvisation exercises.

In a similar way to me as the puppeteer manipulating organza or rope to explore

the movements I might perform in their raw form or textile forms; I invited the researchers in design to enter a conversation with their research through the manipulation of everyday materials. They then delivered a symbolic interpretation of their research themes.

I captured the first experiences with the researchers by taking photographs of the interaction between the participants and their improvised characters and taking notes after the session. The researchers engaged physically with the material and improvised characters made of familiar materials that offered the audience a narrative about their research.

Figure 4-3 shows how the materials' expressivity supported the researchers in design 's communication of their topics and their emotional connection to their research. The set of tangible materials and objects successfully acted as mediators for sharing their ideas and abstract concepts with the expressivity of the materials. The visual documentation also illustrates how the audience followed the discourse and the

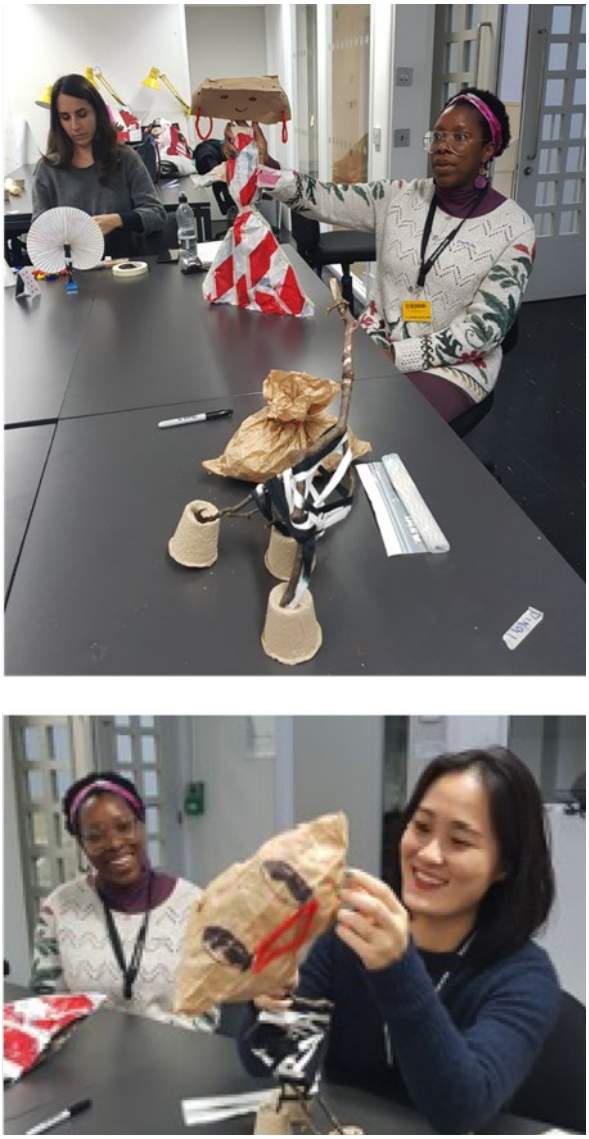

Figure 4-3 Researchers in design ("MRes") exploring their material expressivity to share their research theme (2019 workshop series)

movements of the researcher's invented character while acknowledging the physical connections between the researcher and the improvised character.

I activated my double vision to assess the characters the participants displayed during the sessions. The COG was located between two physical bodies, the devised characters and the researchers. As an audience, I created meaning from three

physical sources of information: the expressivity and movements of the character the researcher had improvised and the physical interaction between the character and the researcher. Although the outcome of the experience aligns with what I already knew from my tacit knowledge of puppetry, it was a new experience for the participants. A student reported that she used the improvised puppet she had made to introduce her research successfully in a tutorial. What the experience in this working environment made visible was the emotional entanglement between the researcher and their research, and how materials gave them an original tool for communicating their concepts, not only verbally but also visually. On the one hand, the session provided them with a symbolic interpretation of their research theme and confirmed the contribution of puppetry as a channel of communication, with a non-human character playing the role of a mediator between humans. Interestingly the early stage researchers were drawn to create a character symbolising their stakeholder or relationship to their research. This prompted me to reflect about my relation to the research as a researcher-puppeteer. [226]

On the other hand, there was no evidence in the session that the participants gained a renewed perspective on their research questions. In their dialogue with the materials, the researchers in design and the textile designers focused on making a character, and in their presentation, we listened to the researcher's discourse, not the research-character's voice.

In other words, the improvisation method successfully supported the participant's communication through the production of a symbolic character for their research. The sessions served as a reference for illustrating how the material conversations supported the researchers in the presentation of their research concepts with puppets, they had improvised and by performing their research as a character. This led me to move forward from character-making to offer the researchers the impulse to explore the character of their research through material transformations in the next cycle of activity (cycle 2.1)

Puppet-making with textile researchers

[226] See "The marionette-research and puppeteer-researcher characters"

When the lockdown period of the Covid-19 pandemic began, the research shifted to an online stage. In parallel with my puppet making activity with the bio-based and thermochromic materials, I planned a session of shared making activity that was centred around the importance of designing the joints in a puppet (Figure 4-4) to establish its ability to move.

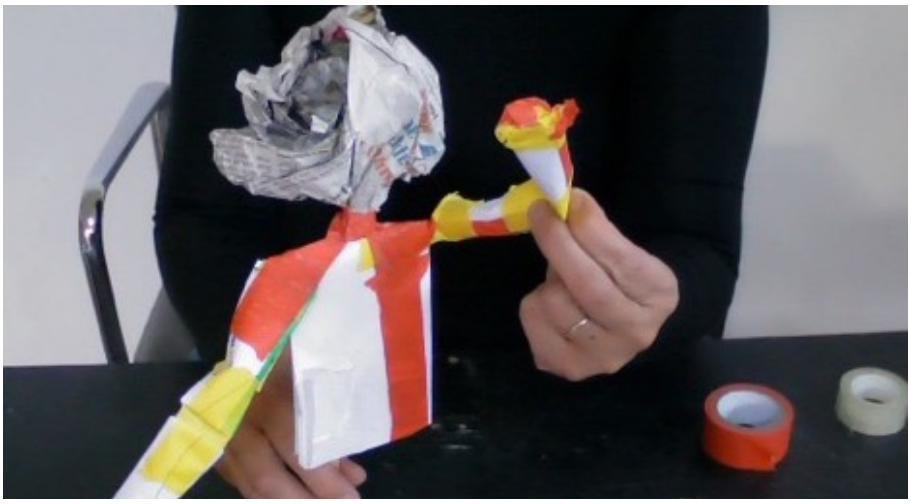

Figure 4-4 Image from Puppet making with paper and tape demonstration for 2020 workshop series.

The practitioners followed the instructions to make joints, first with paper, then with their choice of materials. Figure 4-5 shows a sample of the participants communicating their research with the movable structures they created with their materials. The duration of this making activity, three hours, proved to be too short for the researchers to successfully achieve the second part of the session. It did not give enough time for some of the researchers to adjust their materials for making the joints or to choose another material that could be used for making joints for the character they had in mind for sharing their research. The session was a perfect illustration of how material properties can either lead, or fail to contribute to, the design of a structure.

Figure 4-5 Textile designer researchers ("TDRes") exploring their research theme with paper material expressivity and puppet making activity (2020 workshop series)

Although the textile designers chose familiar materials, they were unfamiliar with how they could use them in making the puppet joints. From a puppet-making perspective the session was not successful, although it gave the participants a new approach to exploring their materials. While I was reading the session outcome through the research question, I also deduced that my focus should not be on turning the textile designers into puppet makers or performers, but on supporting them in their creative process and research journey. This led me to test another style of puppetry that requires less technical adjustments to the material. Instead of a tabletop puppet I invited the researchers to make and perform a mask.[227]

Mask-making with textile designers and PGR in textiles

The next proposal, then, was to investigate a material through mask-making and mask-performing. The process of enquiry was split between making the mask at home and performing it in front of a laptop. The researchers followed a simple pattern to make a mask with a material of their choice. During the session, the participants explained the reasons for their choice of material and shared their perceptions of the material while they were making the mask. Then they were asked to perform their mask and introduce themselves while walking towards the laptop

[227] See Glossary

camera.

Figure 4-6 Textile Design Researchers ("TDRes") and PhD Textile researchers ("PGR") exploring material expressivity through mask making and performing (2020 workshop series)

Figure 4-6 shows a sample of the different masks created by the textile designers while transposing the puppetry methods to create a mask using their choice of materials. They shared their analysis of the differences between their perceptions of the materials before and after making the mask and their perceptions of the materials while performing it. The participants reported their emotional connections to the materials and expressed their physical and emotional reactions to the material while performing.

The audience, all the other Zoom participants, shared their feedback on what they were seeing and at the end of the presentation the mask-wearer reflected on what they had learned during the process.

When the early-stage researchers in Textile Soft Systems considered the relationship between the mask and the material, there were two kinds of answers. On the one hand, when the researcher had prior experience in mask-making, their

answers were more about the mask than the material. (See APPENDICES p. for an extract of written feedback)

The weird life of materials in the mask

In comparison to the sessions that the research performed when I was still in a studio setting, some improvisation exercises were easier for the students to perform when 'protected' by the screen. The safe space for improvisation was easier to establish behind a screen. Furthermore, the emotional connections to the materials appeared visually stronger than with the joint-making experiences. The audience experienced the metaphorical deployment of the materials embedded in the mask. In these experiences, the researcher's body disappeared completely behind the materials. The weird life of the materials was made visible by the total disappearance of the researcher's face behind the mask. Moreover, the rest of the researcher's body was hidden behind the screens of our laptops. The COG and the visual information were located on the mask.

Overall, the method supported the emotional and haptic connections between the researcher and the materials. The textiles researchers confirmed the potential of the mask activity to offer new avenues for their discovery of the material's physical and symbolic properties. The researchers reported that the transformation from a raw material to a mask and performing it brought them new information about their materials. Nevertheless, there was no clear evidence of the connection between the activity and the production of new relationships between the researchers and their research. The method failed to establish a solid ground for sharing a theme that is not directly connected to the idea of a mask, and the context of the pandemic gave a strong cultural bias to the concept of masking, which is visible in the feedback from the researchers. Hence, the reflective analysis in relation to the research questions led me to abandon the mask-making and performing activity while keeping character-making as a research method to support the emotional and haptic connections between researchers and their materials and with the audience and researchers' study interests.

MATERIAL, TEXTILE AND CHARACTER- DRIVEN PUPPETRY IMPROVISATIONS

In the following section, I present the textile language improvisations that helped

me to familiarise myself with textile thinking, and my character improvisations that had the purpose of getting to know the weird materials. I also use the term 'character doodles' to illustrate the similarities of the improvisations of 3D structures with the process of doodle drawing and the simultaneity of the thinking and making in my character improvisations.[228]

Textile language improvisations

The need to become familiar with the textile designers' vocabulary gave me the impulse to manipulate the textile words I had identified from my immersion in the textile design community. The impulse came from my previous work with electronic puppets, where I staged electronic puppets 'talking' to visitors about their human conditions through a generative poetry application (Recoules Quang 2018). In my last sonic installation with textile automata, I considered language as material that could be shaped through code to perform a character. Similarly, in the first cycle of activities, while I as the researcher immersed myself among textile researchers and reviewed the work of textile designers, I identified a list of key terms and themes such as 'cavity', 'resilience', 'stealth' and 'belonging' that fed the computational production of surrealist characters: 'The wheel made in green is a soft system, hand-woven with organza, trusts luck for finding the morning in non-conductive wire.'[229] Instead of a database of words related to electronic devices and the physical computing field, we fed the generative poetry application with terminology from the textile process and the materials that were extracted from the textiles students' reports.[230] I then wrote a new template that generates a symbolic character from an object existing in a random location. I generated a script from the natural language utterances to devise a character in combination with ordinary objects and weird materials to create a fictional character. The object was made of a random set of textile process and materials. The template was as follows:

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[228] Niki Wallace, 'Thinking While Drawing and Drawing to Think: Exploring "Reflective Doodling" as a Critical Reflective Practice in Design for Transitions.', in *Proceedings of Synergy - DRS International Conference 2020, Vol.1: Synergy, Situations, 11-14 August 2020* (DRS, 2020), pp. 204-223 doi:10.21606/drs.2020.187

[229] Extract from a diary of surrealist poetry computationally generated (Recoules Quang 2020-2023)

[230] 'Textiles (MA)' *Royal College of Art* <https://2020.rca.ac.uk/programmes/textiles-ma> [accessed 13 May 2024], 'Themes' <https://2021.rca.ac.uk/themes/> [accessed 13 May 2024]

Once upon a time in [a location] lived a [object] who was [textile process] with [material].

Although the outcome[231] had no correspondence with my research question, it helped me to become familiar with, and be inspired by, the language of textile design. The experience brought up a list of storylines for fictional characters and is an expression of my transposition into the textiles discipline as a non-English native speaker and puppeteer.

Material-Driven

"Le tardigrade vorace" (The hungry tardigrade)

During the pandemic, as I stayed in contact with fellow puppeteers through online devising sessions, I took the opportunity to get feedback on my character improvisations. The short video presents a ramie bobbin and my hands on stage.[232] Instead of having a preconceived idea of the character and forcing it onto the material, my hands and gaze followed the ramie fibre's expressivity to find a character.

The first manipulations came from seeing, as an audience, the threads escaping from the bobbin. It gave me, the puppeteer, the impulse to wrap them around the bobbin's body. The unsuccessful attempts to tame the threads led me to try tucking them back in through the top of the conical bobbin. In the process, my index finger got trapped into the bobbin's body. I established the COG in the bobbin's upper body and built the character from the visual and haptic tensions between the fibre and my skin.

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[231] See Appendices for an extract of the random script.

[232] *Video 4-2 'Le Tardigrade Vorcace' is a character improvisation with a boobin of ramie fibre (Le Tardigrade Vorace*, dir. by Sabrina Recoules Quang, 2021 <https://vimeo.com/540235472> [accessed 13 May 2024]

Figure 4-7 A coloured scanning electron micrograph of a tardigrade in moss (https://www.bbc.co.uk/news/news

As both audience and performer I then follow the movement of the puppet's COG. In the final scenes, while the bobbin and my finger wander out of the stage, we read the similarities of the bobbin to the tardigrade, who is a creature that sucks the world through its alimentary canal[233] (Figure 4-7).

The visual and haptic perception induced the performance of a hungry, blind creature that eats our index finger: 'le Tardigrade Vorace' that became part of the story (the hungry tardigrade who ate my finger).

Although I shared the improvisation in a live performance for my fellow puppeteers, I kept a record of it through live shooting a video. In the thesis, I present the video and the still images that reflect the character improvisation on Zoom. The character-making process was material-driven and increased my knowledge about the texture of the ramie fibre wrapped into a bobbin and its potential for generating metaphorical correspondences. I successfully located a COG in the bobbin and from my haptic and visual relation to the ramie fibre I built a metaphorical correspondence between the bobbin and a lively character. While I reflected on the video at a different place in my thesis timeline, I observed a second metaphor for the ramie bobbin, that relied on my enhanced knowledge of the material: 'My literature review is a yarn organised in a bobbin' (Figure 4-8) This illustrates how the metaphorical correspondences can become different each time we read them and how the journey of the research contributed to the symbolism of the bobbin.

[233] While performing, I was inspired by this article about the tardigrade: Michael Marshall, 'Tardigrades: Nature's Great Survivors', *The Observer*, 20 March 2021, section Science <https://www.theguardian.com/science/2021/mar/20/tardigrades-natures-great-survivors> [accessed 13 May 2024]

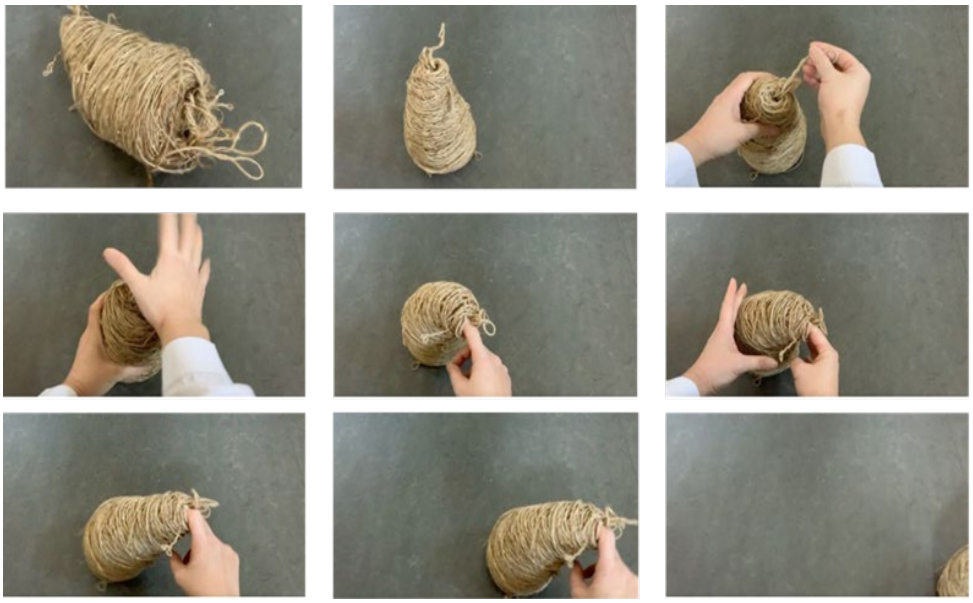

Figure 4-8 “My literature review is a tardigrade.”

Textile-Driven (Les créatures de la mer, "La Chenille" and Saori woven cloth)

I began the 3D character improvisations driven by textile processes with basket weaving, and stitching textiles, yarns and threads. I performed them in shadow theatre and tabletop puppetry styles. I identified sea creatures while I pursued my experimentation with woven casting forms: I began with my textile automata and

Figure 4-9 Basket woven sea creatures

coiling[234] twisted hemp ropes into 3D structures. (Figure 4-9)

Figure 4-10 Process of hand stitching a ribbon.

"La Chenille "(The Caterpillar)

[234] 'Basketry - Coiling, Weaving, Materials', *Encyclopedia Britannica* <https://www.britannica.com/art/basketry/Coiled-construction> [accessed 15 May 2024]

This character emerged from the juxtaposition of my hand manipulations of the hemp ribbon when I was stitching and folding it (Figure 4-10) and the activity of staging the structure along with other artefacts (Figure 4-11)The scale of the textile artefact in comparison to my hand makes the character reading more difficult in the

Figure 4-11 Staging stitched ribbons with other artefacts.

image, where I can see my hand manipulations. I also compared its undulating expressivity to the same textile structure with thermochromic materials. The heat of my fingers activated the thermochromic material, but the complexity of the textile pattern prevailed over the colour change in the expressivity of the caterpillar.

Saori Woven Cloth

In the investigation of textile processes for creating a lively character, I came across a free-style weaving technique, Saori,[235] that emphasises spontaneity and randomness. In my textile sample, I randomly inserted a variety of fibres mixed with paper string. The cloth itself benefited from the ability to create interesting shadows with the spaces between the warp and the weft (Figure 4-12a). The addition of the paper strings gave the structure more rigidity and the ability to stand up. In this setting, I identified a body shape from the bunch of paper threads trapped in the weave (Figure 4-12e) that I could not move without the rest of the cloth. The hand manipulations of the tension between the rigid paper strings and the soft wool

[235] Misao Jo. "SAORINOMORI - About SAORI," February 12, 2020. https://www.saoriglobal.com/.

supported the puppetry reading of the cloth and allowed me to spot a white head sticking out of the woven cloth (Figure 4-12c).

The still photos share the activity of the character I identified while manipulating the cloth. Nevertheless, the character was so entangled into the cloth that I could not make the performative space visible. The body shape was only visible in close-up conditions with a camera zooming in. By contrast, the still images were a fair representation of my perception of the 2D woven shadows. I pursued this path by

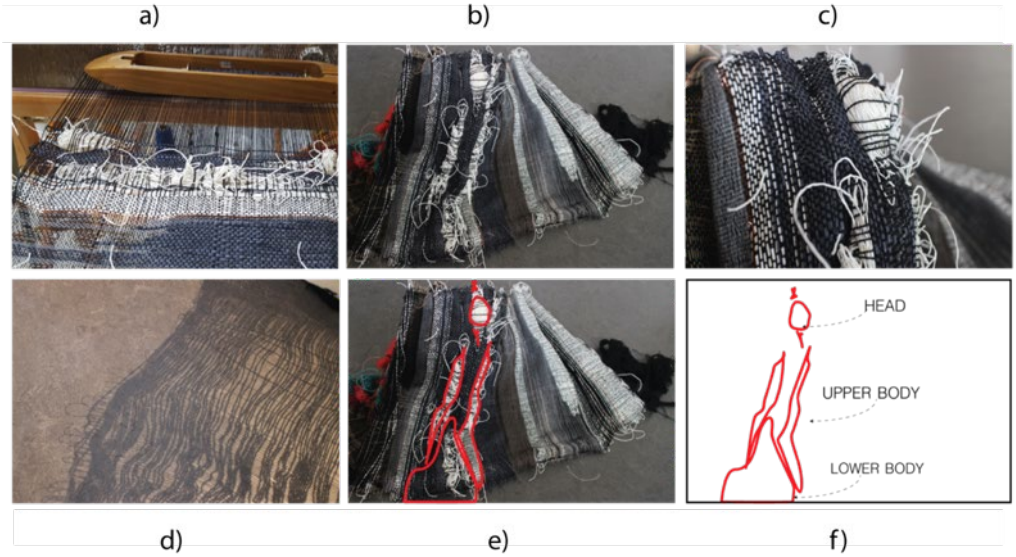

Figure 4-12 Character emergence from a Saori cloth

staging the cloth in a shadow performance. In my reading of the documentation (Figure 4-12f), I located the COG between the sticking-out head, its body, made of paper threads, and the rest of the woven cloth. I identified a performing space in the empty spaces between the warp and the weft and between the cloth trapping the shape. Although it was not useful to pursue the study of this metaphorical character in this textile process for telling a story during the research time frame, I kept the experience as a reference for future work.

Character-driven making

The heads and bodies

In the character-driven experiences, I attempted to make heads and bodies with resin, bioplastic and textile materials. With the textiles, I pursued my experimentation with woven cast forms that I began with my textile automata (Figure 4-13). While exploring bio--based materials, I found some dried poppy seed-heads, cast them in resin, and improvised puppet characters with the resin heads set on a wire stick; their bodies were made of organza or wire crocheted with cotton threads.

Figure 4-13 Basket woven bodies with various materials

The birds

Instead of following the material to create a character, I investigated by using different processes – analogue and digital drawing, laser cutting, and creating an assemblage of bioplastic shapes – to find a bird character.

I made 2D prototypes to locate the joints and decide which parts of the bird would move (Figure 4-14) to get a sense of the general behaviour of the bird, that was made

from paper and basket weaving. Then I translated the pattern through a textile process I was familiar with, basket weaving. I used the same polystyrene egg to cast three different materials: hemp, polypropylene and paper cane. The first material

Figure 4-14 Researching the bird mechanism.

produced a soft, open body shape while the polypropylene rope generated a rigid, closed body shape.

While I devised a series of bird characters with the same textile process, the different types of threads, paper threads, hemp, polypropylene, cotton and leather (Figure 4-15d) led me to different textile structures and different metaphorical characters. In the closed, basket-woven structure, the sturdiness of the paper cane provided the aesthetic of the beak (Figure 4-15e). In the open-ended woven structure, however, the puppeteer's finger acted as the beak. (Figure 4-15f).

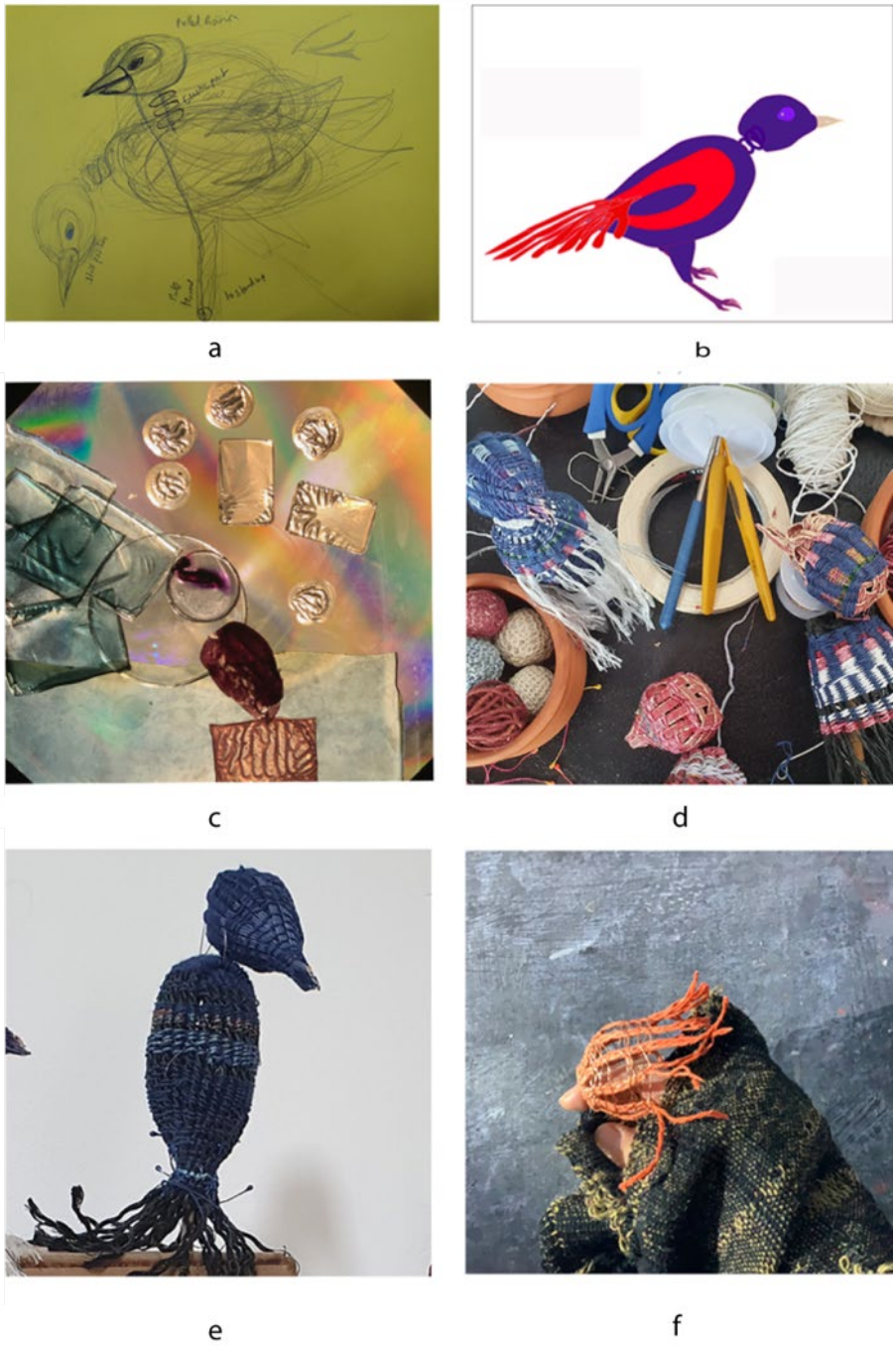

Figure 4-15 Researching bird with analogue drawing (a), digital drawing (b), bioplastic shapes (c), basket weaving (d), basket woven bird with polypyrene and paper cane woven cotton threads(e), basket woven bird's head with paper threads and aluminum wire and the finger as the beak(f).

THE WEIRD LIFE OF NON-HUMAN MATERIALS

The research initiated the agential transposition of puppetry thinking and making by devising textile characters while becoming familiar with textile processes. In response to the ambiguity of the textile that 'we experience as neither object nor subject, but as the threshold between',[236] I proceeded with an 'intuitive, open-ended working modality '[237] with the ramie bobbin and took advantage of unexpected findings in the Saori cloth. I drew from my tacit knowledge of improvising characters to experiment with yarns, woven cloth, resin and silicone for making and improvising 3D characters. Although the yarns and woven cloth did not require a particular kind of processing, more rigid materials, such as resin and silicone, required processing before they could generate a character. The resin and the silicone kept the heat longer than a textile fabric would. I was prompted by this material property to use the hot resin heads for activating thermochromic fabric.

I accessed the weird life of the textiles through three types of impulses: the material, the textile structure and the stage. The puppetry evaluations gave me haptic and visual information from the relationships between the material, the textile and my manipulations that I could transpose into my character improvisations. The knowledge I acquired with my improvisations with textile bodies with basket-weaving processes and my tacit knowledge of cutting out silhouettes shaped the expressivity of the bird character. My knowledge of basket-weaving processes supported the choice of materials for the puppet's head. The textile and material-driven improvisations gave me the impulse to define new expressivity that turned into symbolic characters. The names I gave them in French reflect how I began to connect to the weird materials and textile processes through my practice.

The diffractive analysis of the documentation highlights how the activity of documenting the work created a new layer of experience as I organised the stage for taking still pictures of the puppets and read their characters through the eye of

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[236] Pajaczkowska, 'On Stuff and Nonsense ', p,.229

[237] Ana Piñeyro, 'Kinetic Morphologies. Revealing Opportunity from Mistake', *The Design Journal*, 22.sup1 (2019), p.1877 doi:10.1080/14606925.2019.1595027

the camera; returning to the documentation at a different place in the timeline brought another metaphorical character on stage.

Bio-based materials (1.2)

CHARACTER IMPROVISATION BIOPLASTICS

As the pandemic hit the research context, the research was inspired by the flood of pictures on textile designers' Instagram accounts showing how they were researching the aesthetics and functionality of bioplastic materials. In her work, Alice Potts' focus on the aesthetic of these materials symbolises the innovative character of my collaboration with nature.[238]

I followed their translucent aesthetic that is similar to the property that performs in polycarbonate, a synthetic material I use in my shadow theatre puppet-making. I investigated bioplastic materials for their potential to achieve a similar performance. I used the Materiom database[239] for my investigation of plant-based materials made of seaweed, such as alginate, agar, and carrageenan and compared them to animal-based gelatin such as fish gelatin. With the colour theme still in focus, I also explored natural dyeing processes with pigments from plants such as curcuma, rosemary, and spirulina.

I devised puppet characters to evaluate the differences between the bioplastic materials and traditional materials and how they may be combined. It is important to note that I devised the bioplastic series in the context of the pandemic and produced the biomaterials[240] in a domestic kitchen, rather than a studio.

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[238] Alice Potts,'For Me I Choose to Do Biomaterials Not for the Sustainable Purposes but for the Psychological. For Me the Only Way to Save the Planet Is to Show People How Innovational We and Nature Is.' 2021. Instagram. <https://www. instagram.com/p/CMO8KbXAo8y/> [accessed 10 March 2021]

[239] 'Materiom : Commons', *Materiom* <https://materiom.org/commons> [accessed 14 May 2024]

[240] The cooking recipes were also adapted from the recipes found in Miriam Ribul, '*Recipes for Material Activism* (Issuu, 2014)

As I was looking for dye plants from the garden, I also picked up dried poppies that attracted me, with their crown head shapes, to perform metaphorical correspondences in a puppetry system.

Character Improvisation with spirulina and fish gelatin (small people)

In this experience, I staged bioplastic with natural dyes from charcoal and thermochromic pink pigment side by side. For making the bioplastics, I used the same biomaterial recipe based on fish gelatin and glycerin associated with a variety of thermochromic pigments, and other natural ingredients such as natural dye or dried plants. After cooking and casting bioplastic materials in silicon moulds, I initiated a devising process with the samples through direct hand manipulation.

Although I was using the same recipe and drying the materials in the same technical device; a dehydrator, the samples set in different shapes. The first impulse came from the geometry of the moulded shapes, that prompted me to compose anthropomorphic puppets, using circular shapes for their heads and rectangular shapes for their bodies. The similarities between the translucent properties of the bioplastic surfaces and conventional plastics gave me the impulse to stage the puppets on an overhead projector (OHP) to improvise with light projections (Figure 4-16) .

< https://issuu.com/miriamribul/docs/miriam_ribul_recipes_for_material_a > [accessed 13 May 2024].

Figure 4-16 Staging fish gelatin shapes on OHP.

In this puppetry system, I considered the same elements as in shadow theatre – the bioplastic surface, a source of light and a screen. The activity of staging them on the OHP made me notice the different textures inside the bioplastics. At first when the lights were not on, I did not perceive any difference from regular plastic. Later, I noticed wrinkles inside the smaller shapes that had been set using a dehydrator, that I had not found in other bioplastic forms that were dried at an ambient temperature. Although the moulds in the dehydrator that I used were identical, I observed different patterns from one mould to the other. I then stepped out to repeat the making process and found that depending on their place in relation to the airflow inside the dehydrator the samples would end up with different shapes and visual patterns illustrating how the backlight of the OHP changes the aesthetic of the scene. By changing the path of the light through the surfaces, or by adjusting the density and source of the light, I could reveal intriguing patterns on the surfaces. The light revealed the internal patterns inside the rectangle and small circle shapes, decreased the saturation of the pink thermochromic body and increased the translucence of the flat sheet of biomaterial at the bottom of the picture (Figure 4-17).

The same scene in Figure 4-18 was then projected onto a white wall. Overall, the hue of the scene became more monochromatic. Whereas I could still see the pink

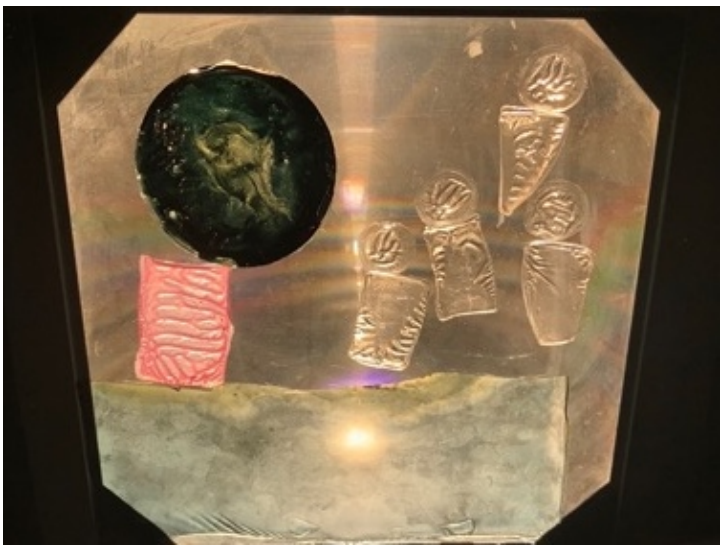

Figure 4-17 Fish gelatin shapes backlighted on the OHP.

colour of the thermochromic shape on the OHP table, this information was lost on the wall. In contrast, the big circle shape's hibiscus dye and the small puppets' internal textures were more visible on the wall than in other stage configurations.

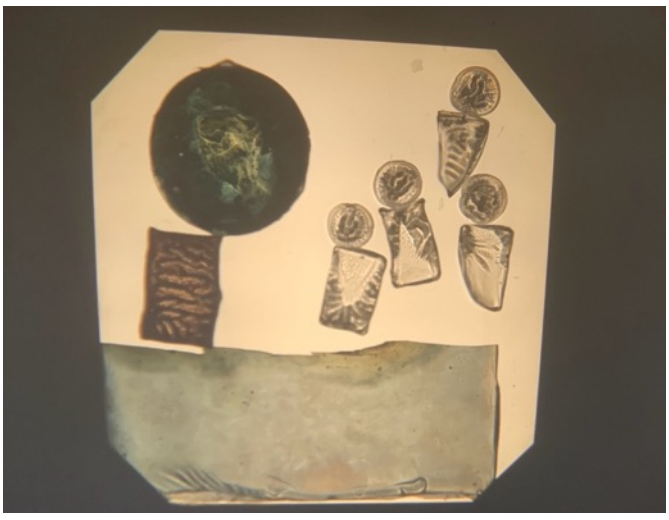

Figure 4-18 Projection of fish gelatin shapes on the wall

While the shapes were flat, it meant that for a live performance I could manipulate them like paper-cut silhouettes with a stick. In this specific organisation of the

shapes, the apparent COG was located between the circular and the rectangular shapes that made the anthropomorphic character.

The construction of the OHP allowed me to test different sources of light and their different effects on the oscillations between the materialness and liveliness of the bioplastic forms. From the findings about their translucence and textured patterns, I could design a puppet system based on similar rules to those of shadow puppetry. In these systems, the light source and physical properties, the size and the material of the screen and the puppets were the main factors that determined the aesthetic of the shadows and silhouettes. In the making process illuminated the dynamic role of the heat source in the designing the aesthetic of the bioplastic. In contrast, it was the light source that generated the symbolic characters in the design of the puppetry performances driven by the materialness of the bioplastics.

In the experience with the fish gelatin, the symbolism came from the material's aesthetic. Even if each of the bioplastic bodies has a distinct character, they appear to belong to the same family. It is like a mother with her children or a teacher with his/her pupils: there is a definite sense of both hierarchy and sameness. The lower rectangular shape has no liveliness, so it could be the ground. Although the shapes were not anchored on it, we read them as jumping up and down from the surface of the OHP.

On the wall, the dark blue circle seems to host a more complex and organic pattern that is almost cosmic in comparison to the smaller ones that seem to have a sort of genetic code in their heads. Switching on a light to shine through the bioplastic material revealed interesting textures on the screen, which could be used in a shadow theatre performance.

In my pictures that share the symbolic activity of the bioplastic samples., I focus on the effect of heat and light on the aesthetic of the samples and their symbolic deployment.

Although the properties of the bioplastic surfaces were similar to those of conventional plastics in terms of translucence and flexibility, the ability to alter the ingredients in the recipes brought a level of intervention for me as a puppet-maker

that was not possible with conventional plastics.

The aesthetic of the samples changed according to the combination of ingredients and the moulds I used for casting the bioplastic materials. In the making activity, the aesthetic of the bioplastic was entangled with the recipes, the shape of the moulds and the technical specifications of the heating devices. The hot air flow in the dehydrator gave internal textures to the material; different positions of the samples in the dehydrator gave different patterns. In summary, the drying process made a symbolic agential cut between the bioplastic shapes.

On the OHP stages, various characters and metaphorical correspondences emerged from the manipulation of the light source, in terms of its intensity and direction. The light revealed how the bioplastic material had dried and the memory that the material retained of the direction from which the dehydrator was blowing. I made the ingredients of the bioplastic recipes visible or invisible with a more or less homogeneous mixture in the making activity. In the devising process, the light made visible the internal textures of the bioplastic forms and the traces of my making process. Interestingly, the light changed the artificial aesthetic of the pink thermochromic material that turned from very bright to a more subtle shade.

In summary, the aesthetic of the samples changed with the form of the casting moulds, the natural ingredients and the design of the drying process. The OHP puppetry system contains different light systems that provided different perspectives of the bioplastic samples, and the light controlled the opalescence of the bioplastic's translucence and the internal textures. The activity of staging them on the different types of lighting stages available on the OHP emulated various material expressivities and aesthetics from the same biomaterial recipes. Although the properties of the bioplastic surfaces are similar to those of conventional plastics, the ability to control their drying process, by altering the ingredients in the recipes or adjusting their position in the dehydrator, brings a level of intervention for puppet-makers that is not possible with conventional plastics.

Character Improvisation with alginate and hibiscus

Following the impulse from the textile community to seek alternatives to animal-based gelatin with 'vegan'-based gelatin, I devised puppet characters with materials

made of seaweed. In the devising process with bioplastic recipes, as well as gelatin made of animal skins, such as fish or beef gelatin and chitosan, I tested seaweed alternatives such as carrageenan, agar and sodium alginate.

Figure 4-19 shows another outcome from devising a bioplastic body shape structure

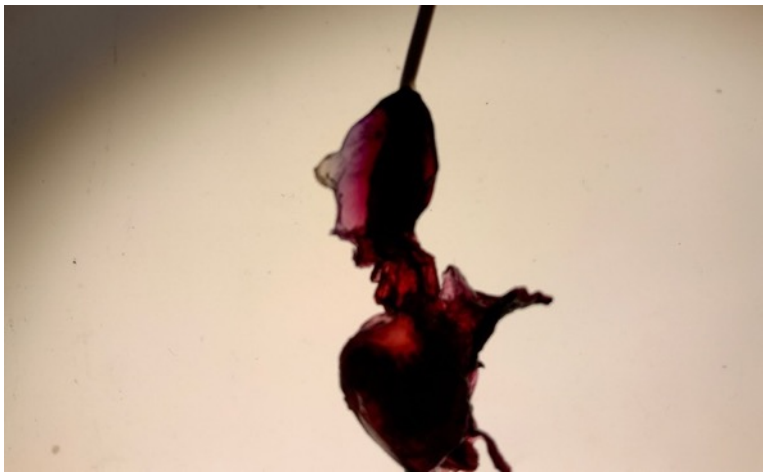

Figure 4-19 Puppet head and Upper Body in sodium alginate with Hibiscus

with sodium alginate and mixing it with glycerin and hibiscus dye. I poured the mixture into five cavities of a food packaging tray, added dried hibiscus petals to connect the cavities with each other and let the mixture to set in an ambient temperature. During the drying process, the sodium alginate mixture retracted from the walls of the moulds and encapsulated the hibiscus flowers and the stick. By chance, one of the cavities turned unexpectedly into a head profile with a very clear nose shape. The texture of the material that emerged was similar to that of rubber or silicone.

I used a piece of jute ribbon to secure the upper body to the lower body. I repeated the experience with lights on the puppet and the light source placed behind it. Then I manipulated the stick puppet to change its expressivity. I locate the head with the nose (Figure 4-18) that appeared in one of the cavities after it dried. As the drying process went on the water encapsulated in the sodium alginate disappeared. Like the first experience with sodium alginate, the puppet's body shrank after a few weeks. It also became more rigid.

I investigated natural alternatives to build my joint mechanisms instead of wire or synthetic materials. The hibiscus petals operated as joints and provided the flexibility for the structure to move from the hips and the head. The alginate puppet seems to look forward in the direction it is going from the nose and jump from the hip joints. Its shadow has the colour of the hibiscus dye. (Figure 4-20)

The stick puppet, the stage that supports the physicality of the puppet, the stick paper puppet movement, the light, and the hand of the puppeteer, all belong to the puppetry system.

Figure 4-20 'Puppet alginate' jumping with its coloured shadow.

In my experience with alginate, the symbolism came from my manipulation and the aesthetic outcome from the casting process. First, taking cues from its aesthetic appearance as a dancer or the figure of Harlequin, I performed the character jumping and sliding on a white surface. After few days, I read the shrinking alginate puppet's body and its reduced flexibility as the puppet getting 'old'. A metaphorical correspondence appeared between the manifestation of the alginate's physical property of shrinking over time and the human concept of ageing.

I took photographs and shot a short video to share and document the symbolic activity of the alginate puppet. The conversation between the alginate puppet and its shadow in the short video gave me the impulse to stage the metaphorical expressions of the alternate bodies of the alginate puppet. In the same frame, I displayed the puppet made of vegan gelatin and the short video I took while devising a choreography with the alginate puppet on a digital screen.

I noted the disappearance of the texture of the alginate puppet in the video. As I watched the analogue and the digital version of the puppet simultaneously, I perceived them as two different instances of the same puppet. (Figure 4-21)

In summary, from reading the documentation of this material experience, I had three characters that could perform together on the same stage: the coloured

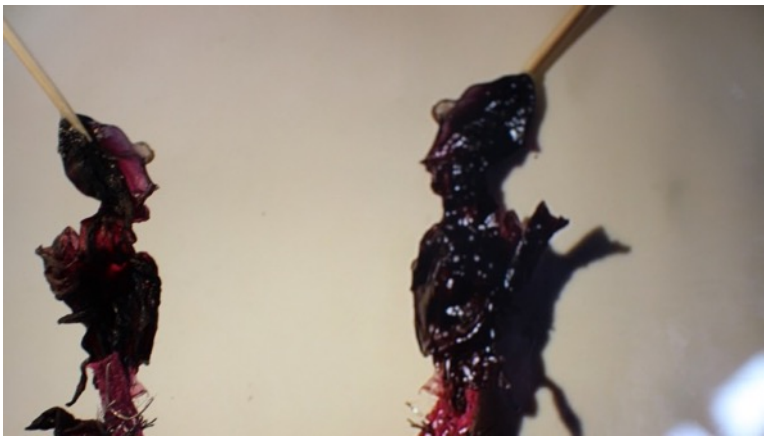

Figure 4-21 Puppet Alginate Hibiscus with its digital image shadow, the flat digital shape and the textured analogue shape.

I could explore the expressivity of the character by changing the construction of the stage. First, on a flat surface I was able to perform the sliding and jumping behaviour of the alginate puppet. Then, while I projected a light onto the surface, I was able to cast the puppet's shadow. Finally, staging the puppet with a backlight put my gaze on the 'nose' of the puppet head and gave me the impulse to manipulate the bioplastic form from the shape containing the nose.

In summary, through the same casting process, the bioplastic materials exhibited their different physical properties. On the one hand, I improvised the 'small people' with the weird materialness of the translucent gelatin that retained their elliptic character and the memory of the heat process. On the other hand, I made a jumping character from the sodium alginate cast with the hibiscus dye and petals that had lost the memory of the moulds and was shrinking over time.

Character improvisation with vegetal elements

I explored anthropomorphic shapes with a dried poppy seed-head and decided to insert the stem of the poppy into a ball of thin ramie yarn and converse with the

soft texture and curvy body shape of the 'poppy pelote'[241] through touch and vision. I also drew from my tacit knowledge of basket weaving acquired from my previous installations to improvise 3D structures around found objects and other vegetal elements and with paper and cotton threads. Interestingly, when the basket-woven process covered the models completely, I could not perceive the material expressivity of the original model, whether it was a stone or a polystyrene egg. The organic character of the basket-woven paper threads overrode the materialness of the models.

[241] A French word that encompasses the concept of textile and the oval shape of a ball

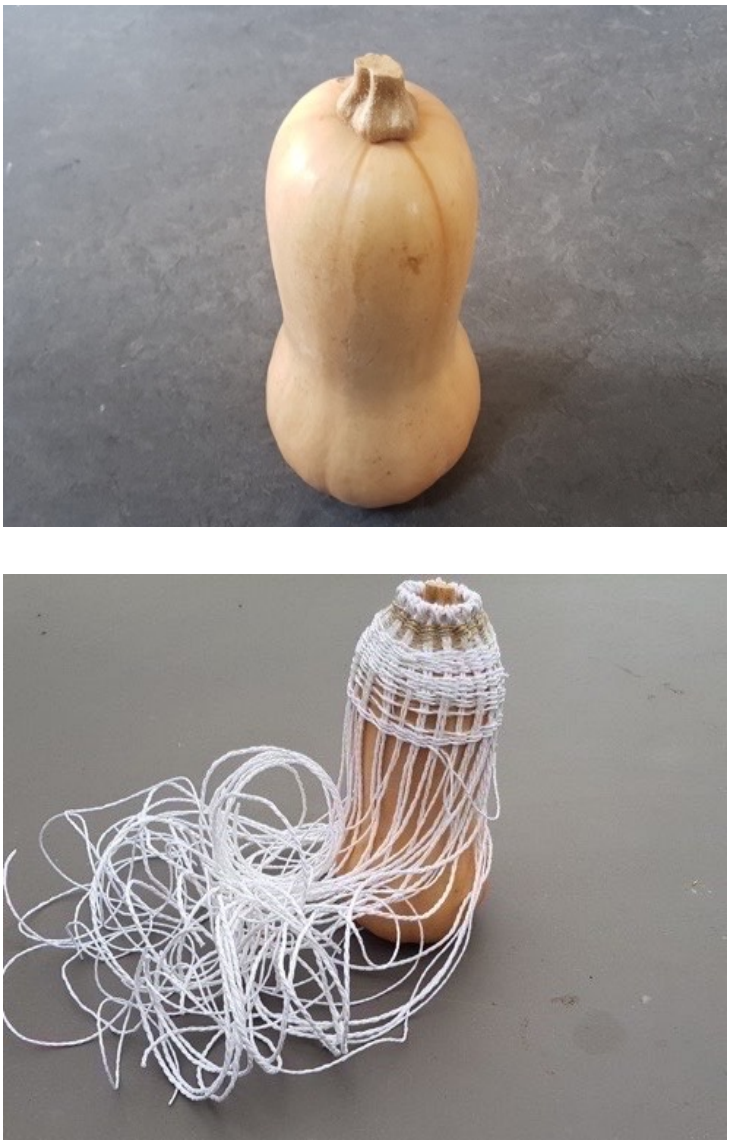

Figure 4-22 Top of a squash covered with a woven paper thread top turned into an octopus running.

Nevertheless, stopping halfway through the casting process in one of my basket-woven iterations provided the space for a puppet character to emerge. The woven paper threads hold the top of the squash (Figure 4-22) and, in their undulation, reveal the squash, still visible through their partial entanglement. In juxtaposing the woven form of the basket on top of the squash, I perceived the squash as the body and the basket form as the mask on its head. (Figure 4-22). I performed another half-covering process, turning a piece of driftwood into a hippocamp (Figure 4-23).

Figure 4-23 'Hippocamp'

THE WEIRD LIFE OF PLANTS

The basket-woven forms performed extended bodies for the squash and the driftwood. Similarly, I extended the resin poppy seed-heads with textile bodies. The assemblage was character driven in that I forced the vegetal forms into anthropomorphic characters. In my manipulation, I included the materialness of the dried poppy head in the poppy pelote and the resin heads. I also had access to the textility of the organza and the crocheted cotton around the flexible wire. The three characters had a kinship through the similarity of their head shapes that contributed to my reading of their characters on the puppetry stage.

My manipulation on the stage revealed their different character expressivity in front of and on the screen. Their relationship gave me the characters of ‘the poppy fairy’, ‘the poppy child’, and ‘the poppy sorcerer’.

My immersion in textile design and its social environment allowed me to explore bio-based materials. From my tacit knowledge of how to perform puppetry with translucent materials and the materialness of bioplastics, I had the impulse to puppeteer them with light. I found symbolic correspondences in their entanglement with heat and time during the making process. I used the lack of control in the

making process and my 'wilful naïveté'.[242]

The construction of the stage and a combination of hand and light manipulation contributed to the emergence of puppet characters while performing the bioplastic materials. The character of the bio-based material and its difference from industrial plastic came from the craft process, leading to non-repetitive patterns, despite the repetitive process. Time and heat performed a series of irreversible transformations of the making process, leading to the emergence of a unique aesthetic for every sample.

Building the messy area with the bioplastic led me to discover metaphorical correspondences about natural elements while feeling uncomfortable about mixing natural elements with thermochromic pigments. The colour shades I obtained with the thermochromics were too bright compared to the delicate and more subtle shades of the natural dyes I had tested, from the rosemary bushes in the garden to the curcuma spices from the kitchen cupboard.

Their ability to oscillate between human and non-human expressivities was similar to what I know from using polycarbonate, acrylics, silicone, and latex. While I initiated the messy area, I investigated an effective design for lively characters from the physical and metaphorical properties of the materials. Instead of focusing on an aesthetically pleasing outcome, I sought to establish the ground for performing the oscillations between a character and a non-living artwork. I manipulated bioplastic textile compositions by hand and with light and activated the bioplastics' materialness in shadow theatre performances. As I increased my tacit knowledge about producing and performing with bioplastics, the research delivered interesting metaphorical correspondences that I would not have found with conventional plastics or without being entangled in the making process.

Interestingly, at that stage of the pandemic I did not have access to the technical knowledge to reproduce the same texture, colour and, more generally, the same

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[242] Ian Lambert, Improvisation: Autonomy, Heteronomy and Wilful Naïveté', in *EKSIG 2019: Knowing Together – Experiential Knowledge and Collaboration DRS Special Interest Group, Estonian Academy of Arts, 2019* <https://eksig.org/EKSIG2019.html> [accessed 8 December 2022] p. 7

aesthetic beyond the doodling activities. Every sample would be different from each other. Although I perceived no difference between the bio-based and industrial plastic in my hand manipulations, there was a clear distinction between them on a shadow theatre stage.

The diffractive analysis underlined the role of the stage in revealing the bioplastic's character expressivity. However, the material transformations I observed while casting and drying the bioplastics were not transferable to reversible changes on a puppetry stage. Although the material transformations were visible in the characters' expressiveness, I could not put them into a dynamic relation with the puppet's structure. Nevertheless, the work with bio-based materials gave me the impulse to reflect on the role of nature and, more generally, of the making environment in my character improvisations. It sparked a desire for my further activities to remain open to the stimuli of natural elements, not only in the creation of puppets but also in the transformations they could induce in a puppetry system where I consider nature not only as a character that I as the puppeteer could manipulate but also as a puppeteer itself, which could manipulate the characters in the puppetry system. I had the impulse to consider Bunraku-style puppetry for my work with nature. In this form of puppetry, more than one puppeteer operates one single puppet, with one puppeteer manipulating the top body of the marionette while the other manipulates the lower part.

> [...] across the multiple figure (puppet and often two manipulators) a single being is represented. This apparently pragmatic decision has profound ontological and existential meanings for an audience.[243]

In summary, experiencing the weird life of plants with the staging of the bioplastics foregrounded the contribution of the stage in the visibility of the material expressivity. Working with the bioplastics led me to reconsider my practice from a sustainability perspective. It gave me the impulse to reduce the use of technological materials and electronic circuitry when designing with thermochromic materials.

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[243] Taylor, 'Introduction', p.32

Thermochromic materials (1.3)

TEXTILE DESIGN

The following examples of thermochromic textiles raised my interest with their playful approaches and inclusion of the surrounding environment of the textiles in their design.

In her investigation of thermochromic materials, textile designer Marie Ledendal

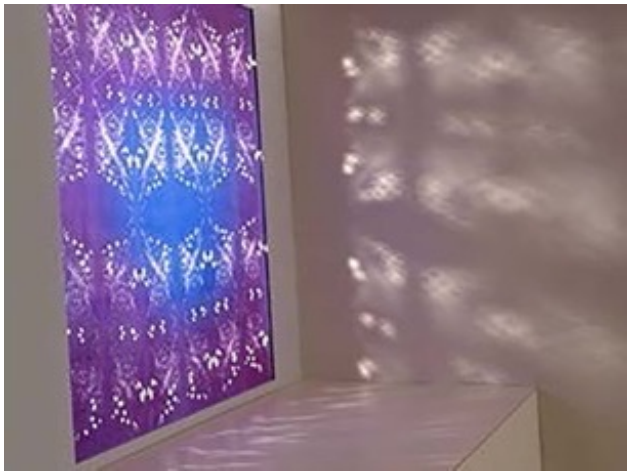

Figure 4-24 Figures 4.51 in Ledendal, Marie, 'Thermochromic Textiles and Sunlight Activating Systems: An Alternative Means to Induce Colour Change' (unpublished Phd Thesis, Heriot-Watt University School of Textiles and Design, 2015), p140.

examines methods for controlling solar activity through time management, fabric heat capacity, and textile structure in thermochromic curtains that capture the sun's heat (Figure 4-24)[244] Similarly, in shadow theatre the clarity of the silhouettes is determined by the material of the screen, the textile structure, the light intensity, and the puppet's position relative to the screen and the light source. Ledendal captures the sun's activities with a palette of thermochromics and dyes. The thermochromic patterns in the textile staged on a window reveals the breathed

[244] Marie Ledendal, 'Thermochromic Textiles and Sunlight Activating Systems: An Alternative Means to Induce Colour Change' (unpublished PhD Thesis, Heriot-Watt University, 2015), pp.152-153

stillness of the sun. In her research, she ponders about how to contain the sun's activity through time management, the heat capacity of the fabric, and the textile design.

In Linda Worbin's playful installation 'Textile Disobedience'[245] the character of the cup shows up as flat circles on the thermochromic tablecloth, while the character of the water escapes from the cup to perform independently from its container

Figure 4-25 Linda Worbin Designing Dynamic Textile Patterns (University of Borås, 2010), p.58.

(Figure 4-25). The thermochromic tablecloth shows the intra-actions between the container (cup) and the content (water). Similarly, Lauren Bowker's Union Jack flag covered with pollution-absorbent ink that was flying at Somerset House[246] tells a story about the unseen threats of the air to our health.

PUPPETS

'The Poppies'

[245] Linda Worbin, *Designing Dynamic Textile Patterns* (University of Borås, 2010), p. 45

[246] Dan Howarth, 'Clothes That Change Colour According to Climate by Lauren Bowker', *Dezeen*, 2013 <https://www.dezeen.com/2013/12/12/clothes-that-change-colour-according-to-climate-by-lauren-bowker/> [accessed 29 November 2023].

Pursuing the research of the design of puppetry performances with thermochromic materials, I improvised puppets with textiles and thermochromic materials. I evaluated three poppy heads made of different materials in combination with different textile bodies. The first of these was the 'poppy pelote', (Figure 4-26) a dried poppy seed-head with a body made of a ramie pelote dipped in thermochromic dye.

I designed the two other forms with poppy heads cast in thermochromic resin. One

Figure 4-26 'Poppy pelote' a dried poppy head inserted in a ramie fiber ball dipped in thermochromic dye.

was set on a wire stick wrapped in a thermochromic organza, and the other was embedded on a flexible wire crocheted with thermochromic cotton thread.

I could visually differentiate the artefacts based on the response time and duration of their change in colour. Without moving the thermo-puppets, I could observe the breathed stillness of the colour changing over time. However, when the characters performed movements and colour changes simultaneously, the moves overrode the colour changes in their characters' expressiveness. To allow me as an audience to focus on the colour change instead of the moves, I had to stay still and perform the breathed stillness of the heads to make the change in the character's expressiveness visible.

Moreover, before the colour changed, I manipulated the puppets in response to the movement of the centre of gravity between the curves of the crocheted wire that moves and bends for the crocheted poppy and at the mid-point of their bodies for

the two other poppy characters. As the heat started to spread and the colour changed, I listened to new information communicated by the material. I then adjusted my manipulation in response to not only the material's texture and the puppet's ability to move but also to the heat capacity of the material. The puppets' different responses to heat, the tension between the timing and duration of the movements of the structure and the colour change contributed to the expressiveness of the characters.

I built the documentation with a stop-motion animation to support the reading of the different heat capacities and character expressivity. The visual and tactile differences in shape and texture of the poppy pelote and the poppy wrapped in

Figure 4-27 Still images from stop motion with Poppy fairy and Poppy pelote

organza gave me a set of symbolic correspondences to a relationship between a mother and child. (Figure 4-27) In this metaphor, I mapped their colour change to the thermo-puppets' breath and emotional status.

L'Oiseau timide[247]

The way forward for exploring the material expressivity of basket-woven structures was to explore which different expressivity the same form would perform when embedded with thermochromic pigment. In this puppetry experience, I repeated the use of paper basket-woven forms as a dynamic extension (Figure 4-22 Top of a squash covered with a woven paper thread top turned into an octopus running). Instead of covering a squash, I (the puppeteer) covered my finger with an orange leaf to lemon haze 28C thermochromic paper thread woven with gold-plated aluminium wires. A Saori-woven cloth hid the rest of the hand. The stage was a grey desktop with cloudy patterns.

In my improvisation, I performed the basket-woven shape as a bird's head, with my finger as its beak and my hand covered by the woven cloth as its body. (Figure 4-28) The basket-woven form enacted a mask staged on my hand. The colour change

Figure 4-28 'L'oiseau timide (the shy bird)'

[247] "The shy bird"

performed the puppet's breathed stillness; its inner world.[248] In the video,[249] we as an audience perceive the thermochromic transformations as the bird's emotional state. The neutrality of the stage supports the spectator's focus on the textile structure, which is the only element in the system showing a physical transformation. I, as the puppeteer, documented the bird's transformations in a live video and extracted different attitudes and colour states for future reference. In conclusion, I as the viewer perceived the character as a shy bird.

Le Mur Carnivore, le Hérisson, et Arlequin [250]

For this textile-driven character, I took an impulse from Huang's exploration of the combination of cubic patterns and thermochromic moulded textiles.[251] I pleated a thermochromic satin fabric into a hedgehog origami pattern and researched its character's expressiveness in three different textile experiences.

"Le mur carnivore" (The carnivorous wall)

The first manipulation focused on the flexibility of the textile pattern. In my hand manipulations, I entered into a dialogue with the folds that opened and closed to catch my fingers. I observed the folds' connection to each other and the inability of a fold to move individually or to retain the heat without spreading it. The colour change followed the textile pattern and propagated from the top of each fold to its inner part, and the top of the folds were the first to return to their original colour. My puppetry evaluation perceived the opening and closing of the folds as the textile's breath and the change in colour from purple to pink as the inhale and exhale phases. By taking multiple pictures of the material transformations and analysing the differences that emerged between them, I could view the textile's structure from both a spectator's and a performer's perspectives. It gave me the time to tune in to the change of colour and pattern in the origami wall and to increase my tactile engagement. I named the character 'Le Mur Affamé' (part of

[248] Adrian Kohler, 'Thinking through Puppets', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), p.73

[249] *Le Ciel va Me Tomber Sur La Tête,* dir. by Sabrina Recoules Quang, 2021 <https://vimeo.com/518374132> [accessed 16 May 2024]Video 5-3

[250] Translated by the author into "the Carnivorous Wall, The Hedgehog and Arlequin"

[251] Huang, 'In-between Pleats'

the series 'Les Mangeurs de Doigts'[252]) to reflect how I perceived my interaction with the origami. (Figure 4-29)

"Le Hérisson" (Hedgehog in his burrow)

The hedgehog pattern gave me the impulse to explore another setting with the same pleated fabric inside a small black cardboard box. This time, I stepped back and manipulated the movement of the textile with a heat sensor circuit that

Figure 4-29 'Le mur affamé', thermochromic origami pleats

activated a small servo motor glued to the bottom of the box. The motor operated the textile from below. As an audience, I received from the video[253] my visual information only from the pleats, as the motor remained hidden under the folds. I took my cues from three tension levels in my puppetry evaluations of the hedgehog

[252] The series include Le tardigrade vorace and L'oiseau timide

[253] *Le Hérisson,* dir. by Sabrina Recoules Quang, 2023 <https://vimeo.com/835816650> [accessed 13 May 2024]

character. (Figure 4-30)

The first one emerged from the stitches between the fabric and the motor. The second level of tension came from the stage construction, where the box operated as an amplifier of the motor's mechanical noise and vibrations. I read the tension between the change in colour of the thermochromic fabric, the sonic environment that seems to come from under the pleats and the movements of the origami. The

Figure 4-30 'Le Hérisson' thermochromic origami pleats

sonic environment and the origami movements prevailed over the colour change. As an audience, I read the centre of gravity in the pleats. The different tensions in the system performed the character of a hedgehog purring in his burrow. The final reading gave me the impulse to shoot the video in light conditions that underline the character's sonic and kinaesthetic character instead of its change in colour.

Arlequin (Harlequin)

Figure 4-31 Harlequin

In this hand manipulation, I pinched the top tier of the structure and held it firmly grounded on a flat surface (Figure 4-31). In doing so, I established the hedgehog origami as an anthropomorphic shape with a centre of gravity at the confluence of my fingers and the pleats, where the colour turned from purple to white. I then took photographs to build the documentation and capture the colour changes in the character's expressivity. I evaluated the relationship between the colour change and the sliding and bending movement of the character during the manipulation and when I reflected on the documentation. The first level of tension was between the hand of the puppeteer, which provided heat and motion, and the origami structure. Although this was the case, I did not see the colour change coming from the fingers in the documentation. The second tension operated between the origami and the stage floor. I perceived the flexibility of the form and the collective activity of the folds. However, puppeteering the textile allowed the spectator to read the difference in expressivity between the top, which was then performed as the head, and the lower part of the pleated body, which was performed as a body. The juxtaposition of these two tension levels between my hands, the stage and the textile produced the puppet character.

My evaluations of these three experiences with the same thermochromic hedgehog textile origami underlined the importance of the staging activity in the production of the character and the challenges of managing the balance between colour changes and movements to keep the conversations going during the performance with the material instead of the textile structure.

SCREENS

This series aimed to evaluate the potential of thermochromic materials for performing in theatre shadow screens. I took my cues from Mayer's and Ledendal's installations with thermochromic materials and embedded thermochromic dye into silicone, cotton, and satin to build a threefold stage. Instead of seeking the material efficiency of the thermo-screens in terms of propagation of the colour change[254] or containing the activity of the heat source as Ledendal had done, I focused on the

Figure 4-32 Traditional Black silhouettes behind a thermochromic screen

dynamic contribution of the thermo-screens to the character's expressivity on a puppetry stage. As expected, my material experiences illustrated the potential of thermo-screens for displaying various visuals based on the distance to the screen and the power of the lighting devices. More interestingly, the thermochromic shadow screens demonstrated new useful properties. First, I found that the heat of the light projectors activated the thermochromic dyes and transformed the

[254] Laura Devendorf and Chad Di Lauro, 'Adapting Double Weaving and Yarn Plying Techniques for Smart Textiles Applications', in *Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction presented at the TEI '19*,Tempe Arizona, USA(ACM, 2019), pp. 77–85 doi:10.1145/3294109.3295625

aesthetic and the potential of the screen to convey metaphorical correspondences that were different from those in traditional screens. (Figure 4-32)

Not only did the screen turn from black to white, but the silhouettes of the artefacts behind the screen also became more visible. (Figure 4-33)

The colour transformations expanded the expressivity of the screen while providing a new type of impulse to the puppetry system. The whole process changed the dynamic between the puppets and the screen and suggested ways for new character expressivity for the puppets behind and in front of the screen.

'THE WEIRD LIFE OF THERMOCHROMIC MATERIALS

Figure 4-33 Superposition of the white shadow on the thermochromic screen and the black silhouettes behind the thermochromic screen

The thermochromic characters ('thermo-puppets') are textile artefacts and laser-cut wooden shapes embedded with thermochromic materials. While pursuing the character of the bird in different mediums and with different tools, I ended up with totally different characters. Introducing the heat activation in a puppetry system changes the location of the puppet's centre of gravity. Instead of focusing only on the changes and the movements in the puppet's structure I followed the colour changing materials. In the puppetry performances, the thermo-puppet evolves from a centre of gravity that is located between its structure that moves and its material that changes colour. The colour-changing materials extend the puppet's character expressivity and their ability to connect emotionally. By incorporating chromic properties into the fabric of the screen, I was able to expand the range of characters that can be performed with and by a shadow screen.

The white silhouettes ('heat characters') on the thermochromic screens ('thermo-screens') have a different materialness from that of traditional shadow silhouettes. These heat characters are white and combine in their expressivity the materialness and the textileness of the screen fabric with the puppets that are behind the screen. The shadow screen reveals their lively characters appearing and disappearing with a rhythm in relation to the heat capacity of the fabric of the screen.

In my working environment I found a long list of heating devices (the 'heat puppeteers') that I could use for changing the colour of the puppets: a desk lamp, a laptop, a computer, a heater, a window…. These were all potential 'thermochromic puppets' or 'heat puppeteers', in the sense that the source of change was external to my body.

With the introduction of a thermochromic resin material in the puppetry system, a new type of relationship appeared. In the thermo-puppets made of resin the material stayed warm longer than other materials, and could activate other thermochromic materials.(Figure 4-34) The material gave me another type of impulse as the puppeteer: I then faced the choice of manipulating the resin puppet

Figure 4-34 the thermochromic puppet is also a 'heat puppeteer'.

based on its shape and colour change activity and/or having the thermo-puppet manipulate the aesthetic of the screen and other thermo-puppets. (Figure 4-35) The thermochromic material suggested a new way for the audience to make meanings

out of the artefact's oscillations between performing as a puppet or as a puppeteer.

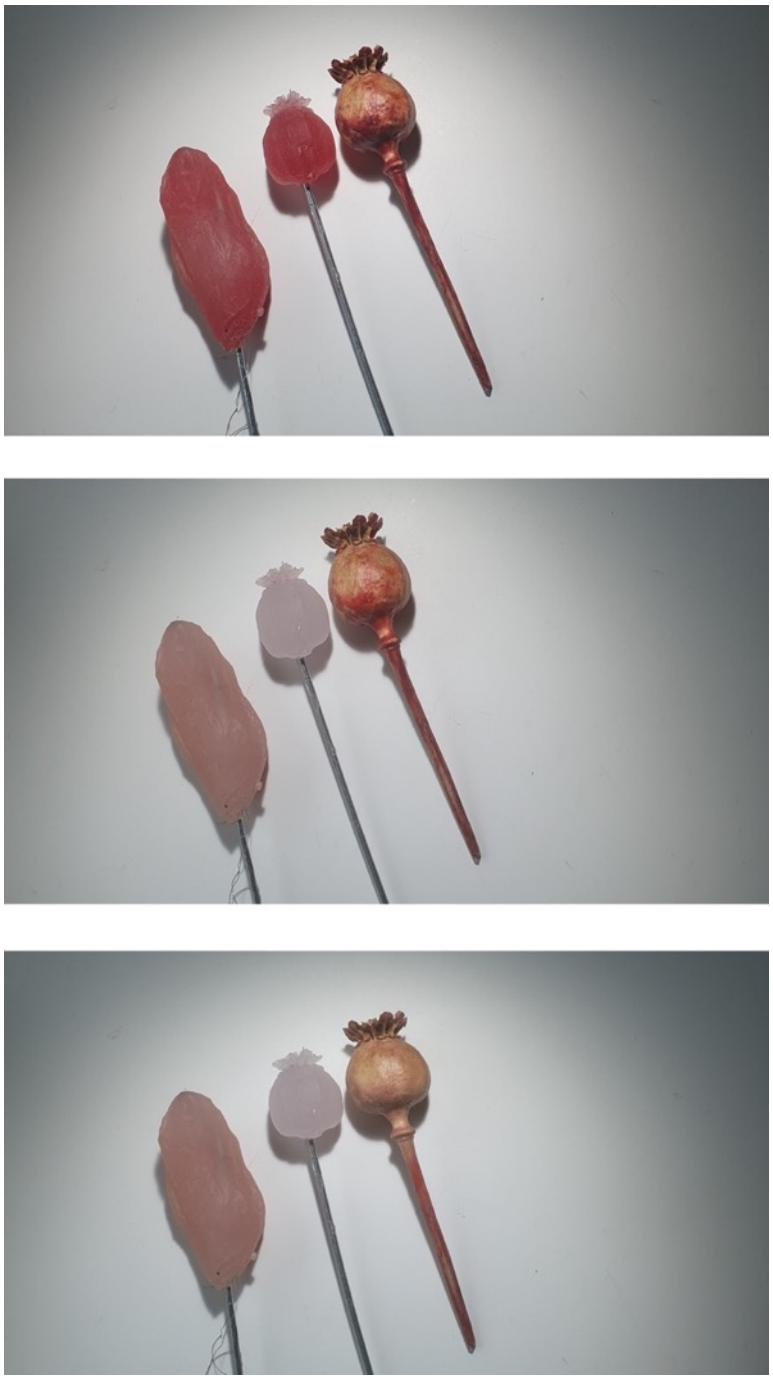

Figure 4-35 Thermochromic heads with resin cast of dried plants and a dried poppy head dyed with thermochromic. The sequence demonstrates the different heat capacities of the artefacts.

Overall, the doodles of thermo-screens and thermo-puppets indicated a dramaturgic potential based on their different heat capacities. Additionally, the material experiences suggested heat capacity as an additional argument for heat as an activation source for thermochromic characters. I read the heat capacity as the property of a 'heat string' that supports the activation of the thermo-puppets.

Reflections on Character improvisation

THERMOCHROMIC MATERIALS AS A SITE OF CHARACTER PRODUCTION

In my puppetry evaluations of textile materials and processes, I looked for physical tensions between the material and the structure expressivity. Many characters emerged from my improvisations with thermochromic materials and textile processes, and from the review of the images and short videos I took to document our process. The characters emerged slowly from repeated improvisation and devising sessions. (Table 1, Appendices, 'Improvising characters') shares my process of building characters from material and structural transformations.

My dialogue with natural elements was lost when I performed the puppetry evaluation of my bioplastic characters on a shadow theatre stage. However, my explorations of bio-based materials gave me the impulse to focus on the contribution of a natural environment in making characters with thermochromic materials and improvising with them on a natural stage. By contrast, introducing the colour-changing materials in my puppetry systems revealed new types of puppets and characters. While improvising thermochromic materials, I looked for unresolved tensions between a textile that moves and materials that changes colour to give me the impulses I need to go forward. My character improvisations revealed the heat capacity as a string that supports the heat puppeteers in manipulating the thermo-puppets and thermo-screens.

Furthermore, a new type of puppet character and stage emerged from the entanglement of thermochromic materials and textile processes into 2D surfaces and 3D artefacts. When activating the materials' weird life, the thermochromic dyes offered colour change as a way, in addition to movement, that does not exist with traditional dyes. In my puppetry evaluation, I took my cues from the temporal dimension of the colour change. I also found that sharing the thermochromic

character called for settings other than a live performance and that filming the thermochromic characters in stop-motion was more relevant than filming them in a live performance. Moreover, manipulating thermo-puppets made of resin revealed their ability, driven by their high heat capacity, to perform as heat puppets and change the colour of their thermo-sensitive surroundings. In this new style of puppetry, the COG depends not only on the weight distribution but also on heat capacity distribution in the artefacts.

Bioplastic and thermochromic materials both elicit their environment as co-creators in the design of lively characters. The material expressivity of the bioplastic materials I made with natural dye extracted from plants changed during the process of making them. However, in my puppetry evaluations, these changes were neither repeatable nor reversible.

By contrast, I could activate the same changes in the thermochromic material expressivities through my manipulations in the making process and my puppetry evaluations. Despite being attracted to the aesthetic of the bio-based materials and their sustainable properties, I decided not to pursue the design of puppetry performances with them. I could not repeat the transformations I experienced in producing the bioplastic artefacts. More importantly, the thermochromic materials, unlike the bioplastic materials. produced different ways of expression for the puppets.

By their weird ability to change colour in response to heat, the thermochromic systems cast the environment as the co-creator of the thermo-puppets and a non-human co-puppeteer of the thermo-puppets.

In my puppetry evaluation, I refer to 'Bunraku puppetry', a form where more than one puppeteer is manipulating a single puppet.[255] In this form of puppetry, the characters' visual transformations result from a collaboration between the different physical abilities of the puppeteers and their position on the theatrical stage in relation to the puppet's limbs. In the puppetry systems with thermochromic materials, I brought a different type of heat capacity and expressivity to the colour

[255] Taylor, 'Introduction', p.32.

transformations of the textiles than the heat puppeteers from my working environment. The thermochromic materials became a site of communication that supported the communication of the puppet's human and non-human ways of interacting with the world. By contrast, in the puppetry systems with the bioplastic materials, the natural elements that contributed to the aesthetic of the bio-based puppets were inactive in the puppetry performance.

I therefore proceeded in the research with thermochromic, rather than bioplastic materials.

TRANSITIONING FROM MATERIALS TO CHARACTERS IN THE NEXT RESEARCH SCRIPT

On the one hand, I improvised material transformations for creating puppetry performances with plants and thermochromics while becoming familiar with textile processes. I took my cues from the bio-based and thermochromic materials embedded in textile processes to transition from material transformations to character expressivity. I evaluated the potential of weird materials for performing in a way that was different from that of traditional materials in a puppetry performance setting. While building fertile ground for my research, I gained first-hand knowledge of the value of textile design for puppetry and bioplastic and thermochromic materials for performing in a puppetry system. These puppetry evaluations gave me the information I needed to proceed with thermochromic materials instead of bio-based materials in the next cycle of activity.

Moreover, the diffractive analysis of the material improvisations led me to consider the tension in the materialness of the artefacts, between the symbolic and the physical properties of the material: the tension in the 'textileness' between the material and the structure and the tension between the manipulation and the character's expressivity. I built my tacit knowledge about the materials by focusing the puppetry activities on improvising the transformation of the material into a lively character with textile processes and becoming familiar with the textile language. The character of bio-based materials and their difference from industrial plastic came from the craft process, leading to non-repetitive patterns, despite the

repetitive process. However, their manipulation in the puppetry systems was similar to that involved in using industrial plastic materials. By contrast, the thermochromic materials retained the originality of their language, both in the material transformations and during their performance as lively characters. I was then able to transpose what I learnt from my making process into the puppetry system. Although the character's movement still superseded the change in colour in terms of the character's expressivity, the thermochromic material suggested a new approach for expressing the changes in the character's emotional state during the period of breathed stillness.

In summary, my material improvisations successfully generated lively characters from the materialness and the textileness of the 3D artefacts I could perform in a puppetry system. The method supported my immersion into the textile field. It generated new information about the bio-based and thermochromic materials that I could integrate into my tacit knowledge.

On the other hand, the research script for the first series of workshops led the textile researchers to explore mask-making and performing as an impulse to explore their material expressivity. The activity provided a new tool to identify haptic information about the materials that could be helpful for material-driven designers. However, it failed to establish a solid ground for sharing a theme not directly connected to the idea of a mask. The workshop series also introduced textile researchers to table top puppetry with a puppet joint making activity. In the analysis of these sessions, I understood the importance of researching a method for supporting their research led by their practice, not mine. With the early-stage researchers in design, the table top puppetry activities focused on supporting them to introduce their research concepts with characters made of tangible materials The experience expanded the researchers' expressivity and created characters from their research themes. Nevertheless, there was no evidence that it delivered new information to the researchers. However, the character improvisations successfully enabled the researchers to share their emotional connection to their research with an audience and confirmed the contribution of puppetry as a communication channel with a non-human character playing the role of a mediator with the human audience.

Moreover, I benefited from the discussions with participants during the sessions with the designers that were at an early stage of their research allowing me reflect on the relationship to my research. This reflection supported mapping in relation to the researcher as a puppeteer with the research as a marionette.

THE MARIONETTE-RESEARCH AND PUPPETEER-RESEARCHER CHARACTERS

At the beginning of the research journey, I read my research as an open system and mapped the research to a puppetry system. In the first cycle of activity, the textile and design researchers explored their research as made-up characters with everyday materials. The analysis of these sessions gave me the impulse to go further into the metaphorical correspondences between puppetry and research systems. In this metaphor, the researcher is a puppeteer, and the research is a marionette, both performing on the research-stage.

The marionette-research diagram represents the entanglement between the marionette-research, the puppeteer-researcher, the research question and themes, the methods, the methodologies, and the transposed puppetry activities. (Figure 4-36) The puppeteer-researcher connects to the marionette-research through the crossbar of puppetry and textiles disciplines.

The puppeteer and the puppet connect through a wooden crossbar and a network

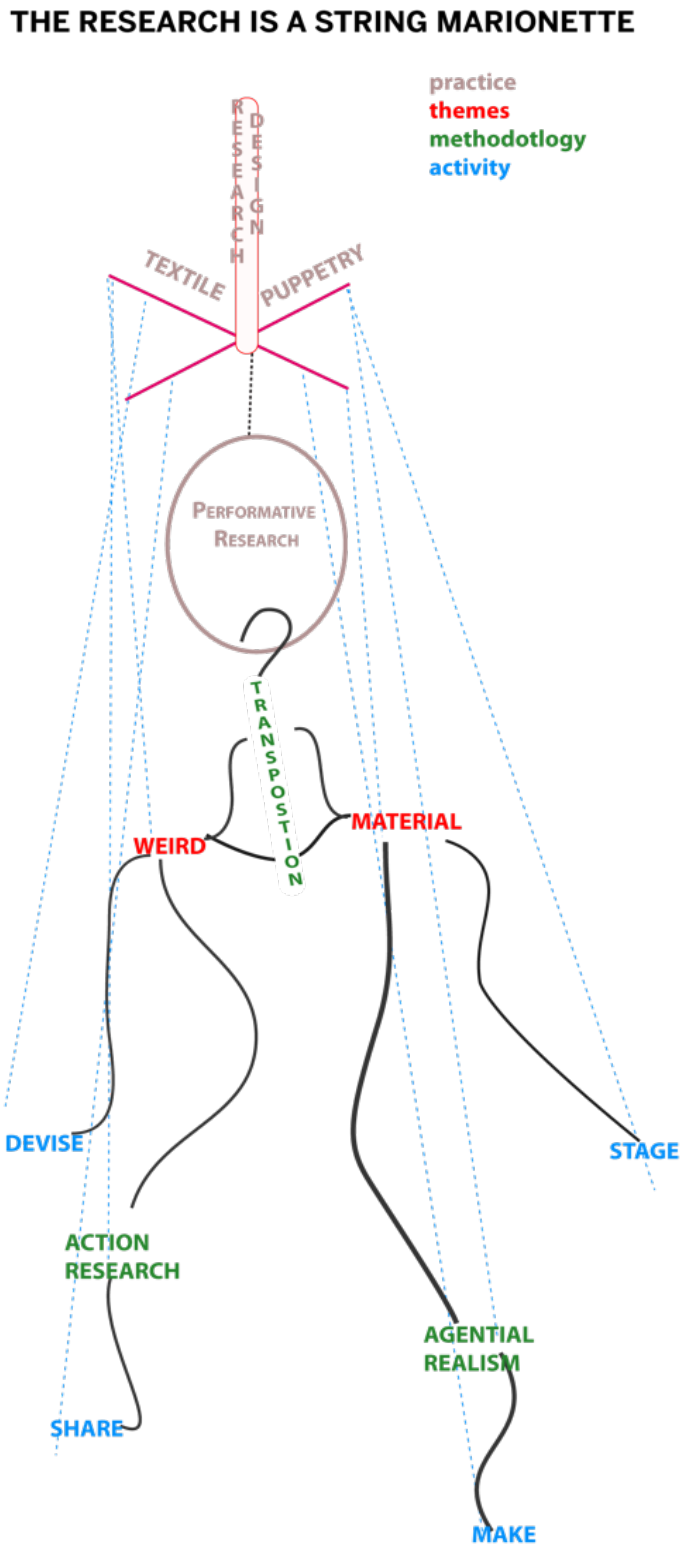

Figure 4-36 Marionette Research Diagram with the main research activities (Recoules Quang 2023)

of strings. While the marionette raises her hand in response to the push and pull of the strings, the puppeteer adjusts her position to keep the puppet's body in breathed stillness. The puppet and the puppeteer synchronise their weight

distributions to prepare the puppetry system for the next movement. Similarly, the puppeteer-researcher and the marionette-research perform the research activities together to move the research system. The puppetry system manages its response to internal impulses, such as a change in the weight distribution in the puppet, or external ones, such as a transformation in the scenery. While they relate to each other, the marionette and the puppeteer mutually extend their human and non-human expressivities. The ongoing negotiation between their materialities contributes to the puppetry performance. Similarly, the transactions between the researcher and the research participate in the research journey.

The research-marionette is a puppetry system where the research activities and methodologies converge in the same direction to answer the research question. In this metaphor, the research question is the COG of the research system and is located between the researcher and the research. The weight distribution in the research system changes in response to the research data impulses that might be internal, such as a change in the distribution between research activities, or external, such as a change in the researcher's social context.

The researcher-puppeteer and the research-marionette undergo a series of transformations through the impulses they receive from the research activities and their environment. At the end of each activity cycle, the puppeteer-researcher and the marionette-research adjust to each other's transformations. In the performance, the audience follows the puppet's body transformations and reads the puppeteer as an extension of the puppet, not the opposite. Similarly, reading this thesis is to follow the researcher's transformations as an extension of the research journey. It is the ensemble of puppet-puppeteer that makes meaning in the play. The model reflects the subjectivity and entanglement of the artist-researcher with the research object.[256] It also provides a tool to perform agential cuts in the impulses from the researched materials, the researcher, and the research context. In my research activity, I constantly evaluated the material through my puppetry knowledge as my gaze oscillated between three perspectives

[256] *Performance as Research: Knowledge, Methods, Impact*, ed. by Annette Arlander, Bruce Barton, and Melanie Dreyer-Lude (Routledge, 2018). p.141

engraved in the 'puppeteery' nature of the researcher. I evaluated the research materials visually and haptically as a maker, improvised lively characters as a performer, and evaluated the documentation as an audience. It is worth noting that these activities are all included in the devising process of the puppetry performance before an external audience can watch the show.

I refer to the marionette-research metaphor every time I step out of the practice to reflect on the completed cycle of activities and to decide on the next step. In the first action research cycle, my participation in seminars in the textile and design communities built connections between the puppeteer researcher and the marionette researcher that increased between my research themes, the concerns of the textile and design communities and their responses to my sharing activities. I can observe the characters of the researcher and the research in my transposition into the textile and design community and my sharing activities with the textile research and textile design communities.

Moreover, in my exploration of the traditional materials in textile structures, I experienced the ongoing tensions between my curiosity as the researcher about bio-based and thermochromic materials and the objective of supporting textiles researchers in their creative process. I also experienced the difference between my character doodle with digital and analogue tools in making the bird character drawing with Adobe Illustrator and basket weaving. I managed the tension by keeping the research question as the COG of the marionette-research activities. It made me choose thermochromic materials over bio-based materials and maintain the basket-weaving processes for tabletop puppetry and laser-cutting processes for shadow theatre puppetry.

In summary, the marionette-research was improvised with weird materials and their transition into characters. I built my tacit knowledge about key terms in textiles while becoming familiar with them through a generative poetry code, textile materials through hand manipulations, and textile processes. Here, I investigated the difference in the expressivity that emerged from embedding the materials into textile structures. The puppetry audit of the characters initiated a series of bioplastic and thermochromic characters, which led me to choose the

thermochromic rather than the bioplastic materials. Moreover, my evaluation and analysis in this cycle gave me the impulse to re-evaluate my research methods. Therefore, I included the activity of unwrapping my new knowledge that emerged from the addition to my tacit knowledge of the transformational knowledge I gained from the transposition activities. The unwrapping activity became part of my research methods between evaluation and new practice.

TRANSITIONING TO THE NEXT CYCLE OF RESEARCH ACTIVITIES (2021)

In summary, this first cycle of research activities aimed to explore the possibility for textile students to create new knowledge about their materials with puppet-making and performing activities. Although this was achieved in the mask theatre activity, it still needed to be visible in the table-top theatre activity. Nevertheless, the transposed methods resulted in the textile students using their knowledge of the materials to create lively characters (Figure 4-5) Despite that all the Mres were not used to manipulate materials at the same level as the textile students, the design researchers were able to share their concepts with tangible materials and demonstrate their connections to the made-up characters and what they symbolised. The designers naturally invested in the metaphorical potential of their materials to create characters that communicate abstract concepts. They strongly connected to their made-up characters instead of the materials they used.

These findings contributed to shifting the focus of the ongoing methodology. Instead of investigating materials through character making and animating characters, the updated script for the research activities with the designers focused on producing stories based on material transformations.

Meanwhile, my participation in textile seminars and conferences gave me the impulse to revisit my definition of a lively character through feminist theory. Following Barad, I switched my focus from the character as a being to the character as the story that emerges from its ongoing characterisation.[257] Instead of focusing on the design of a lively character, in the next activity cycle, my practice focused on researching a method for transposing my metaphorical thinking with tangible

[257] Barad, *Meeting the Universe Halfway,* p.151.

materials. Instead of liveliness, I focused on the emergence of the puppet's 'expressiveness' in the space between their materialness and liveliness. In my investigation of colour-changing materials, I switched my gaze from designing a lively character to designing a system of tangible materials that perform a story. In my practice, I transitioned to devising material transformations that perform a series of character expressivities over time and in different contexts.

Chapter 5

Devising STORIES

(CYCLE 2)

Storytelling as research

After exploring character-making as a research method in the design of puppetry performances and the sharing sessions in an academic context, with the marionette-research, I proceeded to explore storytelling as a research method for exploring the weirdness of thermochromic materials embedded in textile processes.

In design research

Storytelling as a method is not new in design research.

The predominant storytelling model in the design field is inspired by Aristotelian philosophy[258] and seeks to build an emotional connection with the audience and the 'design problem'. The model's centre of gravity (COG) is a design problem. The story is a construction of plots and subplots that develop an emotional connection between the user and the design problem. The story has a beginning, a middle, and an end where the plot converges into a resolution of the design problem.

The model is widely applied with digital materials in the fields of UX design,[259] in computer games or interactive storytelling design[260] or in data visualisation.[261] In terms of telling a story with physical materials, in the context of speculative design, Dunne and Raby stated that 'A story or an idea becomes

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[258] Aristotle, *How to Tell a Story: An Ancient Guide to the Art of Storytelling for Writers and Readers*, trans. by Philip Freeman (Princeton University Press, 2022), doi:10.1515/9780691211107.

[259] Teo Yu Siang, 'How to Create Effective UX Case Studies with Aristotle's 7 Elements of Storytelling', *The Interaction Design Foundation*, 2023 <https://www.interaction-design.org/literature/article/how-to-create-effective-ux-case-studies-with-aristotle-s-7-elements-of-storytelling> [accessed 17 February 2023]

[260] Marc Cavazza and David Pizzi, *Narratology for Interactive Storytelling: A Critical Introduction*, 2006, p. 83 doi:10.1007/11944577_7

[261] Stephen Boyd,Davis Olivia Vane, and Florian Kräutli, 'Using Data Visualisation to Tell Stories about Collections', in *Proceedings of Electronic Visualisation and the Arts (EVA)* (BCS Learning & Development, 2016) doi:10.14236/ewic/EVA2016.44

a constructed reality at the moment it is given form and materially embodied whether as an object, stage set or photograph'.[262] In his design exploration of 'making as thinking 'in primary education, Robert Pulley set up a series of workshops where the children drew, designed, and made objects to support their communication of a specific theme. Pulley noted how the process increased the children's connection to their theme.[263]

In textile design, researchers generate stories from their craft[264] or through textile craft.[265] [266] Seeking to connect her audience to 'living textiles', the designer Julie Arkes explores storytelling on digital platforms as a tool for communicating with consumers[267]. Arkes uses storytelling as a method for triggering a social engagement in consumers with bio-design textiles. She argues that remembering that the material was once alive and telling its history may contribute to the 'aliveness' of the now dead bio-design textiles in the mind of the consumer.

IN PUPPETRY

"Only a puppeteer brings an object alive in order to tell a story"[268]

In the same way that the puppeteers engage with their materials before the

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[262] 'Design for the Unreal World', *Designed Realities Studio* <https://www.designedrealities.org/texts/design-for-the-unreal-world> [accessed 12 May 2024]

[263] Pulley,'Theatre of the Imagination', p.13

[264] Leanne Prain, *Strange Material: Storytelling through Textiles* (Arsenal Pulp Press, 2014)

[265] Seçil Uğur Yavuz, 'MASAL: Bridging Between Two Cultures Through Storytelling with an Interactive E-Textile Toy', in *Developments in Design Research and Practice*, ed. by Emilia Duarte and Carlos Rosa (Springer Series in Design and Innovation) (Springer International Publishing, 2022), pp. 127–39 doi:10.1007/978-3-030-86596-2_10

[266] Arielle Walker, 'On Returning to the Sea: Towards Belonging Through Land, Language, & Tactile Storytelling' (unpublished PhD thesis, Auckland University of Technology, 2020)

[267] Julie Arkes, 'New Digital Narratives for Living Textiles', p.07 (unpublished Master's thesis, Delft University of Technology, 2021)

[268] Mark Down, *Practical Guide to Puppetry* (The Crowood Press, 2022), p.138.

character even emerges while it is being made, puppeteers and their audience engage with the puppet characters before they even connect to the theme of the story.

As the art director of the puppetry company Blind Summit notes, puppetry practices involve tangible materials to tell stories. This relates to Nimkulrat's proposal to 'think about the material as a metaphor' and her invitation to designers to find symbolic connections between their personal stories and their materials. However, the puppeteer's purpose goes beyond creating objects. They think not only about the material as a metaphor but also about the material's transformation as a set of symbolic correspondences that they will then organise in sequences to share a story about a theme with the puppetry materials.

In other words, puppeteers 'bring the metaphors to life'.[269] For example, the metaphor of 'love is a journey' means 'mapping knowledge about journeys onto knowledge about love'.[270] In puppetry, the character follows the material, and the story follows the transformation of the puppet characters. The audience connects emotionally to the quest of the puppet, not that of the puppeteers. From this perspective, the puppetry approach of storytelling is closer to the theory developed in Joseph Campbell's book *The Hero with a Thousand Faces*[271] in which he was inspired by Greek mythology. In this storytelling framework, the reader follows the puppet hero's journey and discovers its purpose along the way. The model's COG is located between the main character, the hero, and their quest. The journey follows the hero's transformation as they face internal or external challenges. This approach is very common in film and literary narratives. In research design, Salter (2019, 527) and Regalado et al., (2017, 122) have applied this model and mapped the

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[269] Rene Baker,'Bringing the Metaphor to Life', *Rene Baker*, 2018 <https://renebaker.org/2018/02/09/bringing-the-metaphor-to-life/> [accessed 12 May 2024]

[270] George Lakoff, 'The Contemporary Theory of Metaphor', in *Metaphor and Thought*, ed. by Andrew Ortony, 2nd edn (Cambridge: Cambridge University Press, 1993), p. 248 doi:10.1017/CBO9781139173865.013

[271] Campbell, Joseph, *The Hero with a Thousand Faces* (Princeton University Press, 1972)

research process as the journey of the ‘hero-researcher’.

The following section reviews the process of creating stories from material transformations in textile design and in puppetry performances. Furthermore, it reflects on the transposition of the traditional storytelling methods associated with Aristotle and Campbell in the sharing activities and in the stories emerging from thermochromic transformations.

Material Transformations (2.1)

‘The puppet system relies on systems of non-verbal communication where the performing objects interact with human and non-human agencies through physical transformations.’ [272]

[272] Sabrina Recoules Quang, ‘Tension and Materiality in a Textile System; A Puppetry Perspective’, Journal of Textile Design Research and Practice, 9.2 (2021), p255, doi:10.1080/20511787.2021.1923201

'Breath [273]

Video 5-1 “Who are you?” Staging material transformations with a thermochromic screen (*Who Are You?* dir. by Sabrina Recoules Quang, 2023 https://vimeo.com/897018419 [accessed 13 May 2024])

Video 5-2 'Comment j'ai grandi', a stop motion animation exploring characters and relationships made of various thermochromic materials and heat capacities (*Comment j’ai grandi*, dir. by Sabrina Recoules Quang, 2023 <https://vimeo.com/835806351> [accessed 13 May 2024])

[273] Click the vignettes or the links in the caption

In this first part of the second cycle, the puppetry evaluations of the material experiences focused on how the material and structural transformations informed the character's liveliness. In other words, the research system's COG was located in the material transformations. The diffractive analysis focused on the changes in the relationships between the aesthetic and the symbolic inside the puppetry system and between the puppetry system and the stage.

Storytelling with material transformations in puppetry

In recent years, a new form of puppetry has appeared, one in which the puppeteers manipulate the materials instead of the puppet's structure. The puppeteers in the company Indefinite Articles, for example, use dust and clay to transform the material from its raw form to a lively character and 'kill' it in front of the audience. [274] Elise Vigneron also plays with the problematic nature of the puppet's life[275] through material properties, she has puppeteered an Oedipus character out of ice. The puppet melts away until it ultimately dies in front of the audience. (Figure 5-1)

The material transformation is definite but repeatable as the ice puppet is re-cast to be reborn again before the next performance.[276] Here, the puppeteer adjusts her manipulations as she follows the rhythm, reinforced by the melting process, to tell the character's story. In this style of puppetry, then, the performers can be seen to search for metaphorical meanings through the

[274] Eleanor Margolies, 'Return to the Mound: Animating Infinite Potential in Clay, Food, and Compost', in *The Routledge Companion to Puppetry and Material Performance*, ed. By Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge,2015), p.328.

[275] "The death of the puppet is a recurring theme in puppetry, since it exposes the problematic nature of the puppet's life" (Williams 2015, 18)

[276] "The inner evolution of this mystical character is in the image of the metamorphosis of water. The spectator is invited to live an experience: to be one with the transformed material." (Hybre, Pierre. "FOR PUPPET OF ICE AND ANIMATED ELEMENTS." https://lentrouvert.com/en/anywhere/.)

physical transformations of the materials.[277]

Figure 5-1 "Anyywhere" Elise Vigneron 2016

Following the same logic of a textile material-driven story is ‘L’amour c’est compliqué’ (‘Love is a complicated thing’) that emerged from an online devising session I shared with other puppeteers. In this material experience, I took my cues from the flexibility and the rough texture of a jute rope coiled into a textile structure to perform a set of metaphorical correspondences with the word ‘love’. As there was no recording, I re-enacted the metaphor to photograph it step by step in front of a camera. Therefore, I had two different experiences of the rope’s transformation — the second experience was drawn from the first and the feedback I received from my fellow puppeteers.

[277]Margolies, ‘Return to the Mound’, p.327

While reflecting on the still pictures I diffractively read my live experience on the 'Zoom stage' through the documentation and organised the transformation of the material in sequences. The outcome shares the story of the rope's

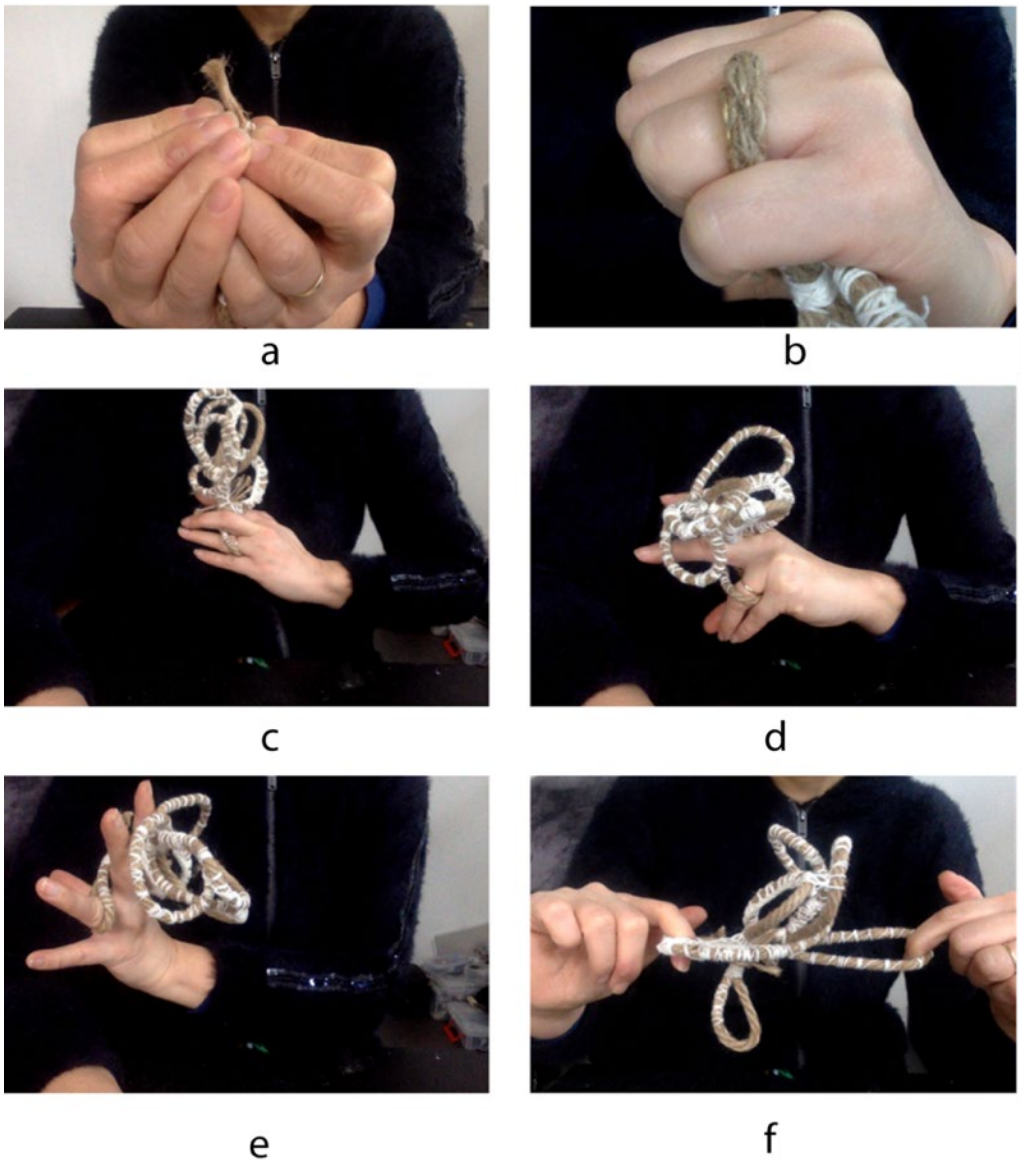

Figure 5-2 Love is complicated thing, Love is… (a) "simple" (b) " a simple knot" (c) "a flower on my finger" (d) " a curious bird"(e) a snake biting (f) Where is Love?

symbolic transformations and reflects on the entanglement of the memory of the live experience and the documenting activity reflected on the entanglement of the memory of the live experience and the documentation:

I read the metaphor of love as starting from a simple thread (Figure 5-2a) that became a lively character and finally died as a character as it returned to perform as a simple couched rope (Figure 5-3).

Figure 5-3 Coiled Rope

The character's COG moves from one location to the other in each picture as the textile shape changes from one frame to another. The character's transformations emerge from the tension between the different textures and the nature of the two performers: my hand and the couched rope. Despite their entanglement, their different expressivities did not disappear. On the contrary, they extended each other's expressivity and the different performances as a bird, or a flower character resulted from the ongoing negotiations between their two forms of materialness.

Storytelling with smart material transformations

With her 'Thunderstorm Dress' (Figure 1-4) Winters demonstrated the ability of interactive textile materials to perform a transforming narrative. [278] For Bergstrom and others, designing with smart textile materials is about designing an imaginary 'script' that would stage the user in contexts 'that are still

[278] Amy Winters, 'Why Does Soft Matter? Exploring the Design Space of Soft Robotic Materials and Programmable Machines' (unpublished PhD thesis, Royal College of Art, 2017) p.17

unknown and often unpredictable' for designers.[279] During the 2019 Textile Intersections conference, I experienced *The Book My Grandmother Might Have Made*, an interactive storybook made of e-textiles and designed by Irene Posch.[280] In translating a textile story-book for children that her grandmother had made, the designer replaced traditional textiles with e-textiles. In this work, the storybook is a stage. We diffractively read our relationship to the artefact through the experience of performing simultaneously as the storyteller on the stage and the spectator off the stage.

The 'reader' of the artefact applies motion and heat through their hand manipulation of the heat capacity and the structure of smart materials. Here the heat capacity performs as a string that they use to manipulate the smart material artefacts.

Off stage, as an audience, I connected emotionally to the transformations of the e-textiles. On the book stage, my hands investigated the coded behaviours of the e-textiles. While I provided a tactile response to their textileness and materialness, I experienced the oscillations between the available responses from the e-textile props and their actual transformations. Overall, I experienced heat as a string to manipulate the smart material artefacts, but did not get to see the heat character as on the thermochromic screen (see ''The weird life of thermochromic materials' p.140)

Interestingly, Posch also reported unexpected interactions while she tested her book with young children.[281] One of them changed the sequences between pages and moved the e-textile props from one page to another. Another child focused exclusively on the sonic interactions. In other words, they transformed the stage itself instead of just interacting with the e-textiles.

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[279] Jenny Bergström and others, 'Becoming Materials: Material Forms and Forms of Practice,' *Digital Creativity,* 21.3 (2010), p.159, doi:10.1080/14626268.2010.502235>

[280] Irene Posch: Interactive E-Textile Storytelling, [YouTube video],2019. https://www.youtube.com/watch?v=-FRqfiTpERY.

[281] Irene, Posch, 'Crafting Stories: Smart and Electronic Textile Craftsmanship for Interactive Books', in *Proceedings of the Fifteenth International Conference on Tangible, Embedded, and Embodied Interaction,* Salzburg Austria (ACM, 2021), pp. 1–12 doi:10.1145/3430524.3446076

When more than one storyteller interacted with the book at once, the designer also noted how the 'specific effects' of the e-textiles became a site of discussion and collaboration. In her paper, Posch also reflects on the challenges of planning the activation of the thermochromic textiles by the surrounding environment.

In this work, unexpected narratives emerged from the contribution of the environment and from the unscripted manipulations from the reader as they break with the initial order of transformations planned by the designer. In summary, the narrative outcome emerged not only from expected but also from unexpected transformations and from turning the reader into a performer of the weird life of the e-textiles.

Devising a story from thermochromic transformations.

In her artistic research, Annette Arlander diffractively edited her films to make new meanings in her installations. In her recent work, she juxtaposed 'images within one or another image in various orders'.[282] Like Arlander, I revisited the short videos from the last cycle of activities and extracted still images with the new focus of making a story instead of finding a character. For instance, the new readings of the character of the hungry tardigrade provided new metaphorical correspondences and a storyline about my entanglement with the research enquiry:

"My thesis is a yarn wrapped around my finger; it takes me wherever it needs to go."

"Le ciel va me tomber sur la tête" ("Something will fall on my head from the sky")

In the live video of 'L'oiseau timide', the transformations were too fast for the

[282] Annette Arlander, 'Diffraction, Mixture and Cut-Ups in Performing with Plants', *Performance Research,* 25.5 (2020), p.38 doi:10.1080/13528165.2020.1868835

viewer to see the colour changes and assess the relationship between the transformation of the material and the body. Therefore, I diffractively edited the movements of the video and extracted still images to map the bird's physical attitudes to its emotional states and organise them into a new sequence. The activity supported the emergence of a story for the thermochromic character based on the reading of the relationship between the transformation of the material and the movements of the textile.

Here, the storyteller is the finger extended by the basket-woven shape that shares the metaphorical correspondences between the bird's 'thoughts' and

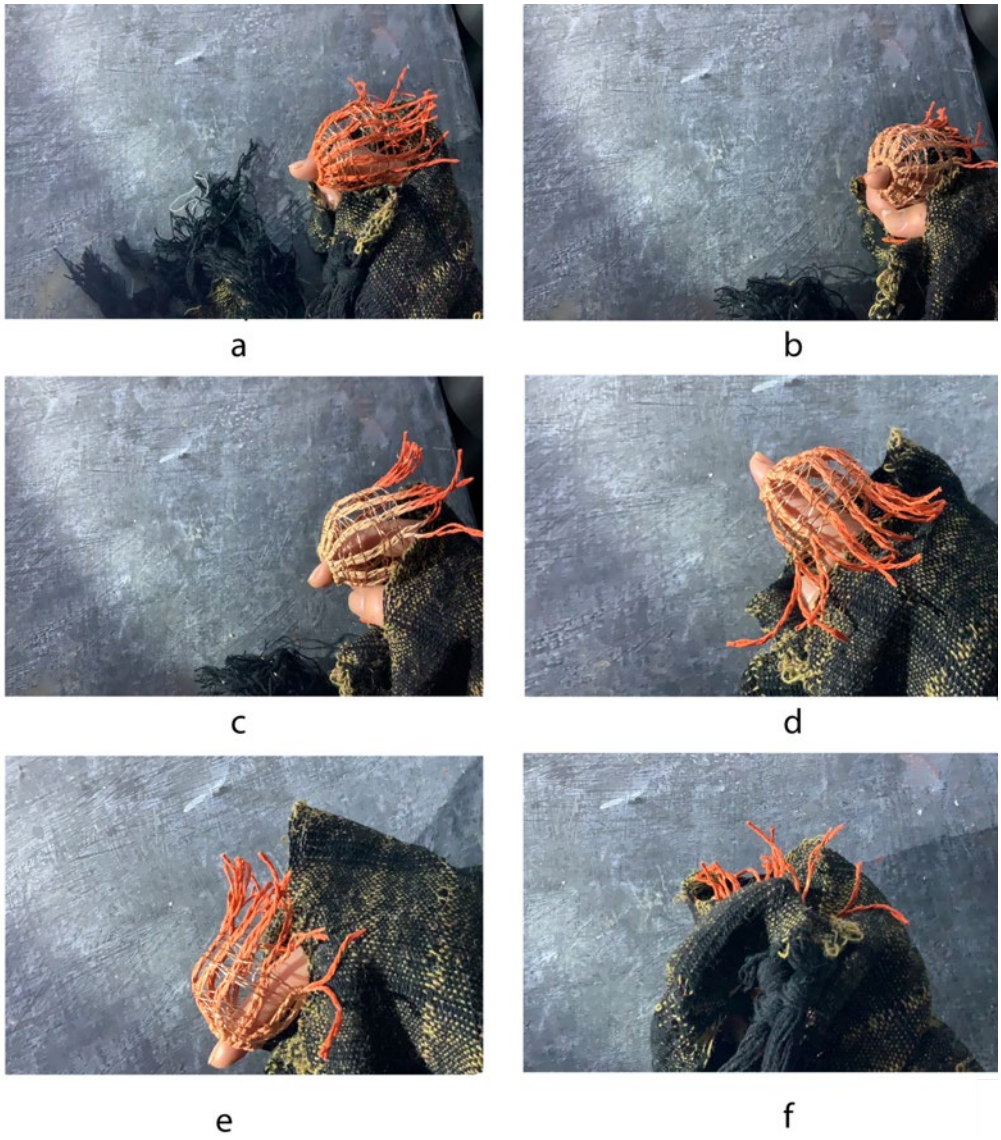

Figure 5-4 "Le ciel va me tomber sur la tête" (a) "I am good" (b) "Have you seen this?" (c)" Where this come from"? (d) "Did it fall from the sky?"(e) "Now it' s moving up from down there" (f) "Let's hide!"

movement and the character's expressivity (Figure 5-4)

With the still images, the spectator gained a space apart from the live video to fill with a narrative and make meanings with the transformations of the bird's character. The story could develop its own breath in this space. The diffractive editing of the video led to a storyline about the bird thinking that something scary was falling from the sky and hiding from it.

"Qui êtes vous?" ("Who are you?")

In another puppetry experience, a Trombetta squash and a jute ribbon ball covered with thermochromic silicon drops share one side of the stage. A wire globe and a wired leaf sewn with a thermochromic organza are set on the other side of the thermo-screen.

While the screen displayed inanimate black silhouettes of a leaf and a wired ball, it also performed two transformations, with white glowing spots appearing on the black fabric and the more contrasting portions of the silhouettes showing up. Only the ball changed colour when both the ball and the squash could move. When the ball simultaneously moved and changed colour, I took it as a cue to go forward with the ball's movements and read its symbolic value instead of making meanings from the colour change.

The heat of my fingers and from a hair dryer performed different alternative versions of the heat character in relation to their heat capacity. What became visible were the material transformations of the screen and the silhouettes. In addition to the traditional display of black silhouettes (Figure 4-32), the thermochromic screen enacted an expressivity for the wired leaf and globe characters that is not visible with traditional shadow screens.

With the activation of the thermochromic pigment, the screen demonstrated a new ability to fragment the silhouettes of the leaf and the wired ball. The silhouettes displayed different textures. When the white glow was turned on, the black silhouettes that were outside the glowing area were less visible than those inside. (Figure 4-33). The visibility of the thermochromic shadows, the black silhouettes and their fragmented expressions and the scale of the white

glow were phased out over time (Figure 5-5). These transformations emulated the shadows' breath between the impulses from the hair dryer and my fingers.

On the thermochromic screen, heat is a storyteller of colours. On the inanimate screen, I, as the audience, followed the colour change from black to white and investigated their symbolic significance. When both characters in front of the screen were still, my gaze switched to the screen that performed black and white silhouettes. In this puppetry system, the COG appeared between the squash, the ball, and the screen.

The difference in scale between the massive squash and the small ball produced

Figure 5-5 Thermochromic shadow phasing out.

a tension that questioned the nature of their relationship. I also read the story as the soft ball, wondering about the colour transformations on the thermochromic screen and the nature of the characters 'living' behind and on the screen. The title, 'Who are you?', reflects the ball's curiosity about the other characters on stage.

In summary, the thermochromic dye creates a new space for intervention for puppeteers. In response to heat, it offers a series of transformations for the silhouettes that a traditional shadow screen cannot display. The thermochromic screen provided three types of shadow characters: two

silhouettes with different resolutions responding to the light bulb and the colour change of the screen, and a thermochromic white shadow character. Filming the experience, reading the film diffractively back and forth, and extracting still images from the animation, offered a way to explore a new form of shadow puppetry. It produced a type of relationship between the screen, the puppets, the puppeteer's body and the electronic devices that may be used as impulses for other experiences in shadow theatre. It also benefited from the diffractive editing in the production of new meanings from the same material experience.

"Comment j'ai grandi" ("How I grew up")

The devising process on a shadow theatre stage with the thermochromic screen, the unfamiliar thermochromic soft ball and the familiar sturdy squash in 'Qui êtes vous?' informed the design of the next puppetry system I investigated.

In this new setting for the stop-motion puppetry performance, the three thermochromic puppets were spread out between the front and the back of the thermochromic screen. They were made of different materials and structures: a resin poppy seed-head on a wire stick, with a body of cotton crocheted flexible wires, a dried poppy seed-head and stem inserted in a ramie bobbin, and a resin-cast poppy seed-head on a wire stick loosely wrapped in organza fabric. Their manipulations focused on the alternation of stillness, moves and colour change in relation to the spatial relationship between them and with the screen. As an audience, besides the poppy fairy and the poppy child characters ('The weird life of plants' p.126), we read another character, 'the poppy sorcerer'. The puppet became a hand in front of the stage and a menacing silhouette on the thermochromic screen. The transformation in the aesthetic of the body of the poppy, combined with the colour change in the dried poppy seed-head, mapped the emotional fluctuations of the 'poppy child' character. (Figure 5-6)

Figure 5-6 Poppy Child neutral attitude

During the devising process, the continuing puppetry evaluations of the metaphorical expressions unfolding in front of me informed the manipulations of the material properties and textile structures. Over time, I followed the evolution of the activities between the screen and the front of the stage. The origin of the black shadow on the screen was unclear.

The diffractive analysis compares the symbolic transformations through the puppets' moves and their changes in colour. The structures of the two poppies and the black shadow are in conversation through their spatial moves and stillness. The relations between the characters evolved with the colour change transformation, but also between the stillness of the black silhouette and the moving puppets in front of the screen. I read the different behaviours of the poppy characters in relation to their size – one is bigger than the other – and their different characters from the materials and the textile processes that I had used for their bodies and heads. The heat source, a hair dryer, was always invisible. What became invisible during the series of events performed by the system was the difference over time between the body and the head of the little poppy. They symbolically became inanimate as the pink colour withdrew from both the body and the head. Only when they were still could we switch our focus to their colour change and perceive the breathed stillness of the

poppies while reading their emotional state. The stillness of the characters made way for reading the colour change instead of looking for movement to make meanings.

The story grew from the space that their material differences and similarities

Figure 5-7 Worried poppy child facing an authoritarian black silhouette .

generated and their relation to their position to the thermochromic screen. Overall, the material transformations performed three different metaphorical meanings that I as an audience entangled into a story as I read them through one another. 'Motherhood' was suggested by the similar head shape of the two poppies, the round shape of the squeezed ball of ramie thread and the enveloping shape of the taller poppy dressed in organza represented the relationship between a mother and a child. *'Authority'* was the tall, slightly menacing straight black shadow on the screen. *'Fear of authority'* was suggested by the poppy child turning white from top to toe. *'Loneliness*' was represented by the poppy child being left alone in front of the authoritarian silhouette on the screen. (Figure 5-7)

Character transformations

On the shadow theatre stage of 'Qui êtes vous?', the material transformations of the thermochromic screen revealed three types of shadow characters. Diffractively analysing this outcome pointed to the effects created by the

difference between the thermochromic screen and the traditional shadow screen, rather than observing what these differences are.[283] It underlined how the interference of the screen played a crucial role in the story performed by the puppets.

In 'Comment j'ai grandi', the audience experienced heat as a puppeteer that performed the thermochromic characters. On the one hand, the colour changes performed the distinctions between the characters, based on their respective material's heat capacities. On the other hand, the entanglement of the thermochromic and traditional materials interfering with each other on the same stage and how their interferences evolved frame by frame supported the identification of the poppy child as the main character and the metaphorical deployment of the 'poppy child' story.

Devising a story of material transformations with researchers

When analysing the workshops performed in 2020, I noticed that only a few of the Mres students had a similar familiarity with textile as the textile researchers in manipulating materials into a structure and transforming them. As a result, I adjusted the design of the workshops with the Mres. Instead of creating 3D characters, the script for the Mres aimed at sharing a narrative about their ideas through tangible materials. In 2021, the research activities took place via Zoom. During the sessions, the designers investigated the materials' ability to convey metaphorical meanings and focused on mapping the transformations of tangible materials into stories.

Conversations between materials

Practically, the research script for the workshops was based on the storytelling method of Campbell's 'hero's journey'. [284] The Mres were given a task that involved identifying a main character related to their research theme and linking it to one of the materials they had brought to the workshops. They then explored how the tangible material could be transformed through tactile

[283] Barad, *Meeting the Universe Halfway,* p.71.

[284] See Campbell's storytelling method in Storytelling as research p

manipulations and connected these transformations to the main character's journey. Next, they had to present the symbolic transformations in a sequence with a beginning, a transition, and an end. Finally, they received feedback on their narrative from me and the other participants.

In these sessions, the Mresin design who were not familiar with handling materials or were more interested in design thinking did not explore the changes in materials for their characters. Instead, they created conversations about their research themes between made-up characters based on the different materials they had.

Figure 5-8 "Conversations between materials" (2021 workshop series).

Figure 5-8 shows a human and the skeleton of an unknown creature staged side by side. This presentation highlighted the relationships between the characters instead of the characters alone. The conversation revolved around time and memory, prompted by the material interferences between the flexible and fragile paper silhouette and the plaster's solid and sturdy bone structure.

Conversations between materials and environments

During the same year, 2021, the research activities with the textile students remained centred around creating and performing a character. The goal extended beyond discovering new knowledge about the materials' physical properties and focused on learning how participants may use their knowledge about the materials to tell a story. Specifically, they explored how to transform

the different characters' materials to convey various characters' behaviours. As the sessions took place online, I got limited information from the physical space occupied by the participants. This gave me the impulse to design the sessions with the textile students around how their made-up characters could interact with the other materials available in their working environment. As a result, the researchers explored and conveyed original perspectives about the materialness of their main characters. Figure 5-9 shows a sample of the made-up characters exploring the textile designer's working environment. The still images are extracted from videos shared by textile students that illustrate their mapping of the material transformations to the symbolic changes of their character.

Figure 5-9a shows a structure of opaque white plastic tubes picking up inks from

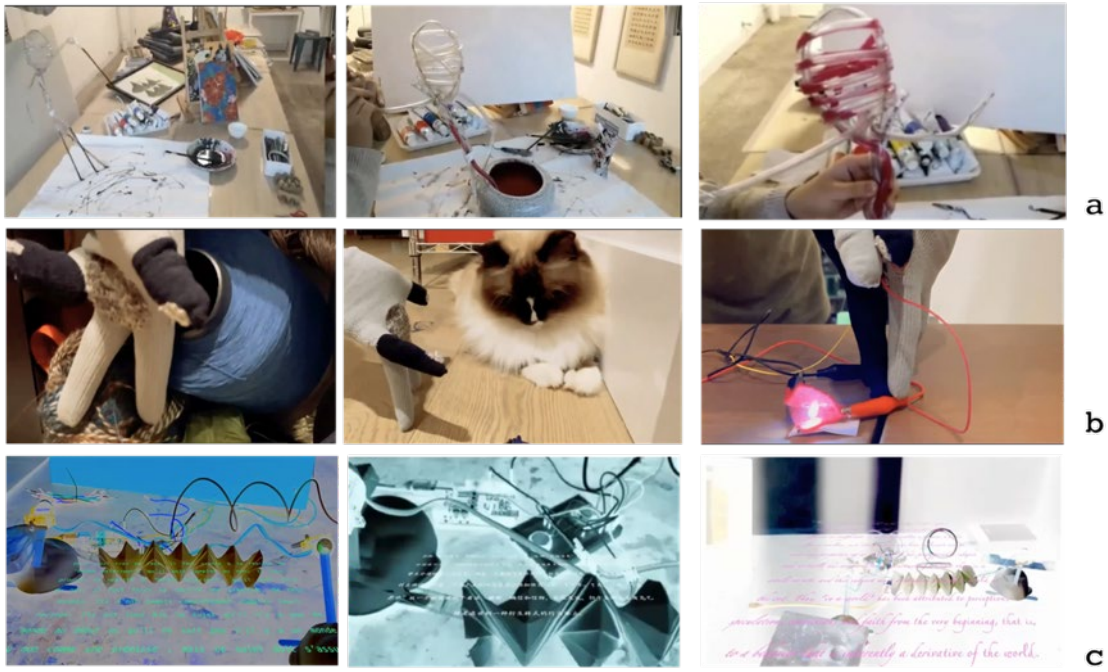

Figure 5-9-a to c Samples of images extracted from videos shared by the participants of their character transformations in relation to the materials in their working environments (2021workshop series)

its surroundings. Diffractively reading the made-up characters through the process of cutting the videos into still images, in light of the participants' comments, added information to the puppetry evaluation of the characters. The first image shows black scribbles that the character has drawn after having picked up the black ink from a plate on the desktop. Then in the following images, the character is sucking up a red liquid coming from a cup. The red ink

moving up into the plastic tube structure appears as the blood flowing into the character's veins. Whereas the character's general aesthetic remained identical after encountering the black ink, its nature changed permanently after absorbing the red ink.

Figure 5-9b tells the story of a conductive glove following the traditional storytelling method of Campbell's hero's journey. The glove is knitted with conductive threads. During its journey in the studio, it interacts with other characters in the studio, such as other textiles or a cat. The glove's challenge is to light up an LED, which is finally achieved when interacting with another conductive glove.

Finally, Figure 5-9c shares the transformation of an origami paper character in relation to three different environments; an electronic, a zen and a two dimensional environment.

TRANSITIONING TO THE NEXT RESEARCH SCRIPT

The 2021 research activities resulted in two different outcomes. For the early-stage researchers in design, it raised the question of identifying the main character among possible stakeholders and the challenges their 'hero' might face. It also prompted them to reflect on their relationship to their research, considering themselves as the main character and sharing their struggles in their research journey and designing process. Moreover, staging characters made of different materials that interfered with each other offered an original material-driven perspective through the production of symbolic conversations with their own set of questions about the designer's research.

Meanwhile, the textile designers successfully produced a narrative for the audience while sharing the character's expressivity through sequences of material transformations. The process supported them in performing their material as the main character. Staging the materials in their working environment generated original narratives for the audience.

In summary, the analysis of the 2021 research activities with the textile researchers and researchers in design provided the impulse to revise the

research script for the workshops in 2022. The research activities with textile designers highlighted the role of the environment in creating a narrative where materials interact. By staging various materials together, the researchers in design could reflect on their research themes. Consequently, the workshop activities for 2022 focused on staging material interferences to help participants communicate a narrative about their themes. Additionally, observing the textile researchers' characters performing in their working environment prompted me to stage thermochromic puppets in non-theatrical settings and study how the material transformations may differ between outdoor and indoor environments in my next practice iterations.

"Breath "

Video 5-3 a squash and a thermochromic puppet ball on a shadow theatre stage (Tu Es Mon Drole d Ami, dir. by Sabrina Recoules Quang, 2023 < https://vimeo.com/896705299 >

[accessed 13 May 2024])

Video 5-4 Staging material interferences in natural environment with a thermochromic puppet in a flowerbed (*Je Ne Suis Pas Seule*, dir. by Sabrina Recoules Quang, 2023 <https://vimeo.com/887683912> [accessed 13 May 2024])

Material Interferences (2.2)

FROM MATERIAL TRANSFORMATIONS TO MATERIAL INTERFERENCES

In the first part of the final cycle of activities, the research system's COG was in the material transformations. Devising a story from thermochromic transformations underlined how the interference of the screen played a crucial role in the narratives performed by the puppets. The activity also highlighted the potential of a shadow theatre stage for generating stories from the interferences between thermochromic and traditional materials.

Moreover, interfering events such as the global pandemic relocated my puppetry practice to unfamiliar settings, with limited control over what could be included or excluded from the puppetry performance stage. In this regard, these interfering events dynamically contributed to the characters and the narratives enacted by the thermochromic materials.

As Barad notes, in theoretical physics diffraction occurs when a wave comes across an obstacle while interference happens when waves overlap.[285] By contrast, in theories of post-humanism, 'Diffraction is a mapping of interference',[286] and interference is about 'the pattern emerging from the entanglement of object (like light) and measuring device'.[287] A third definition, from computational studies, refers to interferences as the product of noise and noise as communicating difference and the presence of the Other.

The marionette-research intertwined theories of posthumanism and

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[285] Barad, *Meeting the Universe Halfway*, p.80

[286] Haraway, *The Haraway Reader* (Routledge, 2004) p. 70

[287] Iris, Van Der Tuin, 'Diffraction', in *Posthuman Glossary*, ed. by Rose Braidotti and Maria Hlavajova, (Bloomsbury Publishing, 2018), p.101

communication through a puppetry perspective. In this way, the research system reads interference as a metaphorical pattern emerging from the physical and symbolic entanglement of different materialities that reveals the presence of the Other.

In this final step of the agential transposition in action, the marionette-research and the puppeteer-researcher focus on the material interferences as 'both metaphor and methodology to surface something new'.[288] The research system explored material interferences as a site of knowledge production. With the material interferences in focus, the marionette-research invited the designers to bring a set of materials with different physical properties onto the session stage and to devise metaphorical correspondences between their researched theme and its organisation into sequences of different material transformations from the transformation and expressivity of the materials. They then created the storyline that emerged from organising these metaphors in sequence.

The design of puppetry performances offered an analysis of the weird materialness of the thermochromics through the observations of their interferences with other materials indoors and / or outdoors. Moreover, the existing documentation provided a ground for exploring the previous material experiences through the perspective of material interferences.

STAGING MATERIAL INTERFERENCES IN THE WORKSHOP ACTIVITIES

Previously, the researchers had manipulated physical materials to devise one metaphorical character from the transformations of their materials and introduced us to their research theme. The new proposition was to explore symbolic transitions and the physical improvisation of tangible materials interfering with each other, both physically and metaphorically.

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[288] Carla K. Rice, Alysse Bailey, and Katie Cook, 'Mobilizing Interference as Methodology and Metaphor in Disability Arts Inquiry', *Qualitative Inquiry*, 28.3–4 (2022) doi:10.1177/10778004211046249

This last iteration of the agential transposition invited the researchers to devise a story based on the manipulations of unrelated materials, such as natural elements and manufactured items. The transposition of puppetry into a research method focused on staging material interferences to read the physical materials through the symbolic relationships that emerged from their differences.

In the first part of the session, the researchers familiarised themselves with the exploration of metaphorical correspondences between tangible materials and abstract concept such as love or nature.

The activity provided interesting metaphors such as ‘nature is a Yi-king book’, ‘nature is a gift’, or ‘love is a window’. It also initiated a conversation about the deployment of the metaphor through a system of characters with tangible or intangible physical properties: ‘Who wrote the book?’, or ‘Closing or opening the window’. Second, the researchers mapped their theme to the physical and symbolic interferences between the materials and shared a series of visuals that represented different states of their metaphorical correspondences with the aim of sharing a story.

Then the researchers took pictures or videos of their installation to serve as a reference for sharing and discussing the symbolic correspondences between the material interferences and the theme of their choice. Through this method, the researchers brought original metaphorical correspondences to life. Staging and manipulating unrelated materials supported the visual production of original stories. The method provided a way for textile researchers to engage physically with their theoretical knowledge and incorporate their making into their thinking.

Below is a selection of the stories developed by the researchers during this last part of the research journey.

"Love cuts. Love is a tomato hiding a treasure."

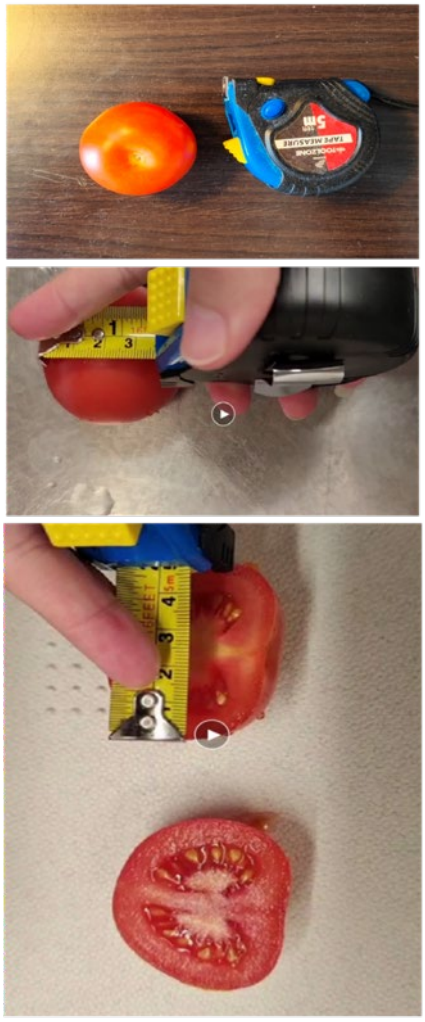

Figure 5-10 Series of still images from a video about Love between a tomato and a metallic ruler (2022 workshop series).

Figure 5-10 share the material interferences between a tomato and a metal measuring tape through their transformations. In this experience, the researcher mapped the material transformations to symbolic correspondences about the notion of love.

In the first picture, we perceive how the tomato's edible softness and the ruler's solid sharpness generate visual tension and curiosity about their relationship. Then we see the measuring tape come out of its case to measure the tomato. The final picture shows the tomato that has been split in two. The lack of information on the causes of the tomato's physical transformation gives us the need to fill the void with a narrative.

With the researcher, I discussed the transition between the two images and mapped it into metaphorical correspondences for the researcher's theme. The material interferences of the metal tape's sharp, cold edges with the tomato's tenderness, and the seeds hidden in the tomato's flesh, produce the love story between the two characters: 'Love is a ruler that cuts you in half' and 'Love is a tomato hiding a treasure (seeds).'

'Am I the odd one out?'

Figure 5-11 shares a system of cut flowers that a textile designer introduced to us. Some were dried, others were fading, and one flower was wrapped in a net with a supermarket tag. From this set of flowers, the designer delivered a metaphorical correspondence: 'Love is colourful and fragile'. Initially, the participant, instead of engaging with the theme of love, explored the metaphorical correspondences between the idea of 'belonging'. The interference of the solid white synthetic net with the fragility and naturalness of the purple flower transformed the relationship between the flowers. The strong aesthetic differentiation between the flowers offset the absence of movement. The tag, that reads 'Large Garlic' interrogated the nature of the

Figure 5-11 A system of characters with cut flowers and a supermarket tagged net over one of them telling a story about belonging (2022 workshop series).

hidden flower. The juxtaposition of the net on the flower created metaphorical interferences. I read the interference as transformative as it initiated a new relationship between the flower in the net and the rest of the system. I still perceived that the flowers belonged to the same world and followed the same logic. What was needed to add to make meaning is why the net was in the

system. The system interrogated this unexpected presence. I translated the physical differentiation that the interference produced into the thoughts of the main character: 'Am I the odd one out? Fitting in yet standing out. Should I even try to fit in?'

Other stories from staging material interferences

The research script, which designed a storytelling system based on the exploration of material interferences, succeeded in supporting the emergence of a few other stories, such as the ones below.

- *"Nature is a system of hierarchies"*

In Figure 5-12, the textile researcher staged the interferences between her

Figure 5-12 System of material interferences for 'Nature is a system of hierarchies' (2022 workshop series)

materials to portray her perspective on Nature. The scene opens with two dried bio-based artefacts and an aluminium paper sheet sharing the stage and illustrating the diversity of materials in our environment. The written word "PEACE" conveys the harmony of the scene. As a fish enters, the scene remains peaceful. However, suddenly, a cooking pan appears and strikes the fish, seemingly killing it. The animation conveys the idea of Nature as a system of hierarchies, with humans at the top of the pyramid, manipulating human-made tools to dominate other living beings and stay at the top of the hierarchy. It also evokes how humans can disrupt the ecological balance of the environment.

- *"Death is a ritual"*

Figure 5-13 System of material interferences for performing ' Death as a ritual'(2022 workshop series)

Figure 5-13 shows the production of a hut with dead branches and colourful threads that emulated the lifelines bridging the departed to the living souls. In the video, the flowers convey the idea of life as they spin in front of the hut where the unseen deceased are laid to rest. The textile researcher manipulated the material interferences of the fresh flowers spinning in front of the hut, the swirling threads and the sturdy tree branches to create a story about her perspective on death as a ritual instead of a status.

- *"Knowledge is a string of crafted materials"*

The textile designer brought printed textiles, a thread, twisted discarded pieces of fabrics, and a pencil. Here, the researcher investigated how she could incorporate her making into her design thinking. By examining the relationship between her materials, she discovered symbolic correspondences based on their material expressivity. She mapped the transformable textiles to her practice and the pencil to her thinking. By intertwining the textile materials around the pencil, she shared the idea of knowledge as her theoretical thinking, hidden inside her practice.

Figure 5-14 System of material interferences for performing 'Knowledge as practice wrapping theory' (2022 workshop series)

Although there was no video, the sequence of the still images staging the material interferences in play succeeded in sharing the researcher's definition of knowledge. (Figure 5-14)

- *"Love is about selecting the right partner."*

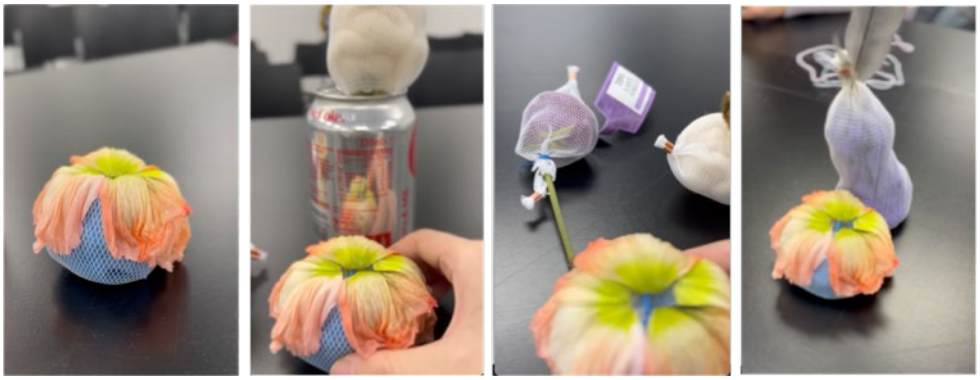

Figure 5-15 System of material interferences for performing 'Love is about choosing the right partner' (2022 workshop series)

In the first image of Figure 5-15, the system of material interferences performs a story about Love. The main character is a bio-based creature made of a fresh flower and a plastic meshy ball. The following images show the main character reviewing the line-up of characters based on other materials that represent its potential love partners.

MATERIAL EXPERIENCES OF INTERFERENCES

Meanwhile in my practice, I also focused on exploring the interferences between the thermochromic puppets and various environments.

'Comment j'ai ressucité dans un bocal'('How I was resuscitated in a jar')

This material experience explored the interferences between artificial and natural elements in a glass terrarium in a jar. The initial design planned to use the natural heat generated by a terrarium to activate a thermochromic dried poppy seed-head over time. The experience failed, as the temperature was never warm enough. I left the poppy inside the jar and forgot about it. After a few weeks, a second character appeared as white fungi spreading over the surface of the poppy head. In this experience, I experimented with two types of interference. The first was the failure of the design to provide the desired effect, and the second interference came from the living form that came alive on the dried poppy seed. Therefore, the character's transformation was not generated by the property of colour change but by the unexpected appearance of the fungi.

When I reflected on this experience to tell a story, the interferences I experienced compensated for the lack of documentation about the transformation that occurred through the emergence of the fungi. Therefore, there was enough information, in combination with our tacit knowledge about fungi, to create a storyline about the fungus being 'resuscitated in a jar'. Figure 5-16)

Figure 5-16 White Fungi spreading on a thermochromic dried poppy head.

The failure of the initial design to produce the desired effect with the thermochromic dye became an opportunity for a different kind of breathed stillness to take place, driven by the emergence of the fungi. The diffractive analysis of the unexpected outcome read the intra-actions between the thermochromic poppy and the living fungi as a productive interference between human manipulation and natural processes. Overall, the experience expanded the boundaries of the puppetry system to the relationships between the fungi and the poppy characters. Moreover, it helped to support the process of staging material interferences to make meaning.

'Tu es mon drôle d'ami' ('You are my unlikely friend')

Switching the focus from material transformation to material interferences gave me the impulse to stage the squash with the blue thermochromic ball again to find the answer to the question asked by the ball in 'Who are you?'[289] In a new stop-motion film, 'Tu es mon drôle d'ami' [290], I investigated the structure of the squash and its COG by placing the ball at different distances from the squash and in relation to different parts of it. I performed the material transformations and movements of the squash and the ball in relation to the character transformations of the wired leaf and globe on the black thermochromic screen. The manipulations supported the investigation of the relationship between the two symbolic characters in relation to the characters on the screen. From the interferences between the scales and textures of the sturdy squash and the soft thermochromic ball, I built sequences of movement and colour change that told the story of an unlikely friendship between a living squash and a lively ribbon ball.

As a puppetry audience, I read the curvy shape of the squash as a physical and symbolic hiding place for the ball, with its spherical shape, when the menacing silhouettes appeared on the screen.

Moreover, as I diffractively read the scenery through the perspective of

[289] See previous reading of the performance in section 'Material Transformations'

[290] *Tu Es Mon Drole d Ami.* Directed by Sabrina Recoules Quang, 2023. Vimeo, https://vimeo.com/896705299.

interferences, I observed the dynamic tension between the change in colour and the puppets' movements and how these movements made the colour change less visible. I could focus on the colour change only when the puppet performed a breathed stillness. I read the stop-motion film 'Who are you' through 'Tu es mon drôle d'ami' and mapped the material transformations and interferences into different emotions for the relationship between the characters in front and on the back of the thermochromic screen, as follows:

a) 'Wonder': the blue ball turned to white while moving towards the white glow on the screen. The squash raised and lowered its head as they both exchanged their curiosity about the growing white glow and the intricate patterns that became visible.

b) 'Fear': as the white glow disappeared, the ball moved into the curve of the squash to find a hiding-place from the dark silhouettes.

c) 'Stronger in unity': Now, with the curve of the Trombetta squash surrounding the white glow, the individual centre of gravity disappears as the squash, the ball, and the patterned white glow go forward as one body.

The puppets communicate with each other through their motions and structural changes. Through their changes in colour the natural and the artificial forms emulated a range of emotions, from wonder at the mysterious patterns on the screen to fear of the menacing silhouettes.

The enactment of material interferences and the interaction between the silhouettes, the white shadows, the squash, and the thermochromic ball led to a narrative about friendship, support, and unity. The squash and the ball became symbolic representations of friendship and protection, with the squash providing shelter and support in times of fear.

As it invited the audience to reflect on themes of resilience and unity in the face of adversity, this puppetry experience highlighted the creative potential of material interferences.

The thermochromic materials led me to visualise heat not only as a character

in the changing colour of the thermo-screen but also as a generator of interferences in my manipulation of the puppets. In other puppetry experiences, the heat would appear at unexpected places that did not belong to puppetry systems, like the stone floor that propagated the heat, it kept, from the sun activity during the day to the thermochromic crocheted balls. The thermochromic puppets operated as a visible extension of heat that had been invisible before. This analysis shifted the symbolism of heat from a string that supported my manipulation of the artefacts in the puppetry system to a storyteller through colour.

'Je ne suis pas seule' ('I am not alone')

Another experience with the poppy fairy (See 'The Poppies' p131) contributed to an exploration of the thermochromic materials in an outdoor environment. It explored the potential of the poppy fairy to perform new expressivities when staged in an outdoor environment.

In this puppetry performance, the puppet character stands in the middle of a wildflower bed. A corner of the poppy's dress is stitched to the stem of one of the flowers. Extending the puppet's body to the stem performed a symbolic hand for the poppy. The time-lapse video captured the behaviour of the thermochromic material as it engaged with its natural environment throughout the day.

From a puppetry perspective, the flower acted as a puppeteer to the human-made element. While the flowers and the poppy fairy met in the flower bed, the transformative interference of their artificial and natural logic enacted the poppy's oscillation between materialness and liveliness. The puppet character took cues not only from the sunlight but also from the flowers and the activity of the wind. The juxtaposition of the flower bed, the wildflower and the sunlight performed the weird materialness of the poppy. The puppetry evaluations read the wildflower as the puppeteer of the poppy's dress and the sunlight as the manipulator of the colour change. In other words, the sun and the wildflowers were the co-puppeteers of the poppy's character.

The diffractive analysis reveals how the wildflowers switched from being part of the stage as a prop to performing as a character alongside the poppy and finally as a co-puppeteer of the poppy. Their interference with the dress of the poppy fairy became an input in the character improvisation. To sum up, the diffractive readings of the performance pointed to the emergence of a new type of puppeteer at my side. In this puppetry system, human and non-human materials perform the story as collective extensions of the same puppet.

Moreover, the time-lapse video supported the diffractive analysis of the relationship between the wildflowers and the poppy fairy. It has been a key tool in revealing the nuances of the relationships in the puppetry system, allowing me to perceive the material's transformations and movements in response to the natural elements of the environment. The video offered a new perspective on the scene when played forwards and backwards in a loop. It revealed a transformation that could not be seen by the naked eye and enabled me to observe the synchronised movement of the puppet's dress with the wildflowers and experiment with the visual representation of their kinship despite their different materialness.

Finally, the juxtaposition of the movements and the changes in colour performed as the puppet's voice for the audience. The title 'I am not alone' highlights the symbolic conversation between the flowers and the lonely poppy.

'Dialogue en silence' ('Silent Conversation')

Ledendal's installation (Figure 4-24) that staged a thermochromic curtain in front of the window underlined the interferences between the thermal efficiency of the window and solar heat. It inspired me to perform a series of installations in which the thermochromic puppets were placed in front of a window. In one of them, the poppy fairy and the poppy child are placed on each side of a window to observe how the intensity of the solar heat played differently on the poppies. I took pictures of the installation at different times and took my cues from the colour transformations to change the position of the puppets. The sun operated the changes in colour where it touched the

puppets' bodies. The COG is on the colour change that produces the meanings. The interference of the window between the puppets altered the rhythm of the changes in colour. The outdoor temperature and the intensity of the sun operated the colour changes in the organza poppy. In contrast, the poppy pelote was in the shadow of the house and changed colour with the temperature of the house and the solar heat, translated by the window. The juxtaposition of their position, face to face, and the difference in the time they took to react provided a metaphorical correspondence with a 'silent conversation'.

In 'Dialogue en silence', Figure 5-17 explored how solar heat performed

Figure 5-17 "Dialogue en silence" Two thermochromic puppets on a different side of a window

differently on each side of a window. In 'Je ne suis pas seule', the wildflowers and the sunlight transformed the poppy's character.

Reflections about Stories

STORYTELLING WITH MATERIAL INTERFERENCES

The shift in focus from material transformations to interferences informed the design of the workshop activities and my practice with thermochromics. The final research script invited the researchers to consider material interferences as a site of story production in addition to material transformations. During this cycle of activities, the researchers staged their materials through the symbolic relationships that emerged from their differences. They documented their installation by taking pictures or videos, which served as a reference for sharing and discussing symbolic correspondences between the material interferences and their chosen theme. This method allowed them to create original metaphorical correspondences and produce unique storylines by staging and manipulating unrelated materials. In the first part of the second cycle of activities, transitioning from a character to a story allowed the designers to explore and expand their knowledge about the expressivity of their material. In the last part of the cycle, staging material interferences made visible the physical and symbolic differences between materials, from where a story could emerge. It opened up a space where the designers received new impulses to script a series of material transformations and share a story.

Beginning with the notion of love or nature as a theme of exploration, they then switched to their research subject to pursue their investigation of metaphorical correspondences in their system of materials. By reading different themes through the same set of materials, or the same theme through different sets of materials, the designers gained new impulses and insights for sharing a storyline about an abstract concept, such as ‘love is a tomato hiding a treasure’. In doing so, the method provided a way for textile researchers to engage physically with their theoretical knowledge and incorporate their making into their thinking.

Moreover, in the sessions, every participant brought their own tacit knowledge. While I turned my tacit knowledge into explicit knowledge for the designers, the productivity of the sessions came from the interferences of my explicit knowledge with the participants' tacit knowledge of storytelling, metaphor, or puppetry. The design researchers, who were not used to manipulating physical materials in their practice, succeeded in emulating a conversation with their audience about their theme with tangible materials.

Material interferences as a site of knowledge

On the one hand, the design of the puppetry experiences shifted from creating one character's material transformations to staging material interferences, both indoor and outdoor. The creative process included the organisation in sequence of one transformation or interference to the other to tell a story. On the other, the sharing activities transitioned from improvising a character to devising the symbolic transformations of tangible materials and weaving them into a story.

The impulse to shift the focus of the research from material transformations to material interferences came from the diffractive analysis of the messy area that made visible the impact of the unexpected events that affected my working environment for my puppetry performance design and the outcomes of the workshop activities with the textile researchers and researchers in design[291]. Therefore, by reading the documentation and designing new puppetry experiences, I explored how the oscillations between the unexpected and expected inputs/outputs informed the narrative, as new characters appeared in the environment and moved onto the puppetry stage.

The new puppetry experiences explored the transformation of the thermochromic characters, revealing their manipulations by the natural environment. While not all these attempts were successful, due to the absence of sunlight or the presence of a cold wind, meaning that the thermochromic

[291] See "Transitioning to the next research script", p225

dye failed to be activated in the puppet's materials, these challenges helped me to establish a dynamic relationship with the natural environment. I learned to respond to the sun's presence and absence by improvising a narrative with the thermochromic puppets.

In this last part of the research journey, the script for the puppetry performances situated the source of change outside of my body, between me, the puppets, and forces from the natural environment. This approach enabled me to create a COG for the puppetry systems where the thermochromic characters performed in response to their surroundings. Devising stories with the thermochromic transformations and staging their material interferences with an outdoor environment shifted the symbolism of heat from being a marionette string to a role as a storyteller.

- Environment as a co-puppeteer

Overall, staging the material interferences with the thermochromic puppets taught me to view the natural environment not just as a backdrop or a prop but as a co-puppeteer with whom I had to engage to perform the puppetry systems. The outdoor puppetry experiences underlined the importance of embracing unexpected outcomes in my creative process.

Moving out of the studio with my thermochromic materials set me on a path of devising stories with natural elements and looking for impulses that came from the surroundings of the puppets rather than from the stage I had designed. I transitioned from one character's expressivity to the next and drew not only on the materialness of the puppets but also from the material properties and symbolic values of elements in their surroundings to express the liveliness of the characters.

The thermochromic materials became the site of conversations with the puppets' surroundings. With the 'puppeteer-environment', I devised novel expressions and original storylines for the characters being created. By documenting and reflecting on these interferences, I expanded my

understanding of the intra-actions between living and thermochromic materials and opened up new avenues for exploration and storytelling. The stories grew from the space that the material interferences continued to open up as they revealed the differences between the characters or invited new characters on stage. They added another type of tension between the human manipulator and the non-human material of the puppets.[292] The materials interfered with each other and the impulses from my puppeteering to make visible new metaphorical correspondences for the thermochromic characters. The thermochromic transformations embodied not only the differences between a character and the other characters on stage, the characters and the stage but also the interferences with elements from the environment that were not initially part of the puppetry system.

In her research project 'Performance with Plants', Arlander pursued a diffractive practice by repeatedly performing the same script in different locations. Although it was not planned initially, the research for designing puppetry systems with weird materials put me on a similar path when I travelled with my puppets and stage screens. The unfamiliar sites made their way into my practice and generated new material interferences that I integrated by changing my script or creating other characters. In contrast to Arlander, I was not led by the repetition of a particular performance. Instead, I focused on the character's transformations that emerged during my improvisation with thermochromic materials.

The diffractive analysis of the relationship between the changes in colour and the movements of the puppets emphasised their different inputs in the production of the stories. In 'Tu es mon drôle d ami', the puppets communicated with each other through their movements and structural changes and emulated a range of emotions through their colour transformations.

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[292] Sabrina Recoules Quang, 'Tension and Materiality in a Textile System; A Puppetry Perspective', *Journal of Textile Design Research and Practice*, 9.2 (2021), p.256 doi:10.1080/20511787.2021.1923201

In 'Je ne suis pas seule' (See page 189) I took my cue for manipulating the thermo-puppets from the presence of natural elements in the puppets' surroundings. While animating the poppy fairy's stop-motion character among the grapevine leaves, I synchronised my manipulations with the wind that lifted the poppy's dress. In 'Dialogue en silence' (see page 190) I took my cue from the different solar heat levels on each side of the window to change the position of the puppets. In another experience, I staged the thermochromic puppets on a beach: while the sun was not hot enough to activate the thermochromic characters, I looked for cues from the elements that were present in their surroundings. In other words, I entered into power play with the natural elements that made themselves visible on the thermochromic materials.[293] As I composed with these natural elements to puppeteer a puppet, I became 'one organism to bring this one puppet to life'.[294]

The practice with thermochromic materials gave me a channel of communication with the environment that I did not have before. My manipulations were informed by the interferences between the puppets and their surroundings that I read in the thermochromic materials. The material interferences gave me the impulse to transition from the characters to the story. In an uncontrolled environment, I responded not only to the puppets but also to the elements in the environment: sun, a wildflower, rain, and wind. In summary, the thermochromic materials offered me a new channel of communication with nature.

Stage-driven improvisation

From the devising activity with other puppeteers[295] and with the researchers[296] a new category of puppetry performance emerged, with its own grammar, that I called 'Zoom theatre'. On this new stage, I performed a story about the notion

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[293] Alex Mermikides, 'Doing What Comes Naturally?: Women and Devising in the UK Today', in *Women, Collective Creation, and Devised Performance : The Rise of Women Theatre Artists in the Twentieth and Twenty-First Centuries*., ed. By Kathryn Mederos Syssoyeva and Scott Proudfit (Palgrave Macmillan, 2016), p.239

[294] Sichel, 'Escaping the Puppet Ghetto', p.166

[295] See "Storytelling with material transformations in puppetry" page

[296] See" Devising a story of material transformations with researchers" page

of love with the metaphorical correspondences of a couched rope through the interference of the computer screen and its multiple frames. The experience of performing puppetry improvisations on Zoom gave me useful information about this new type of stage. I discovered the physical limitations and opportunities of communicating through a computer screen that acted as a mask for hiding my body, whether partly or completely, from other participants.

First, I did not share the same location as the audience, therefore the scenery was diffracted into as many screens as there were spectators. Although I could play with the scale of my puppets through my laptop camera, the puppets had to be small enough to fit the camera's resolution. I could enter the stage from four directions at once without special machinery. Second, I had to perform with a material familiar to my audience so they could deduce the physical properties of the puppet from their tacit knowledge. Third, the 'Zoom-stage' challenged me to perform a series of transformations with unknown parameters, such as the sonic environment of my audience, that could be perceived on screen. I had no information about the viewer's environment: the audience could have been sitting in a garden or a studio or a classroom, alone or with other spectators.

Therefore, I did not control the actual narrative of the puppetry performance. Unlike in the live puppetry performances, I could neither haptically nor visually process the information given by the spectators. Finally, with the 'gallery view' option, the Zoom stage offered the audience the opportunity to include the other participants' live reactions in their perception of the puppetry performance.

However, the interference of the screen performing as a mask offered the opportunity for the audience to be positioned closer to the stage than they would be to a traditional stage. It also gave me and the audience the opportunity to hide momentarily from each other, either partially or completely, with another visual media such as videos or even visual mapping. Moreover, with the gallery view option, the audience could watch other

participants' live reactions as a part of the performance, alongside the material transformations. The Zoom stage offered the opportunity for the audience to include the other participants' live reactions into their perception of the puppetry performance. Therefore, the materialness of the audience, which is part of the puppetry system, played a role that was different from that played in a live performance on a theatrical stage.

THE MARIONETTE-RESEARCH & PUPPETEER-RESEARCHER'S STORIES

Switching from the character improvisations to devising a story as a research method gave me the impulse to map the research journey to a story where I, the puppeteer-researcher and the marionette-research are the storytellers. The story follows the transformations of the marionette-research and the interferences that transformed the research system. It tells how the unexpected events of a global pandemic changed the research system's COG from material transformations to material interferences.

The first interference was the global pandemic, which transformed my working environment and brought my sharing activity online. Then, outside the boundaries of the research stage, I responded to a request to design a session for graduate student designers to give a storytelling perspective on data analysis. The activity did not seem directly connected, and it interfered with the marionette-research agenda. However, revisiting traditional storytelling methods other than those used in puppetry, such as Campbell's 'hero's journey', gave me the impulse to include them in the transposition activities with textiles researchers. In the exploration of the thermochromic weirdness, I also shifted from telling stories about the thermochromic characters' transformation.

While my social environment changed, its transformation interfered with my working environment. It gave the marionette-research the impulse to explore the input of external interferences on the research journey and I, as the puppeteer-researcher, cast the material interferences as a site of story production. Therefore, the COG of the marionette-research shifted from material transformations to material interferences. The research story

illustrates how I, as the puppeteer-researcher, and the marionette-research were able to follow the twists and turns of our journey as the research system remained open to external interferences from both our social and working environments.

Initially, I analysed the interferences in my puppeteer's research journey as events to overcome, like Campbell's hero. Then, going back to my diffractive framework, with the marionette-research I followed Haraway's suggestion about using disturbances creatively and intentionally as a way of knowing.[297] This shifted my perspective about the external events that had displaced me to the Zoom stage and led me to consider the effects of their interferences as a starting point instead of as an obstacle for researching materials. In the exploration of thermochromic weirdness, I took cues from the material interferences instead of their material transformation. Practically, the change of focus meant tuning the puppet characters in response to the impulses from the material interferences within their structure and from other elements in the puppetry system. It meant including the materials I found in the surroundings in the puppetry system.

In Table 5-1 'Puppetry is …', I observed the interferences between my making and sharing activities. I experienced the transformation of my definitions of what it means to be a puppeteer-researcher and to do puppetry as research. My perspective shifted from focusing on puppet-making to staging material interferences as a making method. Throughout the research journey, the way in which I described a puppet in my transposition of puppetry for the designers shifted from thinking of the puppet as an object that the puppeteer put in motion to considering it as a non-human performer of liveliness. The analysis of my practice led me to define the puppet as something that performs

[297] Jeanne Mengis and Davide Nicolini, 'Practising Diffraction in Video-Based Research', in *Organizational Video-Ethnography Revisited, Making Visible Material, Embodied and Sensory Practices*, ed. by Sylvie Grosjean and Frédérik Matte (Palgrave Macmillan, 2021), p.80

transformations and, finally, as a storytelling character.

Interference as a metaphor provided a new focus for the ensemble of puppeteer-researcher and marionette-research. It delivered a new understanding of puppetry and what a researcher in design is. The analysis of the research journey through the concept of 'interference' led to the reorganisation of the research timeline. I read the journey as a cycle of breathed stillness and transformations. The external events that were beyond my control, such as the pandemic or the death of close relatives, interfered with the research journey. These unexpected events forced the marionette-research to reflect and the ensemble of puppeteer-puppet to perform a

Table 5-1 Puppetry is...

In this research, Puppetry is...	***& the researcher is***
2019 *..the manipulation from a certain distance by a power source of an object, made of a combination of materials, to perform lively characters in front of an audience.* *The ability to show liveliness of the materials in the object and to perform a puppet character from material expressivity.*	*The main character of her research*
2020 *...the manipulation from a certain distance by a power source of a form or a surface, made of a combination of materials, in order to perform opalescence.*	*The puppeteer of the research*
2021 *...a practice to tell stories based on the puppet's physical and symbolic change.*	*Improvisation practitioner adapting to the change in the working and social environment*
2022 *...a practice to perform metaphorical correspondences and translate an abstract concept into physical intra-actions of materials*	*The art director of the research*
2023 *...a practice that turn impulses from material interferences into a series of material transformations and weave them into a story*	*All the above at once. Diffracted, oscillating between being a puppeteer and a researcher, transitioning into researcher while staying true to the puppetry practice.*

breathed stillness. Instead of the puppeteer-researcher changing the research system, it was the research system that produced the interferences to which the puppeteer and the marionette research adjusted. In the process, with the marionette-research I added a selection of external interferences to my next step. The periods when I was not producing research data are mapped to the marionette-research's breathed stillness. With this new perspective, I am always 'on stage' until the end of the research journey.

The timeline of the research journey (See Appendices, p239.) shows how, with the marionette-research, I alternated periods of research activity and periods when I took a breath and reflected on the activities to find the next impulse to go forward.

At the end of the research timeframe, I, the puppeteer researcher, end up both inside and outside the research system as the artistic journey continues off the research stage:

‘In talking and in making the artist comes to know, but that knowing is never complete, in the same way that an artist’s work is never over’[298]

At the end of the research journey the thesis documents the transformations of the marionette-research in relation to the puppeteer-researcher with an updated diagram of the research-marionette introduced in Figure 4-36.

[298] Elizabeth Fisher and Rebecca Fortnum, *On Not Knowing: How Artists Think,* 2013.

Figure 5-18 illustrates the oscillations of the marionette-research. between a

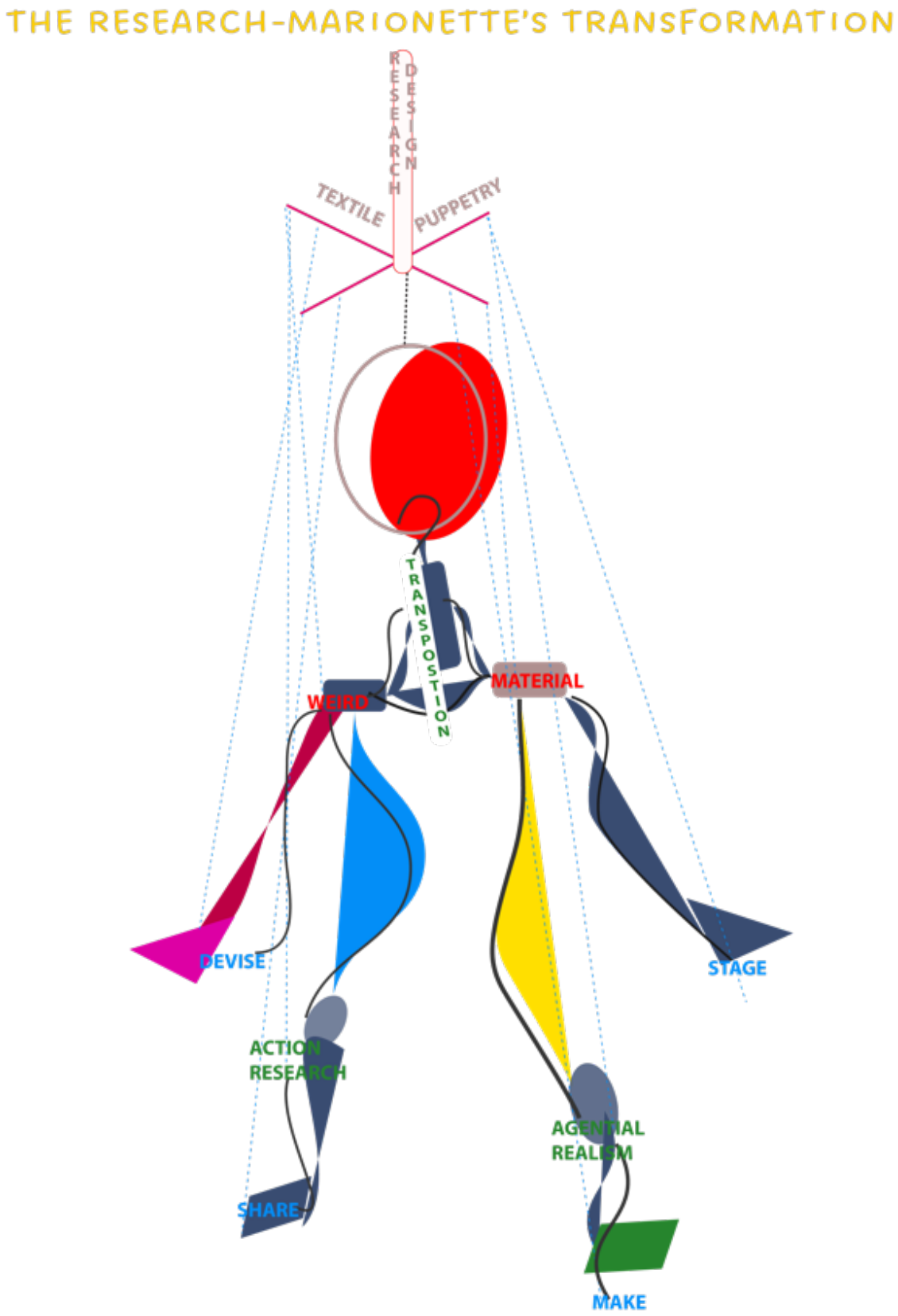

Figure 5-18 Marionette-research transformation

theoretical structure made of the entanglement of the textile and puppetry in

an academic context to a structure covered with colourful researched materials that the practice collected along the research journey. The marionette-research transitioned between two states from being connected only to the puppeteer-researcher in the initial diagram(Figure 4-36) to being controlled by the environment and the researcher.(Figure 5-19).

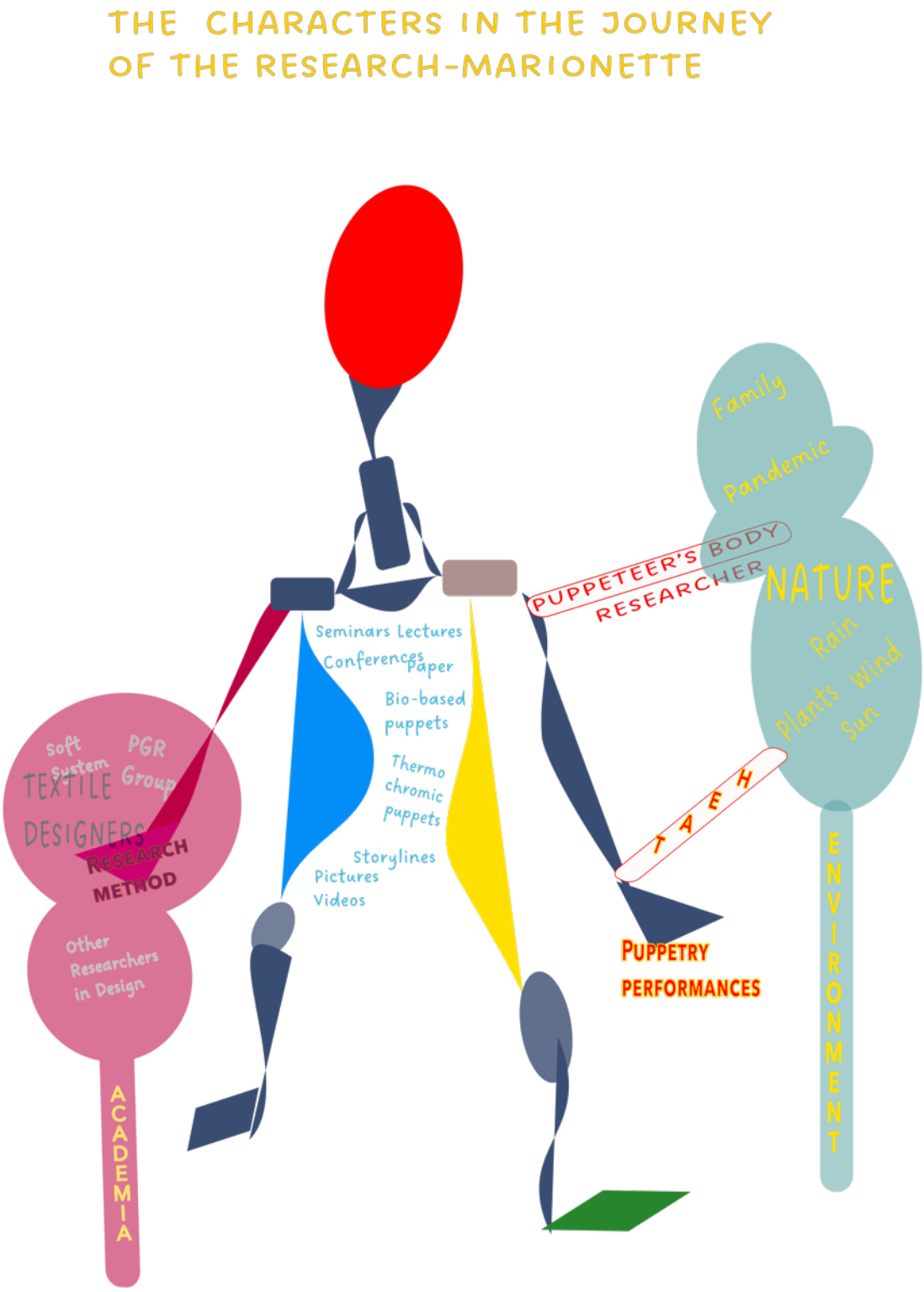

Figure 5-19 Research system as a puppetry system with different characters

The final diagram of the marionette-research is a still frame from the marionette 's journey that delivers a visual metaphor of the entanglement and the interferences in the production of the marionette-research's performance

and contribution to the textile designers' field in an academic context and its co-puppeteering with the environment for producing puppetry performances. The marionette-research is now covered with coloured shapes. The shapes are the research materials that the transposition activities produced within the methodological framework.

Finally, the still frame reveals the new characters in the research environment and the academic context. The control system has changed from a string marionette to a group puppet where the researcher is co-puppeteering with forces from the natural environment.

Chapter 6

WRAPPING UP

At the beginning of the research journey, my practice set the stage for the quest for knowledge of weird materials in which puppetry and textile design were involved in an investigation of the design of puppetry performances. The research placed heat as the centre of gravity (COG) of the puppetry system and the natural elements as co-puppeteers of the material interferences. The transposition activities led to the design of a research script that initially improvised characters performing a weirdness based on their material expressivity. It then evolved into telling stories based on material transformations. The final research script provides a support for telling stories with tangible materials based on transformations that have been generated by their interferences with other materials. At the end of the research journey, the design of puppetry performances with thermochromic materials and the exploration of how to support the creative journey of textile researchers locates the site of knowledge in material interferences.

Contributions

The originality of my contribution stems from the unprecedented perspective of a puppeteer who delved into the realm of textile research. It has resulted in an innovative assessment of thermochromic, and bio-based materials based on the puppetry concepts of opalescence, breathed stillness and COG, and given birth to a new style of puppetry with its own grammar, where the environment serves as a co-puppeteer. In this form of puppetry, the human puppeteer and the environment collaborated, manipulating the thermo-puppets in front of thermo-screens, creating a novel pathway through the thermochromic interferences for improvising characters and narratives. In a natural environment, this collaboration helped me to forge emotional connections with the thermochromic characters and with nature itself.

As a puppeteer working in textile research, I approached the textile processes from a character-design perspective, offering an original perspective for engaging with materials. In this approach, the focus shifts from viewing

materials as purely functional to becoming storytelling characters in the design process. The originality of my contribution draws from the unprecedented perspective of a puppeteer who delved into the realm of textile research. This research is unique because it is the first to explore the two disciplines through a diffractive framework.

For five years, I lived and breathed the language of textiles, bringing a unique viewpoint that bridges puppetry and textiles. I explored how textile designers investigate strategies to incorporate the fluid and ambiguous nature of the weird materials that exist between the manufactured and the natural, as well as the digital and the analogue. Moreover, during the participatory activities, as we exchanged insights into our creative processes driven by the expressivity of materials, I embraced the emotional response of the textile designers to their everchanging working environment.

The research supports textile researchers for presenting their work to diverse audiences both within textiles research and beyond. This transdisciplinary study provides tools for expanding the impact of textile research using puppetry methods and material storytelling to bridge the communication gaps between disciplines. It fosters greater understanding of making practices and practice-based research.

The research has successfully transposed my tacit knowledge of storytelling with tangible materials into a valuable research script. This script is designed to support textile designers' creative process. It offers a fresh perspective on research design that can help textile designers in their creative and research journey with:

A. A research method that recognises material interferences as a source of knowledge for evaluating new materials and provides an effective stage for devising their research with other designers. The method informs the qualitative evaluation of new materials, based on the activity of staging and devising material interferences. It supports the communication of the research through physical materials. The method has been applied to the improvisation of characters and storylines by textile researchers and researchers in design.

B. An original perspective that maps the research system to a puppetry system in which the researcher is a puppeteer and the research is a marionette. The arguments are developed through the exegesis, using the metaphor of the research as a string marionette and the researcher as its puppeteer to illustrate the dynamic relationship between the researcher and the research in a transdisciplinary study.

C. A new reading of puppetry through textiles and textiles through puppetry which has led to a new style of puppetry based on textile processes with chromic and bio-based materials.

A. Material interferences as a source of knowledge

Chapters 4 and 5 discuss how my material and character improvisations informed the qualitative evaluation of the bio-based and thermochromic materials. In these material experiences, I engaged with the environment and became a co-puppeteer in the performance of the thermo-puppets. The thermochromic materials led me to visualise heat not only as a character in the thermo-screen's changes in colour but also as a generator of interferences in the manipulation of the puppets. In the transposition activities, the designers were able to engage their audience by using tangible materials to represent their perspective on their researched theme. Chapter 4 recalls how, through staging material improvisations and researching metaphorical correspondences to their research theme, the researchers used the materials as a site of conversations about their researched theme. Then in Chapter 5, by experimenting with different materials and researching metaphorical correspondences, they were able to create unconventional yet inspiring metaphors that opened up wider conversations about their themes. The production of symbolic meanings about the research was challenging but impactful, as it generated deeper discussions and understandings of their theme.

The final research script emerged from the material experiences I undertook with weird materials and discussions with fellow researchers in the fields of design and textiles. It is based on improvisations involving the symbolic

representation of the research with tangible materials interfering with each other.

The research script includes the following sequences of actions.

1) Explore how to transform the material physical and aesthetic properties (What the materials are doing, how they perceive the world)
2) Document the transformations with still images or a video recording
3) Devise the metaphorical correspondences between the material transformation and the researched theme. (What the materials are telling about the theme)
4) Share and discuss,
5) Repeat the exploration while staging different materials side by side and explore how the materials perceive the world differently,
6) Organise the transformations in a sequence to perform a story with still images or a video recording.
7) Share and discuss,
8) Repeat the readings of the documentation at different times to find other metaphorical correspondences.
9) Share and discuss.

This research script does not aim to provide researchers with an outcome in the form of a final artefact or installation but to support them in reflecting collaboratively about their research process with an audience which is unfamiliar with the designers' practice. Overall, this approach invites textiles researchers and researchers in the design field to embrace the unexpected and use material interferences as a valuable site for exploring the variety and range of character expressiveness the materials can offer.

B. The research system as a puppetry system

The research invites researchers to reflect about their research system as a puppetry system, in which the researcher is a puppeteer, and the research is a marionette. Entering this metaphor is to acknowledge the entanglement between the researcher and the research. In this open system, the researcher and the research operate as extensions of one another, 'breathing' together in their journey that is centred around the research question, informed by their environment and mutual impulses. It also puts a focus on going forward from the COG of the research system that is located in between the researcher's and the research 's COG. The research journey begins with the marionette-research

entering the research stage alongside the researcher.

In this metaphor, the practice is the material, and the theory is the structure. The tension between them informs how the research-marionette goes forward and the perception of its character by the audience and the puppeteer-researcher. The research question is the COG of the research system and the marionette's journey is led by the impulses, transformations and interferences that affect both the researcher and the research activities. The puppeteer-researcher adjusts the weight distribution of the research methods in the research in response to the impulses and interferences from the research context and the transformations of the researcher and the research.

The model contributes to a dynamic vision of the research in action and the relationship between the researcher, the research and its stakeholders. It maps the reflective practice as the breathed stillness of the research, and the research activities as the periods when the marionette-research is in motion. The moments of breathed stillness support the researcher in reflecting on the character of the research. Here it is interesting to note that my unsuccessful attempts to prevent the events of my social environment from interfering with the research performance meant that the puppeteer-researcher and the marionette-research were forced to stop moving and to perform a breathed stillness.

In this symbolic representation, the marionette-research comes to life when it is performed, shared, disseminated by the puppeteer-researcher in front of an external audience: this might be academics or practitioners. During the research journey, the repeated presentations in front of diverse audiences and the discussions that follow are the devising sessions that shape the character of the research. The convergence of the puppeteer and the audience gazes on the marionette-research during these sessions and their different readings of the research significance generate the research's lively character.

C. a new style of puppetry

The practice-led enquiry of the thermochromic and bio-based materials with

textile processes has identified a set of specific methods for activating their weirdness and performing them in a puppetry system. Performing puppetry online led me to explore the specificities of a Zoom theatre stage. In this form of puppetry, the performer and the audience do not share the same physical environment, and other spectators are part of the performance. The stage also offers the possibility of playing with the scale of the puppets and to hide or reveal the puppeteer behind other visual media such as videos or even visual mapping. Overall, the design of puppetry performances emerged as environmentally led. The process of staging the thermochromic materials outdoors highlighted the potential of engaging with natural elements as co-puppeteers.

In conclusion, the value of my contribution to textile research lies in its unique ability to integrate material expressivity and the surrounding environment into storytelling characters. With its unique puppetry design perspective, the research addresses the need of the textile designers to develop new ways of thinking about materials and their interest in working with the fluid nature of the weird textiles.[299]

Through publication[300], workshop activities, interventions in research seminars and conferences[301], the research has reached an audience beyond textile designers. The research method of telling stories with material interferences and the model of the research as a marionette can be applied in various design contexts. The method for creating storytelling characters with a system of tangible materials has the potential to extend beyond textile design and support researchers from other design fields in their creative and research journey. Lastly, the design of puppetry performances with thermochromic textiles and bio-based materials has demonstrated a potential for other puppeteers that have not been explored before.

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[299] See “Weird textile designers” pp31-2

[300] Recoules Quang, Sabrina, ‘Tension and Materiality in a Textile System; A Puppetry Perspective’, *Journal of Textile Design Research and Practice*, 9.2 (2021), pp. 252–72, doi:10.1080/20511787.2021.1923201

[301] See Conferences, lectures, p

Challenges & limitations

The research has the limitations of an artistic enquiry. However, its subjectivity aligns with the research question, which focuses on providing narratives for a human audience with weird materials and devising a qualitative research method for supporting designers in their relationship to their research. While I 'wrap up' the thesis in this writing, as the research has already transformed me, I reflect on the documentation not as a performer but as a spectator of the research journey. The variety of material experiences and transposition activities I engaged in provide strong evidence supporting the research findings.

While the diversity of the material experiences delivered a fertile foundation for the research, it also challenged me to select which material experiences would be visible or invisible in the thesis to make the transformational knowledge explicit. In that respect, reading the different patterns of the materials becoming a character or the material interferences becoming a story, helped me to select the experiences to report. Finally, as a non-native English speaker, the PhD was not only about making through thinking and thinking through making but also thinking through writing and debating with the choice of words to stay true to the research journey.

The thesis is a testimony of the contribution of textile design to another field and a hint of what a collaboration between a textile designer and a puppeteer might be like. Textile practices gave me a new language for my puppets and contributed to creating a form of puppetry I had not encountered before. The research journey created transformational knowledge through the enmeshment of my tacit knowledge, the explicit knowledge of the textile designers and the production of new experiential knowledge. I experienced the transposition as learning to operate with a new tool, thermochromic material, in a new language, textiles. Textile thinking inspired me to follow the feminist

philosophy of difference through sameness[302] that supported the readings of my textiles practice. Puppetry's phenomenological approach to materials is similar to textiles designers' making, and thinking through making; however, the focus on making tangible material into likeable characters is specific to puppetry. The research challenges the textiles designers' tacit knowledge of materials with a new tool, character improvisation, inviting them to communicate in the universal language of storytelling.

I noted earlier that performing the puppet characters and producing the short videos or the still images of the puppets in action informed my research process. The puppets were also a tangible and comforting presence in my practice that I could return to during my writings. Like the 'visual interludes' that Dr Jackie Batey and Linda Knight refer to as essential for supporting their academic writing (Batey Knight 2018, 116) I had these 'interludes' with my new puppets made of thermochromic materials.

Going forward

This PhD has evolved around the practice of one singular puppeteer; the influence of other puppeteers with a set of other craft skills could be explored, as well as the potential collaboration between a textile designer and a puppeteer for designing a puppetry performance. For example, material-driven designers could collaborate with performers to investigate an original research method for evaluating materials through mask-making and performing with masks.

Moreover, soft systems designers, willing to demonstrate 'a rich and multi-sensory engagement' with their interactive composite[303] could introduce devising sessions, staging their composite in interference with other materials

[302] Trinh T.Minh-ha, 'Not You/Like You', pp.415-19

[303] Winters, 'Why Does Soft Matter?', p.173

to perform metaphorical correspondences with an abstract theme.

The writing shares the potential of weird materials to improvise lively characters with the environment as the other puppeteer and to make a story from staging material interferences. In my future work, I look forward to increasing my tacit knowledge of improvising textile characters with a combination of natural and technological materials interfering with each other in a natural environment.

My artistic practice has expanded through my transposition into the textile field and has opened up to new perspectives that I will pursue in my future projects. I am in the process of filming new narratives with the textile and chromic characters that have emerged during the research. The study also opened new avenues for collaborating with other puppeteers, sharing my interest in developing a practice of using textiles and natural elements to develop puppetry performances. The research activities paved the way for producing short films about the textile characters in various locations and environments. Their experimental and innovative nature will fit into festivals such as the Newcastle Puppetry, Manipulate, The Paris International Animation Film and The Brussels International Animation Film.

Additionally, I am pursuing my activities of supporting textile design and sustainable performance practices by hosting regular meetings with textile researchers and academics from various institutions, where we apply the methods developed in my research to tell stories through material interferences. By weaving their improvisation with curated works from e-textile designers, I am crafting a storybook inspired by the narratives emerging from traditional and technological materials. The aim is to inspire other artists and designers to use storytelling techniques to support their interdisciplinary practices. I will submit the work-in-progress for publication in the next edition of the Textile Intersections conference (Autumn 2026).

In conclusion, I share here a final story and visuals (Figure 6-2 and Figure 6-1) that

illustrate my relationship to the marionette-research as a puppeteer-researcher:

Figure 6-1 A thermochromic caterpillar with the stone of knowledge attached to his eye.

"My thesis is a yarn wrapped around my finger; it took me wherever it needed to go. Together, we went on a journey of transformations and interferences and met a weird caterpillar that holds the stone of knowledge attached to his eye…"

Figure 6-2 My thesis is a yarn bobbin wrapped around my finger.

-APPENDICES

Glossary

Agential Realism

In agential materialism, Karen Barad[304] and Donna Haraway[305]read the world as an outcome of the entanglement between material practices. These relationships produce differences and precede beings, and beings cannot materialise or come into existence independently from these relationships. In other words, agential realism means that knowledge is not only situated but also performed.

Bio-based materials

In this research, the term refers to materials that are based on materials from vegetal ('plant-based materials') or animal (such as fish gelatin) sources, as opposed to fossil materials or synthetic materials.

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[304] Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Duke University Press, 2007)

[305] Haraway, Donna, and Lynn M. Randolph, *Modest_Witness@Second_Millenium.Femaleman_Meets_Oncomouse: Feminism and Technoscience* (Routledge, 2018)

Breathed stillness

The term refers to the state in which only 'when the puppet is still and just perceived to be breathing is the audience able to read its thoughts and emotions. So, paradoxically, even when motionless, there exists a "text" – the text of thought.'[306]

(See Chapter 2, Unwrapping, Puppetry Systems)

Bunraku puppetry

See Group puppetry

Centre of gravity (COG)

The puppetry system is physically organised around the centre of gravity (COG) of the puppet character and is located somewhere between the puppet and its puppeteers.[307] The location of the COG may change during the performance. Any of these changes will have an impact on the movements of the puppet. [308] (See Chapter 2, Unwrapping, Metaphorical Thinking)

Chromic Textiles

Chromic textiles are smart textiles, such as photochromic or thermochromic textiles, that change colour in response to external stimuli from the environment. [309]

Crankie theatre

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[306] Basil Jones, 'Puppetry, Authorship, and the UR-Narrative', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.66

[307] Mark Down, *Practical Guide to Puppetry* (The Crowood Press, 2022), p.83.

[308] Adrienne Sichel, 'Escaping the Puppet Ghetto', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), p.163.

[309] Heloisa Ramlow, Karina Luzia Andrade, and Ana Paula Serafini Immich, 'Smart Textiles: An Overview of Recent Progress on Chromic Textiles', *The Journal of The Textile Institute*, 112.1 (2021), pp.152–71 https://doi.org/10.1080/00405000.2020.1785071

A form of puppetry theatre in which the background of the performance is a crankie box displaying a scrolling panorama.[310]

Devising

In physical and creative theatre,[311] the process of devising is based on the performer using their body's response to the impulses given by the art director for improvising a character, a scene or a story with what is on the theatre stage. Jacques Lecoq has theorised the process in his book The Moving Body: Teaching Creative Theatre.[312] (See Chapter 3, Research Materials, Transposition Activities, Devising).

Diffraction

While Donna Haraway introduces optical diffraction as a metaphor for mapping differences and interference,[313] Karen Barad adds a dynamic understanding of diffraction through time and space,[314] in which she calls on us to focus on which differences matter, how they matter and for whom they matter.[315] Diffraction theory implies that reality dynamically forms through intra-actions of phenomena in the world.[316] (See Chapter 3, Agential Transposition in Action, Agential Realism)

Double vision

The term evokes the phenomenon of the audience seeing the puppet in two ways at once: as a perceived object and as an imagined

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[310] 'A (Moving) Panorama', *The Crankie Factory* <http://www.thecrankiefactory.com/348971241> [accessed 22 June 2021].

[311] Alison Oddey, *Devising Theatre: A Practical and Theoretical Handbook (*Routledge, 1994)

[312] Jacques Lecoq, Jean-Gabriel Carasso, and Jean-Claude Lallias, *The Moving Body: Teaching Creative Theatre* (Routledge, 2001)

[313] Donna Haraway and Lynn M. Randolph, *Modest_Witness@Second_Millenium.Femaleman_Meets_Oncomouse: Feminism and Technoscience* (Routledge, 2018), p.16

[314] Karen Barad, 'Diffracting Diffraction: Cutting Together-Apart', *Parallax,* 20.3 (2014), p.168, https://doi.org/10.1080/13534645.2014.927623&gt.

[315] Barad, *Meeting the Universe Halfway,* p.177.

[316] Ibid., p.74

life.[317] It relates to the 'opalescence' of the puppet (see Glossary, 'Opalescence')

(See Chapter 2, Unwrapping, Puppetry Systems

Group puppetry

A form of puppetry in which more than one puppeteer operates one single puppet. Bunraku is a form of group puppetry.[318] [319]

Impulse (as used in theatre)

'Viewpoints-trained actors discover their characters as a result of physical impulses. '[320] In the research, the term 'impulse' conveys the sense of direction that is given for the puppeteer and the puppet to go forward.

Interference

The term is used in revealing the effects of difference, in Karen Barad's sense, in her physics-informed feminist theory of agential realism According to Barad's view, an interference, like diffraction, is 'a tool of analysis for attending to and responding to the effects of difference. '[321] In the research, the term 'interference' is used as a provocation, for staging material interferences. It is used as a tool for attending to the effects of difference between materials and analysing the story emerging in the devising process, as an effect of their difference.

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[317] Steve Tillis, *Toward an Aesthetics of the Puppet: Puppetry as a Theatrical Art (Contributions in Drama and Theatre Studies, no. 47)* (Greenwood Press, 1992), p.62

[318] Down, *Practical Guide to Puppetry*, pp.129-140

[319] Sichel, 'Escaping the Puppet Ghetto',p.170.

[320] Eric Bass, 'Visual Dramaturgy: Some Thoughts for Puppet Theatre -Makers', in *The Routledge Companion to Puppetry and Material Performance,* ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.54

[321] Barad, *Meeting the Universe Halfway,* p72, p80.

Liveliness

Liveliness represents turning dead matter not into something that is alive but into something that performs the attributes of a life form. It is about the contribution to a live experience instead of the state of being alive. Puppet makers reveal the 'unseen liveliness of matter by making visible material qualities.[322]

The same nuances stand between liveliness and livingness as between what is alive as opposed to being lively.

In material-driven design, 'livingness is understood as a biological, ecological, and experiential phenomenon '.[323]

Marionette-research

Or Research-marionette: see Research System.

Mask Theatre

Mask theatre is a particular style of puppetry in which the puppet is on the performer's face, and the audience perceives the entanglement of the puppeteer's body and the mask as a whole entity. [324]

Material-driven design ('MDD')

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[322] Eleanor Margolies, 'Return to the Mound: Animating Infinite Potential in Clay, Food, and Compost', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), p.322.

[323] Elvin Karana, Bahar Barati, and Elisa Giaccardi, 'Living Artefacts: Conceptualizing Livingness as a Material Quality in Everyday Artefacts', *International Journal of Design*, 14 (2020), pp. 37–53.

[324] Sears A. Eldredge, *Mask Improvisation for Actor Training & Performance: The Compelling Image* (Evanston, Ill: Northwestern University Press, 1996).

Karana and others introduced a material-driven-design ('MDD') method in a paper of 2015[325] to support material scientists and industries in the design of products. The method is based on the design of material experiences that includes the evaluation of the materials through tactile manipulation and the identification of symbolic meanings.

Materialness

The term has been defined as 'the ability of a specific material to express or to convey meaning through its physical qualities to the artist and audience'.[326]

Material-driven textile design ('MDTD')

In her material-driven textile design (MDTD) method, Ribul, Goldsworthy and Collet invited textile designers to follow the material to create forms rather than imposing a shape or a pattern on it, and support their research with transdisciplinary strategies.[327]

Messy Area

The term is a reference to the definition by Tina Cook, who proposes that 'the "messy area" provides the space for clarification of the already known (explicit knowledge) and what is nearly known (implicit or tacit knowledge). This is the precursor to the creation of something entirely new (transformational knowledge)'.[328]

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[325] Elvin Karana, Bahar Barati, Valentina Rognoli, and Anouk Zeeuw van der Laan, 'Material Driven Design (MDD): A Method to Design for Material Experiences', *International Journal of Design*, 9.2 (2015), pp. 35–54.

[326] Nikithul Nimkulrat, 'Paperness: Expressive Material in Textile Art from an Artist's Viewpoint' (unpublished PhD Thesis, Aalto University, 2009), p. 170

[327] Ribul, Miriam, Kate Goldsworthy, and Carole Collet, 'Material-Driven Textile Design (MDTD): A Methodology for Designing Circular Material-Driven Fabrication and Finishing Processes in the Materials Science Laboratory', *Sustainability,* 13.3 (2021), p.14 , doi: 10.3390/su13031268

[328] Tina Cook, 'The Purpose of Mess in Action Research: Building Rigour Though a Messy Turn', *Educational Action Research*, 17.2 (2009), p.282. https://doi.org/10.1080/09650790902914241

Metaphor

In this research I refer to Lakoff's definition of a metaphor as system of correspondences between an abstract concept and a set of physical materials.[329]

New Materialism

New Materialism[330] is a methodology, a theoretical framework and a political positioning that emphasises the complex materiality of bodies immersed in social relations of power.[331] It is 'a field of distributed agency'.[332] This philosophy considers the vitality of the matter[333] and the production of knowledge in the materials.

(See Agential Realism)

Opalescence

The term 'opalescence' in a puppetry context was first used by Henryk Jurkowski in reference to the ontological oscillation of the puppet between its lively character and dead matter.[334] In puppetry performances, opalescence occurs when the puppet's duality is performed. (See Chapter 2, Unwrapping, Puppetry Systems)

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[329] George Lakoff, 'The Contemporary Theory of Metaphor', in *Metaphor and Thought*, ed. by Andrew Ortony, 2nd edn (Cambridge: Cambridge University Press, 1993), pp. 202–51, doi:10.1017/CBO9781139173865.013

[330] Diana Coole and Samantha Frost, 'Introducing the New Materialisms', in *New Materialisms: Ontology, Agency, and Politics*, ed. by Diana Coole and Samantha Frost (Duke University Press, 2010), pp. 1-43 https://doi.org/10.1215/9780822392996-001

[331] Rick Dolphijnand Iris van der Tuin, 'New Materialism: Interviews & Cartographies', *New Metaphysics (*Open Humanities Press, 2012), 2012 https://openhumanitiespress.org/books/download/Dolphijn-van-der-Tuin_2013_New-Materialism.pdf doi:10.3998/ohp.11515701.0001.001

[332] Serenella Iovino and Serpil Oppermann, 'Theorizing Material Ecocriticism: A Diptych', *Interdisciplinary Studies in Literature and Environment, 19.3* (2012), p.451.

[333] Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Duke University Press, 2010)

[334]Henryk Jurkowski *Aspects of Puppet Theatre*, ed. by Penny Francis (Puppet Centre Trust, 1988) p.78

Puppeteer-researcher

See Research system.

Research journey

See Research system.

Research scripts

In the thesis this term is used instead of 'research methodology' and the set of research methods used. See Chapter 4, 'Research Scripts'.,

Research stage

With the metaphor of the research as a puppet system, the research context is the puppet theatre stage where the researcher and the research perform the research activities that constitute the research journey.

(See Research system)

Research system

Using the metaphorical correspondences with a puppetry system, I mapped the researcher to a puppeteer, and the research to a marionette. The diagram in Chapter 4 supports the metaphor of the research as a marionette (research-marionette), where the researcher and the research work as a puppet ensemble with the research question as the centre of gravity and the limbs as the research methods. Moreover, in Chapter 5, the updated diagram shows the transformations in the body of the research-marionette as it holds the research outcomes and the contributions. The puppeteer-researcher and the research-marionette perform the research journey as an ensemble. In that sense, the research journey is a performance.

Research timeline

See below (in Appendices :"The Research Timeline" p.239)

Saori cloth

Saori weaving is a free style weaving technique that put an emphasis on spontaneity and randomness, conceptualised by Misao Jo.[335]

Shadow theatre

This is a style of puppetry where the puppeteers perform the puppets with the support of lighting devices in front of a 'shadow screen', usually made of textile fabric or paper.[336]

Smart (textile) materials

'Smart textiles are products that can receive and give responses to the external stimuli so as to accommodate themselves to changes in the surroundings.'[337] (See Chromic textiles)

Tabletop (table-top) puppetry

A form of puppetry in which the puppet performs on a table and the puppeteer manipulates it from behind.[338]

Transposition model

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[335] SAORINOMORI - About SAORI', 2019 <https://www.saoriglobal.com/> [accessed 12 February 2020]

[336] 'Shadow Theatre', *World Encyclopedia of Puppetry Arts*, 2016 <https://wepa.unima.org/en/shadow-theatre/> [accessed 3 November 2020])

[337] Ramlow, Heloisa, Karina Luzia Andrade, and Ana Paula Serafini Immich, 'Smart Textiles: An Overview of Recent Progress on Chromic Textiles', *The Journal of The Textile Institute*, 112.1 (2021), p.152 doi: 10.1080/00405000.2020.1785071

[338] 'Tabletop Puppetry', *World Encyclopedia of Puppetry Arts,* 2016 <https://wepa.unima.org/en/tabletop-puppetry/> [accessed 8 May 2024]]

In the context of a transdisciplinary artistic research, Kirkkopelto[339] proposes a model where the artist transposes their practice into a non-artistic field. In this transposition, the artist is the 'transposer' who carries out the transposition and performs a 'transponent' that contains the research outcome and findings.

See Chapter 'Research Scripts'

Weirdness or Weird materialness

See Chapter 1 'Beginnings, Weirdness'. The terms reflect the ability of a specific material, through its physical qualities, to express the oscillations between lively and dead matter in the context of a puppetry performance. It bridges the puppetry concept of liveliness and the concept of 'materialness' described by textile artist and researcher Nithikul Nimkulrat.[340]

Weird materials

This term defines the materials that are neither human nor entirely material because they are mixed with humans and non-human actors. The use of the term in the thesis refers to Hunsinger's definition[341]and echoes the ambiguous nature of the puppet, that oscillates between dead and lively matter. (See Chapter 1, 'Beginnings, Weird materialness')

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[339] Esa Kirkkopelto, 'Abandoning Art in the Name of Art':, in *Transpositions: Aesthetico-Epistemic Operators in Artistic Research*, ed. by Michael Schwab, (Leuven University Press, 2018), pp. 33–40 <http://www.jstor.org/stable/j.ctv4s7k96.5> [accessed 20 August 2021]

[340] Nithikul Nimkulrat, 'Paperness: Expressive Material in Textile Art from an Artist's Viewpoint' (unpublished PhD Thesis, Aalto University, 2009)

[341] Jeremy Hunsinger, 'Reflections from the Field of Communications: Weird Materiality', in *The Oxford Handbook of Social Media and Music Learning,* ed. by Janice L. Waldron, Stephanie Horsley, and Kari K. Veblen (Oxford University Press, 2020), pp. 502–9 <https://doi.org/10.1093/oxfordhb/9780190660772.013.40>

Sharing activities

TABLE OUTLINING THE WORKSHOP ACTIVITIES

The table displays the details of the workshop activities and the transitions between the cycles.

The first research cycle, “Researching material expressivity", focused on the participants exploring their material's expressivity through puppetry making and performing in three different styles of puppetry: table-top, mask theatre and object theatre. The aim was to provide tools to the participants for exploring their material expressivity. The purpose was to encourage designers to create metaphorical characters from the materials and share a narrative about their research themes.

Title Aim (A) Intention	Purpose (P)	Participants (Number Category)	Outcome (O) Reflective Analysis (R)
CYCLE1 **2019 "Researching material expressivity"**			
Puppetry as a research method (in person) (A)The participants used familiar materials to express their research concepts, using movements and transformations.	**April 2019** (P)The purpose was to introduce the researchers to puppet-making and using their materials' expressivity. To explore a means of communication for their research, improvise a conversation about their research concepts and identify the different characters in their projects.	6 MRes Design, RCA	(O) The researchers engaged physically with materials to perform narratives about their work. Despite lacking prior experience with material manipulation or crafting, participants effectively conveyed emotional connections to their research through these characters. (R) This outcome demonstrates how the activity facilitated reflection on the researchers' relationships with their work. The sessions highlighted how material-based interactions supported researchers in presenting their research concepts through improvised puppets and character performances. This led me to move forward from character-making to offer the researchers the impulse to explore the character of the research through material transformations in the next cycle of activity (cycle 2.1)

CYCLE 1 – **2020 "Researching Material Expressivity"**			
Storytelling with everyday materials (online) (A) Explore materials through the activity of making joints with paper and everyday materials. Learn how to make puppetry characters that move for table-top puppetry performances.	**August 2020** (P) Use puppet making and performing tangible materials to share a perspective on their research The purpose was to make a paper puppet that moved and used it to communicate the research	10 Textile designer researchers from the Soft Systems Group	(O) The session was unsuccessful from a puppet-making perspective, although it gave the participants a new approach to exploring their materials. The activity duration was too short for the researchers to create the character they had in mind for sharing their research. (R)After the material investigation through mask (see below) As a result, I decided not to interfere with their making process and teach them to make puppets and let them use their own craft to manipulate the materials for communicating their research. I focused on character making, storytelling methods and communicating through tangible materials instead of puppet making
Material investigation through mask making **(online)** (A) Learn a puppetry method that requires a minimum of technical adjustments for creating a character. Use the mask to communicate.	**July 2020 and November 2020** (P) Discover new perspectives about the materials while making and performing a mask. The intention was to test an alternative style of puppetry than table-top puppetry. I performed this workshop with early-stage researchers and repeated the workshop with PhD researchers as I wanted to use the same style of puppetry to support the different categories of researchers.	11 Textile designer researchers 6 PGR Textile, There were no repeat participants.	(O) Through the process of mask making and performing, the researchers engaged emotionally with their materials and discovered new insights into their materials' physical and symbolic properties. (R) The script effectively supported the emergence of new insights about the materials. However, there was no evidence of new perspectives for the researchers about their research. Moreover, the concept of mask, influenced by the pandemic context, led to a cultural bias in the feedback. Consequently, I decided to abandon the mask-making and performance activity. I kept the activity of character-making to support the emotional and haptic connections between the researchers, the materials, and their research interests.

Environment investigation through puppet making (online) (A) The participants used their material expressivity to improvise a character that evolves in their working environment. The script focused on how the made-up characters interacted with the other materials available in their working environment.	**October 2020** (P) The purpose was to use puppet making as a quick method to produce a probe: "a device used to penetrate or send back information ", and to explore the environment as an actor of the designer's system.	11 Textile designer researchers There were no repeat participants. .	(O) The researchers shared the transformations of their made-up characters for telling stories in their working environment (R) The process highlighted the potential for creating original narratives from the interactions between the materials present in the environment and the material in their made-up characters.
Puppetry perspective on research projects (online) **Tutorial** (A) These sessions served as an extension of the group activities, providing an opportunity for more in-depth reflection on their projects from a storytelling perspective.	**August 2020 and November 2020** (P) Tutorials to Explore the correspondences between the research journey and a story.	3 Textile designer researchers 4 MRes Design, RCA[342]	(O) The textile researchers reflected on the visual narratives emerging from the transformation of their materials. With the same script, the non-textile researchers positioned themselves as characters; they reflected on their relationship to their research and the stakeholders involved in the process. (R) The different reflective path taken by non-textile designers inspired me to reflect about my relationship as a puppeteer to the research as a marionette.

[342] These participants had joined in previous workshops about *Puppetry as a research method* and *Storytelling with everyday materials (online)*

Transition to Cycle 2 Phase 1

From a puppetry perspective, the script that was the most successful in telling stories from tangible materials was the one that included the transformative journey of the made-up character as it explored the researcher's environment. This analysis of the workshops and my practice with chromic and bio-based materials led to a focus in the next research cycle on telling stories from the material transformations instead of focusing only on the material's expressivity.

CYCLE 2 PHASE 1 - **2021 "Storytelling with material transformations"**			
Puppetry as a design method (online) (A) Introducing puppetry design process for performing a story based on character transformations and storytelling methods.	**March 2021** (P) The purpose was to support the researchers in communicating a narrative about their research through the transformation of tangible materials. It was performed with different categories of participants with the same script, the purpose was to find a research script that works for researchers in design at different stages of their research journey and with different crafting skills.	The workshop was performed twice. the first group was formed by 12 Textile designer researchers, Soft Systems Group and Mixed media students. The second group was formed by 11 MRes Students There were no repeat participants.	(O) The participants successfully mapped the series of the material's changes to the evolution of metaphorical characters. (R) The activity of organising the material's transformations in sequences in relation to their research theme generated new sets of questions for the textile designers about their research. The early-stage researchers managed to open the conversation about their research themes mapping the sequences of the material transformations to their research journey.

Transition to Cycle 2 Phase 2

The activities highlighted how staging various materials together helped the participants. The one-to-one tutorials prompted me to develop a model for representing my relationship to the research and reflect on my research journey through this model of the research as a marionette and the researcher as a puppeteer. Consequently, the transposition activities for the last part of the second research cycle focused on staging material interferences to help participants communicate a narrative about their research. In the last phase of the second research cycle, “Storytelling with material interferences", the transposed activities focused on researching the metaphorical correspondences between a researched theme and a system of materials with different expressivities, staged side by side to visually interfere with each other and change over time.

CYCLE 2 PHASE 2 - **2022** “**Storytelling with material interferences”**			
Performing [with] Nature on a Zoom Stage (online) (A) Telling stories about Nature with natural and manufactured materials?	**February 2022** (P) Design storytelling characters with natural and manufactured materials interacting together.	8 Designers from other disciplines than Textile Across RCA There were no repeat participants.	(O) The participants used still images and videos to share their metaphorical correspondences and the evolution of their symbolic characters in relation to the themes of Love and Nature. (R) The activity generated unexpected storylines about Love and Nature and supported meaningful discussions in relation to these themes. It suggested a common theme that the participants from diverse disciplines in design could relate to. The theme of Nature was kept as a proposal for bringing natural materials to the next workshops.

Interactive storytelling system (in person) (A) Sharing a sequence of visual transformations with a system of characters made of various materials interacting with each other	**March 2022** (P) Explore new paths for reflecting on abstract concepts through the activity of staging various materials visually and metaphorically interacting with each other through their transformations.	14 Textile designer researchers 5 PGR Textile, RCA There were no repeat participants.	(O) The participants found that the script was a valuable tool for bridging their practice and their theorical thinking. (R) Adding material interferences to the research script expanded the range of metaphorical correspondences that a single material could perform. It generated meaningful discussions with the other participants.
Interactive Storytelling System (in person) (A) Find metaphorical correspondences between a research theme and the transformations in a system of tangible materials	**March 2022** (P) Explore new paths for reflecting on abstract concepts through the activity of staging various materials visually and metaphorically interacting with each other through their transformations.	10 MRes Design, RCA There were no repeat participants.	(O) Researchers found it challenging to identify metaphorical correspondences when they were at the beginning of their research journey. (R) The analysis of the workshop outcomes showed that the research script was particularly adapted to those with prior experience in material manipulation, offering valuable insights for reflecting on their research themes.

Conferences

2019	
Material experience through Masks	“Face-off: the provocation and possibilities of Masks and Head coverings https://fashioninstitute.mmu.ac.uk/faceoff/ “
Expressivity/ Sensitivity, workshop	Delft University, HCI Design department
Puppetry perspective, Textilic Practice: An afternoon symposium of research in textiles and materials, interactive storytelling system"	RCA, PGR Textiles group
Performing Material Expressivity on Zoom	Festival of Emergences, Design Research Society
	PGR Conferences RCA
2020	
Storytelling with data	Research, Knowledge Exchange and Innovation, RCA
	PGR Conferences RCA
2021	
Material experience through Masks	“Face-off: the provocation and possibilities of Masks and Head coverings https://fashioninstitute.mmu.ac.uk/faceoff/ “
	PGR Conferences RCA
2022	PGR Conferences RCA
2023	
Storytelling and Material Interferences, a Practice-Led Research between Puppetry and Textiles	Textile intersections 2023: Doctorial Consortium

PARTICIPANT CONSENT FORM

Participant Project Information & Consent Form

(One signed copy of this form should be retained by the Participant and one copy by the Project Researcher)

Storytelling based on material expressivity

For further information
Supervisor:
Dr Sara Robertson/
sara.robertson@rca.ac.uk

06/03/2023

Dear Potential Participant,

I am Sabrina Recoules Quang, a PhD candidate in the Textile and Material Department in the School of Design at the Royal College of Art. As part of my studies, I am conducting a research project provisionally entitled "**Exploring material expressivity for designing an interactive storytelling system**". You are invited to take part in this research project which explores the process of embodiment of animated and sensorial qualities through materials.

If you consent to participate, this will involve:
Improvising relationship between objects made of materials such as, but not limited to, paper, cardboard or plastic.

Participation is entirely voluntary. You can withdraw at any time up to the point of publication and there will be no disadvantage if you decide not to complete the study. All information collected will be confidential. All information gathered will be stored securely and once the information has been analysed all individual information will be destroyed.

Images which could lead to participants being identified will only be used with express consent.

Research Office Royal College of Art Kensington Gore London SW7 2EU
t +44 (0)20 7590 4126 f +44 (0)20 7590 4542 research@rca.ac.uk www.rca.ac.uk/research

If you have any concerns or would like to know the outcome of this project, please contact my supervisor (Dr Sara Robertson) at the above address.

Thank you for your interest.

I *(please print)* ..... have read the information above and all queries have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that I can withdraw my participation from the project up to the point of publication, without penalty, and do not have to give any reason for withdrawing.

I understand that all information gathered will be stored securely, and my opinions will be accurately represented. Any data in which I can be clearly identified will be used in the public domain only with my consent.

Participant Signature.....

Researcher Signature.....

Date: .....

Complaints Procedure:

This project follows the guidelines laid out by the Royal College of Art Research Ethics Policy.

If you have any questions, please speak with the researcher. If you have any concerns or a complaint about the manner in which this research is conducted, please contact the RCA Research Ethics Committee by emailing ethics@rca.ac.uk or by sending a letter addressed to:

The Research Ethics Committee
Royal College of Art
Kensington Gore
London
SW7 2EU

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Certificate

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sabrina recoules quang

Successfully completed the course

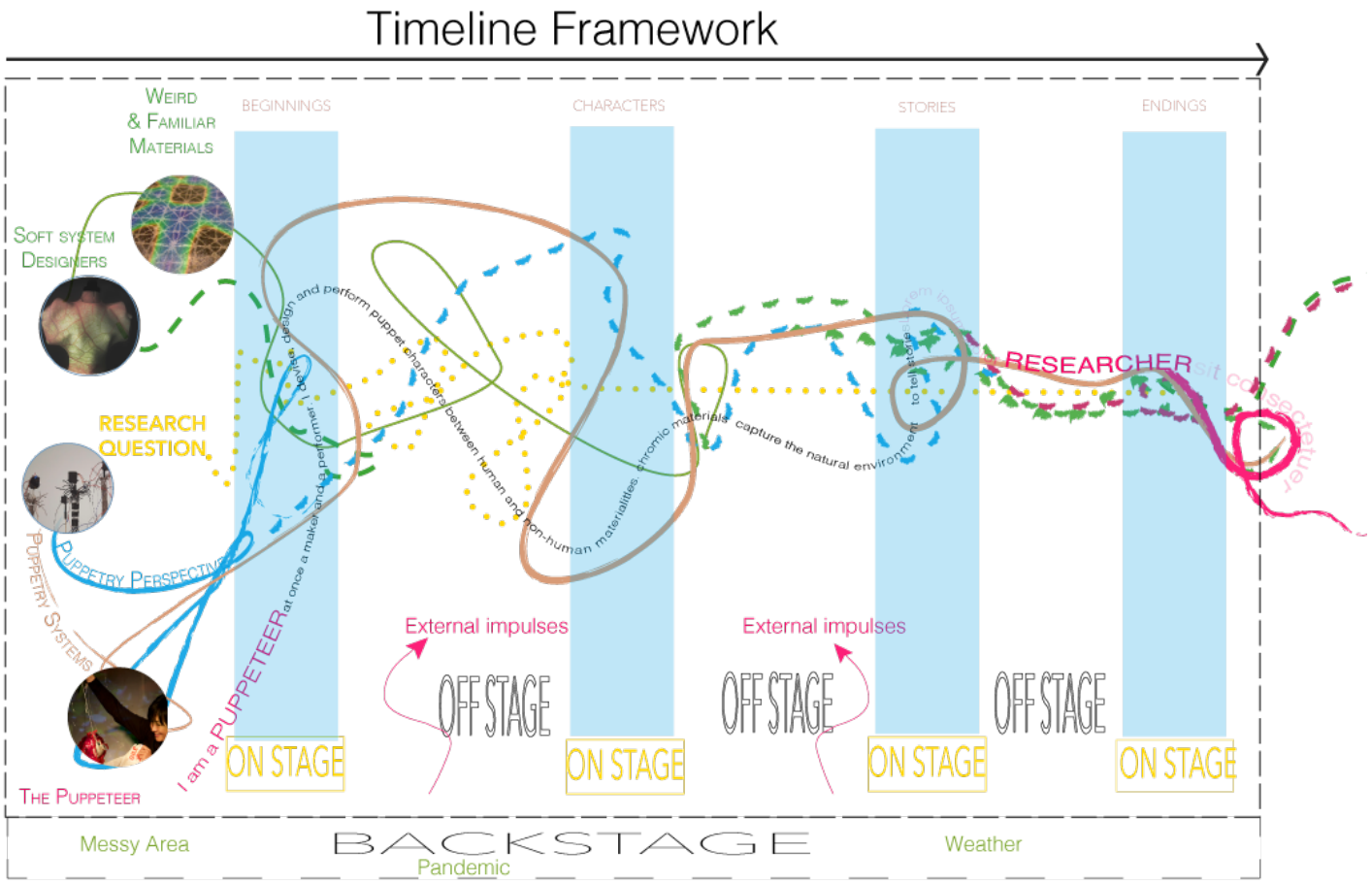
Ethics 1: Good research practice

as part of the Epigeum Online Course System with a score of 100%.

Dated: 05 February 2019

ETHICS CERTIFICATE

The Research Timeline



The diagram ‘Timeline of the research’ unwrapped the research journey and cycle of activities with the constraint of a one-dimensional plane. The production of the timeline supported my reflective activity that still occurred during the writings. It gave me a tool to visualise the breadth of the research between the cycles of activities.

At the beginning of the study, the puppeteer, puppetry systems, soft system designers and weird materials share the stage. The timeline maps the research to a puppet system. It differentiates between the periods of ‘research on stage’ or ’research front stage’ and the periods of reflective activities, ‘off stage’ or ‘research backstage’. I use the expression ‘research stage’ instead of ‘research framework’ to transpose the openness of our research system. The fertile ground from where the research grows in the ‘backstage’. It includes the data that the practice collected through the research activities. External impulses are impulses remaining off stage as elements that I as the puppeteer did not consider at that time as participating in the research activities, but that impacted my further activities, like heat from the environment, before I included it in the puppetry systems after testing chromic materials in outdoor conditions. Internal impulses include the changes to the research elements during off-stage periods between the research cycles, such as the impulses from the outcome of my reflective practices when the puppeteer-researcher came back on stage and embodied the transformations from these impulses that happened off stage.

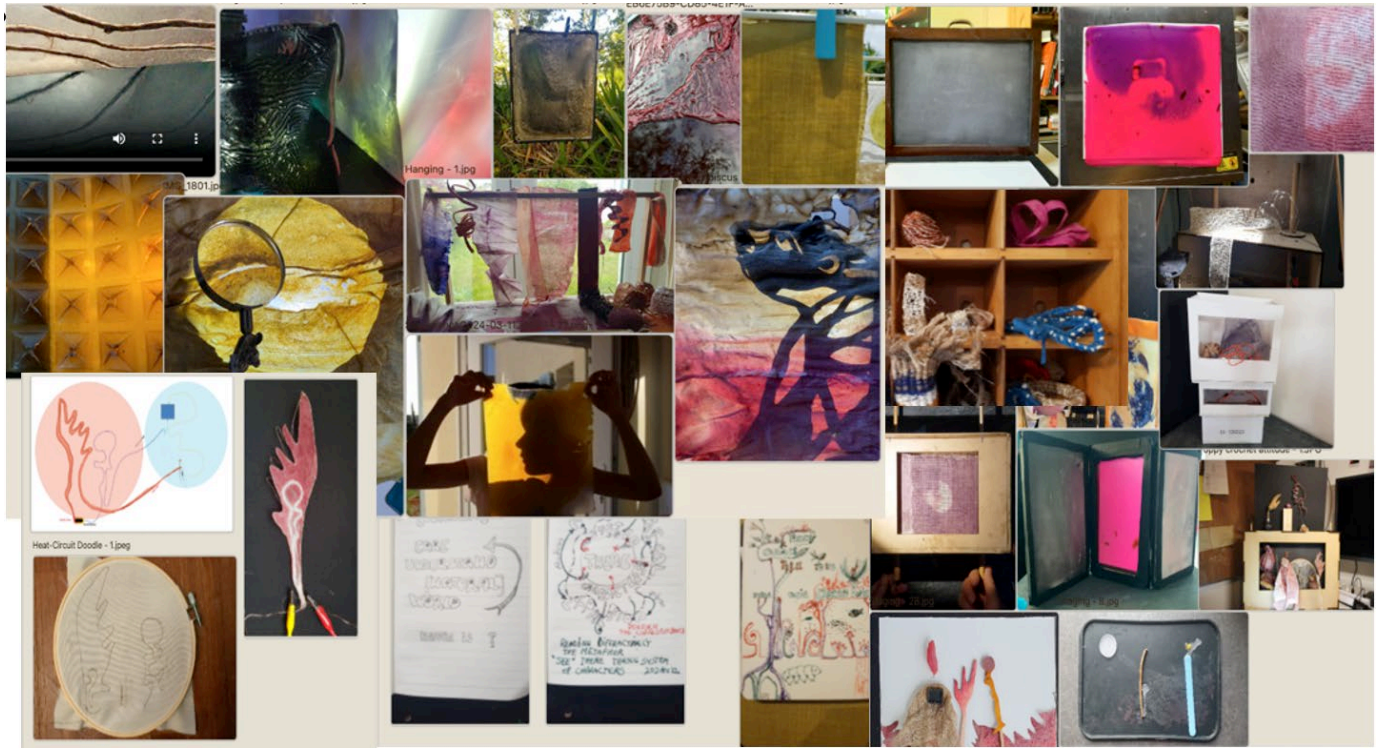
The graphic diagram shows the elements of the research system on the front stage and how they relate to each other, with the research question as the centre of gravity. The curves illustrate their evolution on and off stage inside the timeline framework. The elements of the research systems oscillate between the back and the front stage through their participation in the research activities. The diagram represents the breadth of the research and the alternation between periods of moving on with the practice and periods of reflecting on

the research journey. When off stage, instead of moving forward the research stays still and reflects on the activities performed on stage. On the right-hand side of the graphic, the charts stepped out of the timeline ‘s framework, to show how the once entangled perspectives will move in different directions after their transformations until their next meeting.

Finally, it is important to acknowledge that cycles evolved as an awkward assemblage up to the end of the research.

Messy Area

DOODLES



TEXTILE LANGUAGE IMPROVISATIONS (EXTRACT)

Once upon a time in a sewer, lived a mobile phone who was braided with cashmere.
Once upon a time in Kerist, lived a DC motor who was crocheted with acrylic.
Once upon a time in the Pacific Ocean, lived a leaf who was dyed with leather.
Once upon a time in a car, lived a remote controller who was crocheted with lurex yarn.
Once upon a time in a hotel, lived a thread who was braided with felting wool.
Once upon a time in a forest, lived a car who was braided with air.
Once upon a time in the House of the Parliament, lived a thread who was embroidered with wire.
Once upon a time in the ocean, lived a sticker who was naturally dyed with polycotton.
Once upon a time in a library, lived a bicycle who was embroidered with optical fibre..
Once upon a time in the House of the Parliament, lived a crab who was crocheted with silk.
Once upon a time in an office, lived a drifted wood who was naturally dyed with cotton yarn.
Once upon a time in the Mediterranean Sea, lived a shell who was painted with organza.
Once upon a time in an island, lived a pierced stone who was printed with silicon.
Once upon a time in a library, lived a hemp caterpillar who was naturally dyed with silicon.
Once upon a time in a car, lived a cat who was naturally dyed with tree bark.
Once upon a time in a fun fair, lived a cat who was stitched with thermochromic.
Once upon a time in la Manche, lived a cat who was printed with organza.
Once upon a time in a sewer, lived a Trombetta squash who was embroidered with raffia.
Once upon a time in Kea, lived a basket woven thermochromic bird who was sewed with acrylic.
Once upon a time in la Manche, lived a basket woven thermochromic bird who was basket woven with leather.

EXTRACT TABLE OF CHARACTER IMPROVISATION WITH TEXTILES, AND THERMOCHROMIC MATERIALS

Performing	Material	Structuration Process	Shape	Motion	Material transformation	Assemblage	Manipulation
Arlequin wander	Satin	Pleats	Origami	Slide, Bend	Purple to Pink	N/A	Hand
Bird stay still	Polypropyrene	Basket weaving		Stick	N/A	Wire	Hand
Body	Jute Rope	Basket weaving		Stick	Thermo	Wire	Hand
Body	Squash	Raw	squash	Stump	N/A	N/A	Hand
Body	Servo Motor	Raw	Rectangle	Turn around	N/A	Electronic	Code
Body	Cotton Thread	Knitting	Ball	Roll, bounce, squish	Magenta to white 28C	N/A	Heat Gun
Body	Organza		Dress	Stick			Heat Gun
Body	Ramie thin thread	Raw	Bobbin	Slide		Natural poppy head	Hand
Head	Thread	Crochet, Knitting	Ball	Roll, bounce, squish	Various Thermochromic	Stick	Hand
Head Heat puppet-puppeteer	Resin	Cast	Drifted wood,	Stick	Magenta mix with Mars	Drill	Body
Head with a beack	Rattan cane	Basket weaving	Top Egg	N/A		Wire	Hand
Head with a beack	Paper Thread and wire	Basket weaving	Conic	Finger Hand	Orange to yellow- 28C	Juxtaposition on the	Hand
Hungry Tardigrade	Ramie thick thread	Raw	Bobbin	Slide, Bend, Grasp	N/A	N/A	Hand
L'oiseau timide	Paper Thread and wire	Basket weaving	Conic	Finger Hand	Orange to yellow- 28C	Juxtaposition on the	Hand
La Chenille	Jute Ribbon	Sticthing	Curvy	Hand manipulation	Black to white 28C	Wire, Pearl, Plasticin	Hand
Le Herisson	Satin	Pleats	Origami	Servo motor pulling	Purple to Pink	DC Motor attached	Motor Circuit
Le Mur Carnivore	Satin	Pleats	Origami	Opening and Closing	Purple to Pink	N/A	Hand
Leaf Heat Puppet	Organza	Cutting	Leaf	Bend		Conductive wire	Heat circuitry
Leaf Heat Puppeteer		Sewing	Leaf	Touch		Conductive wire	Heat circuitry
Leaf shadow silhouette	Organza	Cutting	Leaf	Slide		Conductive wire	Hand
Medusa	Cheese cotton cloth	Raw	Not fixed	Hand manipulation	* Thermochromic	Raw	Hand
Medusa stay still	Paper Thread	Basket weaving	Ring	Slide	Orange to yellow- 28C	N/A	Heat gun
Octopus	Squash	Basket weaving	Top of the squash vegetable		N/A	Paper thread	Hand
Poppy fairy stay still	Organza + Head on a Stick	Sewing		Stick	Hydro	Poppy resin head	Rain
Poppy fairy-organza	Organza	Sewing Wrapping	Dress	Oscilate			Hand
Seed inside a leaf	Organza	Cutting & Sewing	Leaf	Appear		Conductive thread	Heat circuitry
Seed stay still	Cotton Thread	Knitting	Ball	Roll, bounce, squish	N/A	Silicon	Hand
Seed stay still	Cotton Thread	Knitting	Ball	Roll, bounce, squish	Magenta to white 28C	N/A	Hand
Seed stay still	Cotton Thread	Knitting	Ball	Roll, bounce, squish	Magenta to white 28C	Electronic	Heat Circuit
Surrealist poem	Words	Code	Script	Talk	N/A	Collage	Code
Thermo screen	Cotton Fabric	Heat	Rectangle	N/A	Black to white 28C	Screen Frame	Hand
White Shadows	Cotton Fabric	Heat	Heat puppet	Heat puppet moves	Black to white 28C	Screen Frame	Hand
Thermo screen	Silicon	Heat	Rectangle	N/A	Purple to Pink, kept the	Screen Frame	Hand
Thermo screen	Resin	Heat	Rectangle	N/A	Purple to Pink	Screen Frame	Heat Gun

Head snake fish	Fish gelatine	Dye Cast Dry and Glu	Shallow vase	Nod, Slide, Scale	Aqua green translucent	Juxtaposition on the	Hand and Arm
Little people	Fish gelatine	Dye Cast Dry	Ellipse and Sq	2D moves, stop motio	Translucent dye	N/A	Hand
Head Bird	Fish gelatine	Dye Cast Dry	Ellipse and Sq	2D moves, stop motio	Translucent dye	N/A	Hand

Bibliography

Adams, Catherine, and Terrie Lynn Thompson, *Researching a Posthuman World: Interviews with Digital Objects* (Palgrave Macmillan, 2016)

Adamson, Glenn, *Thinking Through Craft* (Bloomsbury Publishing, 2019)

Allain, Paul, and Jen Harvie, *The Routledge Companion to Theatre and Performance* (Routledge, 2014) doi: 10.4324/9781315779010

Aristotle, *How to Tell a Story: an Ancient Guide to the Art of Storytelling for Writers and Readers*, (Ancient Wisdom for Modern Readers), trans. and introduced by Philip Freeman (Princeton University Press, 2022), doi:10.1515/9780691211107

Arkes, Julie, 'New Digital Narratives for Living Textiles', (unpublished master's thesis, Delft University of Technology, 2021)

Arlander, Annette, 'Calling the Dragon, Holding Hands with Junipers: Transpositions in Practice, in *Transpositions in Practice from Transpositions: Aesthetico-Epistemic Operators in Artistic Research*, ed. by Michael Schwab (Leuven University Press, 2018), pp. 41-58

————————, 'Diffraction, Mixture and Cut-Ups in Performing with Plants', *Performance Research*, 25.5 (2020), 31–38, doi:10.1080/13528165.2020.1868835

Arlander, Annette, and others, *Performance as Research: Knowledge, Methods* (Impact, 2018)

Baker, Rene, 'The Puppet as a Teacher of Acting', in *Theatre Materials: What Is Theatre Made Of*?, ed. by Eleanor Margolies (Centre for Excellence in Training for Theatre, 2009), pp. 51–53.

————————, 'Bringing the Metaphor to Life', *Rene Baker,* 2018 <https://renebaker.org/2018/02/09/bringing-the-metaphor-to-life/> [accessed 12 May 2024]

Barad, Karen, 'Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter', *Signs*, 28.3 (2003), 801–31 doi:10.1086/345321

————————, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Duke University Press, 2007)

————————, ‘Diffracting Diffraction: Cutting Together-Apart’, *Parallax*, 20.3 (2014), pp.168–87, doi:10.1080/13534645.2014.927623&gt

Barati, Bahareh, Elisa Giaccardi, and Elvin Karana, ‘The Making of Performativity in Designing [with] Smart Material Composites’, in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, *Montreal, Canada* (ACM, 2018), pp. 1–11, doi:10.1145/3173574.3173579

‘Basketry - Coiling, Weaving, Materials’, *Encyclopedia Britannica* <https://www.britannica.com/art/basketry/Coiled-construction> [accessed 15 May 2024]

Bass, Eric, ‘Visual Dramaturgy, Some Thoughts for Puppet Theatre -Makers’, in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), pp. 54–60.

————————, ‘The Myths of Puppet Theater’ HowlRound Theatre Commons, 2018 <https://howlround.com/myths-puppet-theater> [accessed 3 November 2020]

Bell, John, ‘Playing with the Eternal Uncanny’, in *The Routledge Companion to Puppetry and Material Performance,* ed. by Dassia N. Posner, Claudia Orenstein, and John Bell,(Routledge, 2015) pp.43-52.

Bennett, Jane, *Vibrant Matter: a Political Ecology of Things* (Duke University Press, 2010)

Bergström, Jenny, and others, ‘Becoming Materials: Material Forms and Forms of Practice,’ *Digital Creativity*, 21.3 (2010), pp.155–72,

doi:10.1080/14626268.2010.502235>

Berzowska, Joanna, ‘Programming Materiality’, in *Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction*, *Kingston Ontario, Canada, 2012* (ACM, 2012), pp. 23–24, doi:10.1145/2148131.2148136

Berzowska, Joanna, and Marcelo Coelho, ‘Memory-Rich Clothing’, in *Proceedings of 2006 Conference on Human Factors in Computing Systems, CHI 2006, Montréal, Québec,* (ACM, 2006), pp. 275–278, doi:10.1145/2148131.2148136

Berzowska, Joanna, Marcelo Coelho, and Hanna Søder, ‘Kukkia & Vilkas | Xs Labs’ <http://xslabs.net/kukkia&vilkas/> [accessed 11 November 2020]

Bicât, Tina, and Chris Baldwin, eds., *Devised and Collaborative Theatre, a Practical Guide* (The Crowood Press, 2002)

Bowker, Lauren, ‘C H O R O P L E T H’, *The Unseen,* 2018 <https://seetheunseen.co.uk/about> [accessed 4 December 2022]

Bozalek, Vivienne, 'Socially Just Pedagogies', in *Posthuman Glossary*, ed. by Rosi Braidotti and Maria Hlavajova (Bloomsbury Publishing, 2018), pp. 396–98.

Braidotti, Rosi, 'Transformations,' in *Transpositions*, ed. by Michael Schwab, (Leuven University Press, 2018), pp. 23–31.

Braidotti, Rosi, and Maria Hlavajova, *Posthuman Glossary* (Bloomsbury Publishing, 2018)

Buso, Alice and others, 'The Unfolding of Textileness in Animated Textiles: An Exploration of Woven Textile-Forms', *in Proceedings of DRS Biennial Conference Series, Bilbao, Spain*, *2022,* edited by D. Lockton and others (DRS, 2022), doi:10.21606/drs.2022.612

Cabral, I., and others, 'Exploring Dynamic Lighting, Colour and Form with Smart Textiles', *IOP Conference Series: Materials Science and Engineering*, 254.7 (2017), 072005, doi:10.1088/1757-899X/254/7/072005

Campbell, Joseph, *The Hero with a Thousand Faces* (Princeton University Press, 1972)

Carlson, Casja, 'Alice Potts Makes Biodegradable Face Shields from Food Waste', *Dezeen*, 27 October 2020 <https://www.dezeen.com/2020/10/27/alice-potts-biodegradable-face-shields-food-waste-ngv-triennial/> [accessed 15 June 2021]

Carr, Wilfred, and Stephen Kemmis, *Becoming Critical: Education Knowledge and Action Research* (Routledge, 2003), doi:10.4324/9780203496626

Cavazza, Marc, and David Pizzi, 'Narratology for Interactive Storytelling: a Critical Introduction', in *TIDSE '06, Proceedings of the Third International Conference on Technologies for Interactive Storytelling and Entertainment, December 2006* (Springer, 2006), p. 83 doi:10.1007/11944577_7

Checkland, Peter, 'Soft Systems Methodology: A Thirty-Year Retrospective', *Systems Research and Behavioral Science*, 17.S1 (2000), S11–58, doi:10.1002/1099-1743(200011)17:1+<:AID-SRES374>3.0.CO;2-O

Choat, Alyssa, 'Performance and New Materialism: Towards an Expanded Notion of a Non-Human Agency', *Idea Journal*, 17.02 (2020), pp.350–61, doi:10.51444/ij.v17i02.398

Christie, Robert M, Sara Robertson, and Sarah Taylor, 'Design Concepts for a Temperature-Sensitive Environment Using Thermochromic Colour Change', *JAIC - Journal of the International Colour Association*, 1 (2012)

Coleman, Rebecca, 'Feminist New Materialist Practice: The Mattering of Methods' (Editors' note) *MAI: Feminism & Visual Culture*, 2019 <https://maifeminism.com/feminist-new-materialisms-the-mattering-of-methods-editors-note/> [accessed 30 May 2021]

Collet, Carole, 'Grow-Made' Textiles', in *International Conference 2017 of the Design Research Society Special Interest Group on Experiential Knowledge (EKSIG)*, *Delft University of Technology,* ed. by Elvin Karana and others (Eksig, 2017) <https://www.eksig.org/EKSIG2017.html> [accessed 19 August 2020]

Cook, Tina, 'The Purpose of Mess in Action Research: Building Rigour Though a Messy Turn,' *Educational Action Research*, 17.2 (2009), pp. 277–91, doi:10.1080/09650790902914241>

Coole, Diana H., and Samantha Frost, eds., *New Materialisms: Ontology, Agency, and Politics* (Duke University Press, 2010)

Currell, David, *Making and Manipulating Marionettes* (The Crowood Press, 2004)

Davis, Stephen Boyd, Olivia Vane, and Florian Kräutli, 'Using Data Visualisation to Tell Stories about Collections', in *Proceedings of Electronic Visualisation and the Arts (EVA)* (BCS Learning & Development, 2016) doi:10.14236/ewic/EVA2016.44

De Landa, Manuel, 'Material Complexity', in *Digital Tectonics*, ed. by Neil Leach, David Turnbull, and Chris Williams (Wiley-Academy, 2004), pp. 14–21

———————, *Assemblage Theory* (Edinburgh University Press, 2016)

Devendorf, Laura, and Chad Di Lauro, 'Adapting Double Weaving and Yarn Plying Techniques for Smart Textiles Applications', in *Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction, TEI '19*,*Tempe, Arizona, USA* (ACM, 2019), pp. 77–85 doi:10.1145/3294109.3295625

Dolphijn Rick and Iris van der Tuin, *New Materialism: Interviews & Cartographies* (Open Humanities Press, 2012) https://openhumanitiespress.org/books/download/Dolphijn-van-der-Tuin_2013_New-Materialism.pdf

Dormor, Catherine, 'The Event of a Stitch: The Seamstress, the Traveller, and the Storyteller,' *Textile*, 16.3 (2018), pp. 301–10, doi:10.1080/14759756.2018.1432144>

Down, Mark, *Practical Guide to Puppetry* (The Crowood Press, 2022)

Eldredge, Sears A., *Mask Improvisation for Actor Training & Performance: The Compelling Image* (Northwestern University Press, 1996)

Faste, Trygve, and Haakon Faste, 'Demystifying 'Design Research': Design is not Research, Research is Design', in *ISDA Education Symposium, Boston, 2012* <https://www.idsa.org/wp-content/uploads/Faste.pdf> [accessed 8 April 2020]

Ferrara, Marinella, and Murat Bengisu, 'Materials That Change Color', in *Materials That Change Color - Smart Materials, Intelligent Design*, ed. by Marinella Ferrara and Murat Bengisu (Springer, 2014), pp. 9-60, doi:10.1007/978-3-319-00290-3_2

Ferrara, Marinella, and Murat Bengisu, 'Materials That Change Color for Intelligent Design', in *Materials That Change Color: Smart Materials, Intelligent Design*, ed. by Marinella Ferrara and Murat Bengisu (Springer, 2014), pp. 81–100, doi:10.1007/978-3-319-00290-3_4

Fisher, Elizabeth, *On Not Knowing: How Artists Think*, ed. by Rebecca Fortnum (Black Dog Publishing, 2013)

Foth, Marcus, and Jeff Axup, eds., 'Participatory Design and Action Research: Identical Twins or Synergetic Pair?', *Proceedings of the Participatory Design Conference 2006: Expanding Boundaries in Design 2*, (ACM, 2006), pp. 93–96

Frayling, Christopher, 'Research in Art and Design' (Royal College of Art Research Papers, Vol 1, No 1, 1993/4)' (Royal College of Art, 1993) <https://researchonline.rca.ac.uk/384/> [accessed 19 November 2020]

Frye, Annika, 'Improvisation in Design Processes', in *The Routledge Handbook of Philosophy and Improvisation in the Arts*, ed. by Alessandro Bertinetto and Marcello Ruta, (Routledge, 2021) pp.645-656, doi:10.4324/9781003179443-50

Gaver, William, 'What Should we Expect from Research Through Design?', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Austin, Texas, May 2012* (ACM, 2012), doi:10.1145/2207676.2208538

Gaver, William, Jack Beaver, and Steve Benford, 'Ambiguity as a Resource for Design', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Lauderdale, Florida, 2003* (ACM, 2003), pp. 233–40, doi:10.1145/642611.642653

Geaney, Victoria, 'Vital Assemblages: A Fashion-Led Research Investigation into Collaboration between Fashion Design Research and Biology' (unpublished PhD thesis, Royal College of Art, 2022) <https://researchonline.rca.ac.uk/4985/>

Gemeinboeck, Petra, and Rob Saunders, 'Moving beyond the Mirror: Relational and Performative Meaning Making in Human–Robot Communication',

AI & SOCIETY, 37.2, pp.549–63, doi:10.1007/s00146-021-01212-1.

Glynn, Ruairi, 'The Irresistible Animacy of Lively Artefacts' (unpublished PhD thesis, University College London, 2019)

Gray, Carole, 'Inquiry through Practice: Developing Appropriate Research Strategies', paper presented at *No Guru, No Method? Discussions on Art and Design Research, Helsinki, Finland* (Helsinki University of Art & Design, 1998), pp. 82–95.

Gray, Carole, and Julian Malins, *Visualizing Research: A Guide to the Research Process in Art and Design* (Ashgate, 2004)

Haraway, Donna, and Lynn M. Randolph, *Modest_Witness@Second_Millenium.Femaleman_Meets_Oncomouse: Feminism and Technoscience* (Routledge, 2018)

Haraway, Donna, *The Haraway Reader* (Routledge, 2004)

Haseman, Brad, 'A Manifesto for Performative Research', *Media International Australia*, 118.1 (2006), pp. 98–106, doi:10.1177/1329878X0611800113

Haseman, Brad, and Daniel Mafe, 'Acquiring Know-How: Research Training for Practice-Led Researchers', in *Practice-Led Research, Research-Led Practice in the Creative Arts*, ed. by Hazel Smith and Roger T. Dean (Edinburgh University Press, 2009), pp. 211–28.

Heinzel, Tincuta, and Juan P. Hinestroza, 'Revolutionary Textiles: A Philosophical Inquiry on Electronic and Reactive Textiles', *Design Issues*, 36.1 (2020), pp. 45–58, doi:10.1162/desi_a_00574

Hiltunen, Ari, *Aristotle in Hollywood: the Anatomy of Successful Storytelling* (Intellect Books, 2002)

Howarth, Dan, 'Clothes That Change Colour According to Climate by Lauren Bowker', *Dezeen*, 2013 <https://www.dezeen.com/2013/12/12/clothes-that-change-colour-according-to-climate-by-lauren-bowker/> [accessed 29 November 2023]

Huang, Tsai-Chun, 'In-between Pleats: Pleats, Pleating and "Pliable Logic"' (unpublished PhD thesis, Royal College of Art, 2020) <https://researchonline.rca.ac.uk/4351/> [accessed 23 January 2021]

Hunsinger, Jeremy, 'Reflections From the Field of Communications: Weird Materiality', in *The Oxford Handbook of Social Media and Music Learning*, ed. by Janice L. Waldron, Stephanie Horsley, and Kari K. Veblen (Oxford University Press, 2020), pp. 502–9, doi:10.1093/oxfordhb/9780190660772.013.40

Igoe, Elaine, 'In Textasis: Matrixial Narratives of Textile Design' (unpublished PhD thesis, Royal College of Art, 2013) <https://researchonline.rca.ac.uk/1646/>

————, ‘Change Matters: Theories of Postdigital Textiles and Material Design’, in *Proceedings of DRS 2018 International Conference: Catalyst, Limerick, Ireland*, ed. by C Storni and others (Design Research Society 2018), pp. 1787–99 <http://www.drs2018limerick.org/participation/proceedings>

Ingold, Tim, ‘The Textility of Making’, *Cambridge Journal of Economics*, 34.1 (2009), pp.91–102, doi:10.1093/cje/bep042

————, *Bringing Things Back to Life: Creative Entanglements in a World of Materials*, ESRC Working Paper 5/10 (ESRC National Centre for Research Methods, 2010)

Jansen, Barbara, ‘Composing over Time, Temporal Patterns: In Textile Design’ (unpublished PhD thesis, University of Borås, 2013)

Jansen, Barbara, and Marie Ledendal, ‘Light and Shadow Play : The Sun as an Aesthetic Trigger for Urban Textiles’, in *Ambience 2011, Borås, Sweden*, 2011 <https://urn.kb.se/resolve?urn=urn:nbn:se:hb:diva-5339> [accessed 13 May 2024]

Jiri Trnka - Czech Puppet Animation Master Documentary, 1967, dir. by Kytka Hilmar-Jezek, YouTube,2018 <https://www.youtube.com/watch?v=_4X_-1HnYLw>

Jo, Misao, ‘SAORINOMORI – About SAORI’, 2019 <https://www.saoriglobal.com/> [accessed 12 February 2019]

Jochum, Elizabeth, and others, ‘Robotic Puppets and the Engineering of Autonomous Theater’, in *Controls and Art*, ed. by Amy LaViers and Magnus Egerstedt (Springer International Publishing, 2014), pp. 107–28, doi:10.1007/978-3-319-03904-6_5

Jones, Basil, ‘Puppetry, Authorship, and the UR-Narrative’, in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), pp. 61–68.

Jurkowski, Henryk, *Aspects of Puppet Theatre*, ed. by Penny Francis (Puppet CentreTrust, 1988)

————————, *Aspects of Puppet Theatre*, 2nd. edn., ed. by Penny Francis (Palgrave Macmillan, 2013)

Kaplin, Stephen, ‘A Puppet Tree, A Model for the Field of Puppet Theatre’, in *Puppets, Masks, and Performing Objects*, ed. by John Bell (TDR Books; The MIT Press, 2001), pp. 18–25.

Karana, Elvin, and others, ‘Alive. Active. Adaptive: Experiential Knowledge and Emerging Materials’, *International Journal of Design*, 13.2 (2019),

pp.1–5.

Karana, Elvin, Bahar Barati, and Elisa Giaccardi, 'Living Artefacts: Conceptualizing Livingness as a Material Quality in Everyday Artefacts', *International Journal of Design*, 14 (2020), pp. 37–53.

Karana, Elvin, Bahar Barati, Valentina Rognoli, and Anouk Zeeuw van der Laan, 'Material Driven Design (MDD): A Method to Design for Material Experiences', *International Journal of Design*, 9.2 (2015), pp. 35–54

Karana, Elvin, Elisa Giaccardi, Niels Stamhuis, and Jasper Goossensen, 'The Tuning of Materials: A Designer's Journey', in *Proceedings of the 2016 ACM Conference on Designing Interactive Systems, DIS '16* (ACM, 2016), pp. 619–31, doi:10.1145/2901790.2901909.

Karpati, Julie Ezter, 'Chromosonic', *Transmaterial*, 2017 <http://transmaterial.net/chromosonic/> [accessed 7 January 2020]

Kemmis, Stephen, 'Action Research as a Practice-based Practice', *Educational Action Research*, 17.3 (2009), pp. 463–74, doi:10.1080/09650790903093284

Kimbell, Lucy, 'The Object Strikes Back: An Interview with Graham Harman', *Design and Culture*, 5:1 (2013), pp.103–17, doi:10.2752/175470813X13491105785703

Kirkkopelto, Esa, 'Abandoning Art in the Name of Art', in *Transpositions: Aesthetico-Epistemic Operators in Artistic Research*, ed. by Michael Schwab (Leuven University Press, 2018), pp. 33–40.

Kleinman, Adam, 'Intra-Actions', Interview with Karen Barad, *Mousse Magazine* 34 (2012): pp76-81.

Kneebone, Roger, Fleur Oakes, and Colin Bicknell, 'Reframing Surgical Simulation: The Textile Body as Metaphor', *The Lancet*, 393.10166 (2019), pp. 22–23, doi:10.1016/S0140-6736(18)33173-8.

Kohler, Adrian, 'Thinking through Puppets', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), pp. 42–150.

Kontturi, Katve-Kaisa, and others, 'Practising New Materialisms in the Arts', *Ruukku*, 9 (2018). <http://ruukku-journal.fi/en/issues/9/editorial> [accessed 25 July 2020]

Kooroshnia, Marjan, 'Challenging Current Colour Theory and Practice Using Thermochromic and Photochromic Inks in Textile Design' (unpublished PhD thesis, University of Borås, 2017)

Lakoff, George, 'The Contemporary Theory of Metaphor', in *Metaphor and Thought*, ed. by Andrew Ortony, 2nd edn (Cambridge: Cambridge University Press, 1993), pp. 202–51, doi:10.1017/CBO9781139173865.013

Lambert, Ian, 'Improvisation: Autonomy, Heteronomy and Wilful Naïveté', in *EKSIG 2019: Knowing Together – Experiential Knowledge and Collaboration DRS Special Interest Group, Estonian Academy of Arts, 2019* <https://eksig.org/EKSIG2019.html> [accessed 8 December 2022]

Lamontagne, Valérie, 'Performative Wearables: Bodies, Fashion and Technology' (unpublished PhD thesis, Concordia University, 2017)

Landin, Hanna, Anna Vallgårda, and Linda Worbin, 'A Wall Hanging as an Organic Interface', in *OUI Workshop at TEI 2011*, *Funchal, Portugal, 2011*

Leavy, Patricia, *Research Design Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches* (Guilford Press, 2017)

Lecoq, Jacques, Jean-Gabriel Carasso, and Jean-Claude Lallias, *The Moving Body: Teaching Creative Theatre* (Routledge, 2001)

Ledendal, Marie, 'Thermochromic Textiles and Sunlight Activating Systems: An Alternative Means to Induce Colour Change' (unpublished PhD thesis, Heriot-Watt University, 2015)

Leeker, Martina, 'Performing (the) Digital: Positions of Critique in Digital Cultures', in *Performing the Digital*, Performance Studies and Performances in Digital Cultures (Transcript Verlag, 2017), pp. 21–60.

Lin, Mingjing, 'Interfashionality: Body-Oriented Parametric Design and Parametric Thinking 2.0 for 3D-Printed Textiles and Fashion' (unpublished PhD thesis, Royal College of Art, 2020)

Living Cotton, dir. By Anna Neklesa <https://vimeo.com/220382454> [accessed 28 November 2020]

'LucyandBart — World Renowned Sci Fi Artist and Body Architect', *Lucy McRae* <https://www.lucymcrae.net/lucyandbart> [accessed 13 May 2024]

Marshall, Michael, 'Tardigrades: Nature's Great Survivors', *The Observer*, 20 March 2021, section Science <https://www.theguardian.com/science/2021/mar/20/tardigrades-natures-great-survivors> [accessed 13 May 2024]

'Materiom : Commons' <https://materiom.org/commons> [accessed 14 May 2024]

McDermott, Phelim, '70 Hill Lane', *Improbable,* 1997 <https://www.improbable.co.uk/past-projects/70-hill-lane> [accessed 17 June 2018]

McNiff, Jean, *Action Research: Principles and Practice*, 3rd. edn. (Routledge, 2013), doi:10.4324/9780203112755

Mäkela, Maarit, 'Knowing Through Making: The Role of the Artefact in Practice-Led Research. Knowledge', *Knowledge, Technology & Policy*, 20.3 (2007), pp. 157–63 doi:10.1007/s12130-007-9028-2

Mäkelä, Maarit, and Nithikul Nimkulrat, 'Reflection and Documentation in Practice-Led Design Research', in *Making Design Matter, Nordic Design Research Conference 4 , 2011, Helsinki* (Nordic Design Research, 2011*)* https://archive.nordes.org/index.php/n13/issue/view/7

Margolies, Eleanor, 'Return to the Mound: Animating Infinite Potential in Clay, Food, and Compost', in *The Routledge Companion to Puppetry and Material Performance*, ed. By Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), pp. 322–35

———————, ed., *Theatre Materials: What Is Theatre Made Of?* (Centre for Excellence in Training for Theatre, 2009)

Marx, Gerhard, 'A Matter of Life and Death: The Function of Malfunction in the Work of Handspring Puppet Company', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), pp. 225–52

Mejias, Ulises Ali, *Off the Network: Disrupting the Digital World*, Electronic Mediations, volume 41 (University of Minnesota Press, 2013)

Mengis, J., and Davide Nicolini, 'Practising Diffraction in Video-Based Research', in *Organizational Video-Ethnography Revisited, Making Visible Material, Embodied and Sensory Practices*, ed. by Sylvie Grosjean and Frédérik Matte (Palgrave Macmillan, 2021), pp. 79–97

Merleau-Ponty, Maurice, *The Visible and the Invisible*, trans. By Alphonso Lingis (Northwestern University Press, 1969)

Mermikides, Alex, 'Doing What Comes Naturally?: Women and Devising in the UK Today', in *Women, Collective Creation, and Devised Performance : The Rise of Women Theatre Artists in the Twentieth and Twenty-First Centuries.*, ed. by Kathryn Mederos Syssoyeva and Scott Proudfit (Palgrave Macmillan, 2016)

Mermikides, Alex, and Jackie Smart, eds., *Devising in Process* (Palgrave Macmillan UK, 2010)

Minh -ha, Trinh T., 'Not You/Like You', in *Dangerous Liaisons: Gender, Nation, and Postcolonial Perspectives*, ed. by Anne McClintock, Aamir Mufti, and Ella Shohat (University of Minnesota Press, 1997), pp. 415–19

Miyoshi, Kensho, 'Puppetry as an Alternative Approach to Designing Kinesthetic Movements', in *Proceedings of the 4th Research Through Design Conference, 2019* (RTD 2019) < https://www.diva-portal.org/smash/get/diva2:1683555/FULLTEXT01.pdf> [accessed 9 May 2024]

Myatt, Sean, 'Instinctive Objects Ramblings', in *Theatre Materials, : What Is Theatre Made Of?* Ed. By Eleanor Margolies (The Royal Central School of Speech and Drama, 2009), p. 34

Nelson, Robin, 'Practice-as-Research and the Problem of Knowledge', *Performance Research*, 11.4 (2006), pp. 105–16, doi:10.1080/13528160701363556

————————, *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances* (Palgrave Macmillan, 2013)

Nilsson, Linnéa, Anna Vallgårda, and Linda Worbin, 'Designing with Smart Textiles: A New Research Program', *Nordes*, 0.4 (2011) <https://archive.nordes.org/index.php/n13/article/view/125> [accessed 26 June 2020]

Nilsson, Linnéa, Mika Satomi, Anna Vallgårda, and Linda Worbin, 'Understanding the Complexity of Designing Dynamic Textile Patterns' paper presented at *AMBIENCE 2011*, Borås, Sweden, 2011< http://www.akav.dk/publications/complexity_of_designing_dynamic.pdf >[accessed 2 June 2020]

Nimkulrat, Nithikul, 'Material Inspiration: the Practice-Led Research of a Craft Artist', in *Proceedings of the Seventh ACM Conference on Creativity and Cognition*, *C&C '09* (ACM, 2009), pp. 459–60, doi:10.1145/1640233.1640353

———————, 'Paperness: Expressive Material in Textile Art from an Artist's Viewpoint' (unpublished PhD Thesis, Aalto University, 2009)

———————, 'Voice of Material in Transforming Meaning of Artefacts', in *Proceedings of the Design Research Society Conference (DRS 2012), Chulalongkorn University, Bangkok, Thailand, 1 – 5 July 2012* (DRS, 2012)

———————, 'Hands-on Intellect: Integrating Craft Practice into Design Research', *International Journal of Design*, 6.3 (2012) <www.ijdesign.org> [accessed 28 February 2022]

Oddey, Alison, *Devising Theatre: a Practical and Theoretical Handbook* (Routledge, 1994)

Pajaczkowska, Claire, 'On Stuff and Nonsense: The Complexity of Cloth', *Textile*, 3.3 (2005), pp. 220–49, doi:10.2752/147597505778052495

Paltridge, Brian, Sue Starfield, Louise Ravelli, and Sarah Nicholson, 'Doctoral Writing in the Visual and Performing Arts: Issues and Debates', *International Journal of Art & Design Education*, 30.2 (2011), pp.242–55, doi:10.1111/j.1476-8070.2011.01700.x

Pantouvaki, Sofia, Nithikul Nimkulrat, and Nancy de Freitas, 'Experience, Materiality and Articulation in Art/ Design and Research Practices', *Studies in Material Thinking*, 2016

Paré, Zaven, 'La Marionette Électronique', in *Personnage Virtuel et Corps Performatif: Effets de Présence*, ed. by Louise Poissant and Renée Bourassa, Collection Esthétique (Québec, Québec: Presses de l'Université du Québec, 2013), pp. 141–60

Passionate Discourse (Dimensions of Dialogue) dir. by Jan Švankmajer, YouTube,2020 <https://www.youtube.com/watch?v=EbbNuGkHO_0>

Paul Daniels Magic-Philippe Genty Puppeteer, dir. by Mavis Riley Junior, YouTube, 2007 <https://www.youtube.com/watch?v=SphHaiW7fzg> [accessed 22 March 2023]

Petreca, Bruna Beatriz, 'An Understanding of Embodied Textile Selection Processes & a Toolkit to Support Them' (unpublished PhD thesis, Royal College of Art, 2016)

Petreca, Bruna Beatriz, and others, 'Radically Relational: Using Textiles As A Platform To Develop Methods For Embodied Design Processes', in *Proceedings of Alive. Active. Adaptive. International Conference 2017 of the Design Research Society Special Interest Group on Experiential Knowledge* Delft University, Netherlands: (EKSIG, 2017), pp. 261–74 <http://www.eksig2017.com/proceedings/>

Philpott, Rachel, 'Engineering Opportunities for Originality and Invention: The Importance of Playful Making as Developmental Method in Practice-Led Design Research', *Studies in Material Thinking*, 9 (2007) https://materialthinking.aut.ac.nz/sites/default/files/papers/SMT_V9_05_Rachel_Philpott.pdf > [accessed 13 May 2024]

————————, 'Entwined Approaches: Integrating Design, Art and Science in Design Research-by-practice', *in Proceedings of the Design Research Society Conference (DRS 2012)- Re:Search: uncertainty, contradiction and value,* Chulalongkorn University, Bangkok, Thailand, (DRS 2012)

Philpott, Rachel, and Faith Kane, 'Textile Thinking for Sustainable Materials', *Making Futures Journal*, 2013 <https://makingfutures-journal.org.uk/index.php/mfj/article/view/174> [accessed 12 May 2024]

Pineyro, Ana, 'Kinetic Morphologies. Revealing Opportunity from Mistake', *The Design Journal*, 22:sup1. (2019), pp.1871–82, doi:10.1080/14606925.2019.1595027

Pinto, Raul, and Pedro Maia, 'Narratives in Biodesign: Between Poiesis and Praxis', *Cuadernos Del Centro de Estudios de Diseño y Comunicación*, 140 (2021)

Piris, Paul, 'The Co-Presence and the Ontological Ambiguity of the Puppet', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), pp. 30–42.

Posch, Irene, 'Crafting Stories: Smart and Electronic Textile Craftsmanship for Interactive Books', in *Proceedings of the Fifteenth International*

Conference on Tangible, Embedded, and Embodied Interaction, *Salzburg Austria, 2021* (ACM, 2021), pp. 1–12, doi:10.1145/3430524.3446076

Posner, Dassia N., Claudia Orenstein, and John Bell, eds., *The Routledge Companion to Puppetry and Material Performance* (Routledge, 2015)

Prain, Leanne, *Strange Material: Storytelling through Textiles* (Arsenal Pulp Press, 2014)

Price, Brian, *Classical Storytelling and Contemporary Screenwriting: Aristotle and the Modern Scriptwriter* (Routledge, 2018)

Pulley, Robert, 'Theatre of the Imagination: Exploring a Pedagogic Toolkit for Creative Development and Global Learning in Primary Education' (unpublished PhD thesis, Royal College of Art, 2019)

Ramlow, Heloisa, Karina Luzia Andrade, and Ana Paula Serafini Immich, 'Smart Textiles: An Overview of Recent Progress on Chromic Textiles', *The Journal of The Textile Institute*, 112.1 (2021), pp.152–71, doi: 10.1080/00405000.2020.1785071

Rath, Courtney L, 'Not a Thing but a Doing': Reconsidering Teacher Knowledge Through Diffractive Storytelling (unpublished PhD thesis, University of Oregon, 2015) <http://hdl.handle.net/1794/19229>

Recoules Quang, Sabrina, 'Tension and Materiality in a Textile System; A Puppetry Perspective', *Journal of Textile Design Research and Practice*, 9.2 (2021), pp. 252–72, doi:10.1080/20511787.2021.1923201

Regalado, Mariana, Helen Georgas, and Matthew Burgess, 'Choose Your Own Adventure: The Hero's Journey and the Research Process', *Brooklyn College Publications and Research* (2017) <https://academicworks.cuny.edu/bc_pubs/125>

Ribul, Miriam, *Recipes for Material Activism* (Issuu, 2014) <https://issuu.com/miriamribul/docs/miriam_ribul_recipes_for_material_a> [accessed 13 May 2024].

Ribul, Miriam, and Hanna de la Motte, 'Material Translation: Validation and Visualization as Transdisciplinary Methods for Textile Design and Materials Science in the Circular Bioeconomy', *Journal of Textile Design Research and Practice*, 6.1 (2018), pp. 66–88, doi:10.1080/20511787.2018.1467206

Ribul, Miriam, Kate Goldsworthy, and Carole Collet, 'Material-Driven Textile Design (MDTD): A Methodology for Designing Circular Material-Driven Fabrication and Finishing Processes in the Materials Science Laboratory', *Sustainability*, 13.3 (2021), doi: 10.3390/su13031268

Rice, Carla, K. Alysse Bailey, and Katie Cook, 'Mobilizing Interference as Methodology and Metaphor in Disability Arts Inquiry', *Qualitative Inquiry*, 28.3–4 (2022), doi:10.1177/10778004211046249

Robertson, Sara, 'An Investigation of the Design Potential of Thermochromic Textiles Used with Electronic Heat-Profiling Circuitry' (unpublished PhD thesis, Heriot-Watt University, 2011)

Robertson, Sara, Sarah Taylor, and Joanna Bletcher, 'Collaborative Innovation: Reflections on Research for Smart Textiles in a Theatre and Performance Context' presented at *Textiles Intersections*, *London, 2019,* doi:10.17028/rd.lboro.9741296.v1

Sáez Bondía, M.J., and A.L. Cortés Gracia, 'Action Research in Education: A Set of Case Studies?', *Educational Action Research*, 30.5 (2022), pp. 850–64 doi:10.1080/09650792.2020.1866631

Salter, Daniel W., 'An Archetypal Analysis of Doctoral Education as a Heroic Journey', *International Journal of Doctoral Studies*, 14 (2019), pp. 525–42, doi:10.28945/4408

Saunders, Mark, Philip Lewis, Adrian Thornhill, and Alex Bristow, 'Understanding Research Philosophy and Approaches to Theory Development', in *Research Methods for Business Students*, ed. by Mark Saunders, Philip Lewis and Adrian Thornhill (Pearson, 2019), pp. 128–71.

Sayal-Bennett, Amba, 'Diffractive Analysis: Embodied Encounters in Contemporary Artistic Video Practice' (Tate Papers), *Tate*, 2018 <https://www.tate.org.uk/research/tate-papers/29/diffractive-analysis> [accessed 4 August 2022]

Schwab, Michael, ed., *Transpositions: Aesthetico-Epistemic Operators in Artistic Research* (Leuven University Press, 2018)

Scott, Jane, 'Responsive Knit: The Evolution of a Programmable Material System', in *Proceedings of Design as a Catalyst for change - DRS International Conference 2018, Limerick, Ireland, 2018* (Design Research Society, 2018), doi:10.21606/drs.2018.566

Sherman, Jon Foley, 'The Practice of Astonishment: Devising, Phenomenology, and Jacques Lecoq', *Theatre Topics*, 20.2 (2010), pp. 89–99, doi:10.1353/tt.2010.0104

Siang, Teo Yu, 'How to Create Effective UX Case Studies with Aristotle's 7 Elements of Storytelling', *The Interaction Design Foundation*, 2023 <https://www.interaction-design.org/literature/article/how-to-create-effective-ux-case-studies-with-aristotle-s-7-elements-of-storytelling> [accessed 17 February 2023]

Sichel, Adrienne, 'Escaping the Puppet Ghetto', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), pp. 151–75.

Smith, Vicky, 'Experimental Time-Lapse Animation and the Manifestation of Change and Agency in Objects', in *Experimental and Expanded Animation*, ed. by Vicky Smith and Nicky Hamlyn (Springer, 2018), pp. 79–102

Royal College of Art, 'Soft Systems 2021', Programmes, *Royal College of Art* <https://2021.rca.ac.uk/programmes/soft-systems> [accessed 3 January 2023]

Sturken, Marita, and Lisa Cartwright, *Practices of Looking: An Introduction to Visual Culture* (Oxford University Press, 2009)

Sullivan, Graeme, 'Making Space: The Purpose and Place of Practice-Led Research', in *Practice-Led Research, Research-Led Practice in the Creative Arts*, by Hazel Smith and Roger Dean (Edinburgh University Press, 2009), pp. 41– 65

———————, 'Art Practice as Research', in *Art Practice as Research: Inquiry in Visual Arts*, ed. by Graeme Sullivan, 2nd ed (Sage Publications, 2010), pp. 95–120.

'Summer Camp – Summer of Etextiles' *Etextile* <https://etextile-summercamp.org/2017/summerof/summercamp/> [accessed 8 January 2024]

Syduzzaman, Md, and Sarif Ullah Patwary, 'Smart Textiles and Nano-Technology: A General Overview', *Journal of Textile Science & Engineering,* 5.1 (2015) doi:10.4172/2165-8064.1000181

Tandler, Lynn, 'The Role of Weaving in Smart Material Systems' (unpublished PhD thesis, Northumbria University, 2016)

Taylor, Jane, ed., *Handspring Puppet Company* (David Krut, 2009)

————————, 'Introduction', in *Handspring Puppet Company*, ed. by Jane Taylor (David Krut, 2009), pp. 19–41

Thiele, Kathrin, 'Ethos of Diffraction: New Paradigms for a (Post)Humanist Ethics', *Parallax*, 20.3 (2014), pp.202–16 doi:10.1080/13534645.2014.927627

Thomas, Diana, 'Textiles in Text: Synaesthesia, Metaphor and Affect in Fiction', (unpublished PhD thesis, University of Wollongong, 2014) <https://ro.uow.edu.au/theses/4135>

Tillis, Steve, *Toward an Aesthetics of the Puppet: Puppetry as a Theatrical Art (Contributions in Drama and Theatre Studies,* no. 47*)* (Greenwood Press, 1992)

————————, 'The Art of Puppetry in the Age of Media Production', *TDR* 43.3 (1999), pp.182–95

Townsend, Riikka Claire, Antti J. Karttunen, Maarit Karppinen, and Jussi Mikkonen, 'The Cross-Section of a Multi-Disciplinary Project in View of Smart Textile Design Practice', *Journal of Textile Design Research and Practice*, 5.2 (2017), pp.175–207 doi:10.1080/20511787.2018.1449076

Uğur Yavuz, Seçil, 'MASAL: Bridging Between Two Cultures Through Storytelling with an Interactive E-Textile Toy', in *Developments in Design Research and Practice*, ed. by Emilia Duarte and Carlos Rosa (Springer Series in Design and Innovation) (Springer International Publishing, 2022), pp. 127–39 doi:10.1007/978-3-030-86596-2_10

Valentine, Louise, Jen Ballie, Joanna Bletcher, Sara Robertson, and Frances Stevenson, 'Design Thinking for Textiles: Let's Make It Meaningful', *The Design Journal* 20.sup1 (2017), S964–76 doi:10.1080/14606925.2017.1353041

Vallgårda, Anna, and Johan Redström, 'Computational Composites', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, *CHI '07* (ACM, 2007), pp. 513–22 doi:10.1145/1240624.1240706

Van Der Tuin, Iris, 'Diffraction', in *Posthuman Glossary*, ed. by Rosi Braidotti and Maria Hlavajova, (Bloomsbury Publishing, 2018), pp. 99–101

————————, 'New Feminist Materialisms', *Women's Studies International Forum*, 34.4 (2019), pp. 271–7

Van Wijngaarden, Anna Roos, 'Interview with Diana Scherer', *Berlin Art Link*, 2022 <https://www.berlinartlink.com/2022/08/29/growing-sculptures-interview-with-diana-scherer/>

Walker, Arielle, 'On Returning to the Sea: Towards Belonging Through Land, Language, & Tactile Storytelling' (unpublished PhD thesis, Auckland University of Technology, 2020)

Wallace, Niki, 'Thinking While Drawing and Drawing to Think: Exploring "Reflective Doodling" as a Critical Reflective Practice in Design for Transitions.', in *Proceedings of DRS International Conference 2020*, *Vol.1: Synergy, Situations,* 11-14 August 2020 (DRS, 2020), pp. 204-223 doi:10.21606/drs.2020.187Williams, Margaret, 'The Death of the Puppet', in *The Routledge Companion to Puppetry and Material Performance*, ed. by Dassia N. Posner, Claudia Orenstein, and John Bell (Routledge, 2015), pp. 18–29

Winters, Amy, 'Why Does Soft Matter? Exploring the Design Space of Soft Robotic Materials and Programmable Machines' (unpublished PhD thesis, Royal College of Art, 2017)

Worbin, Linda, 'Designing Dynamic Textile Patterns' (unpublished PhD thesis, Chalmers University of Technology, Gothenburg, 2010) https://www.diva-portal.org/smash/get/diva2:876940/FULLTEXT01.pdf [accessed 14 May 2024]