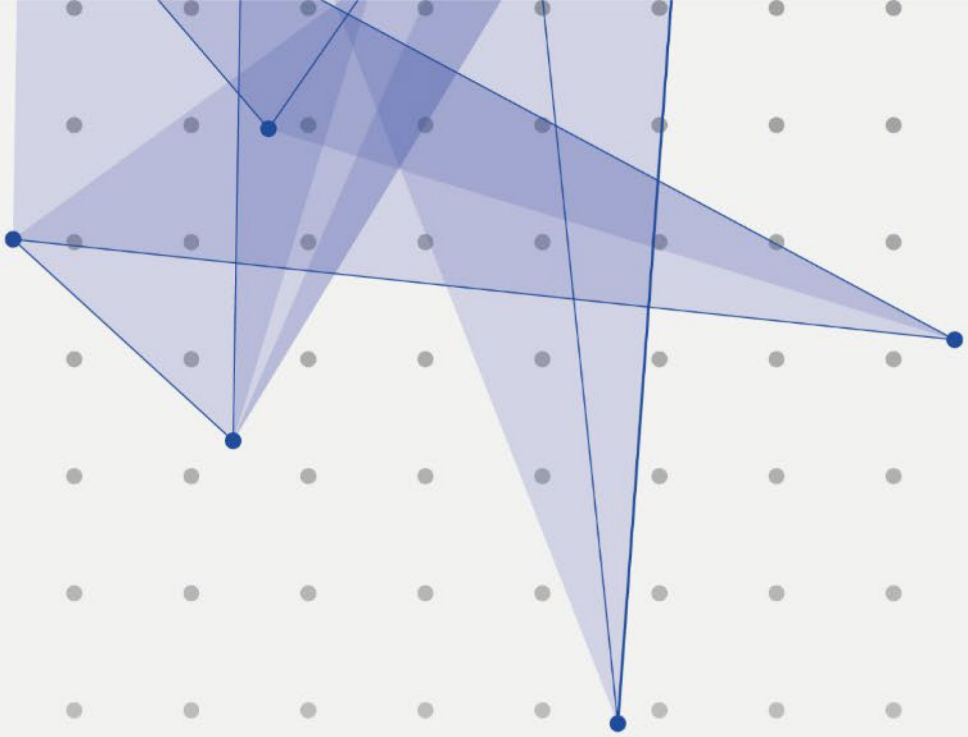

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"**From Abstractness to Concreteness** – experiential knowledge and the role of prototypes in design research"

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DIPARTIMENTO DI DESIGN

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Track 6 Society and Health

Track 7 Materials and Digital

Prototypes as a Structured Information Source in Theory Nexus

Renata Dezso, Moholy-Nagy University of Art and Design Budapest

Abstract

In this paper, I analyse the role of prosthetic prototypes developed during my doctoral research (completed in 2022), generating critical thoughts and new insights into our value system as it relates to human-centred societal challenges. The investigation settled in the experimental approach of Research through Design alongside a qualitative case study combined with the power of critical disability studies to advance space for understanding relationships between phenomena and theory. To focus on the central questions from a particular single case study project, I worked with Luca Szabados (a highly creative independent artist with a congenital disability) to craft a prosthesis using digital technology. The role of prototypes in the research not only encompasses the experimental and physical nature of the study but also creates links in the chain of knowledge development and carries evidence data. The prosthetic prototypes guided reflections on human-centred societal challenges as a non-verbal modelling media. The tangible material nature of the prototypes provides the possibility of operating with a set of 'boundary objects' within discussions that include the enactment of latent perspectives. The prosthetic prototypes encode a tangible chain of thoughts as a result of the design synthesis of knowledge and research questions with the central links of the method. The data of the artefacts construct the evidentiary values of the research and enable an exploration of philosophical and strategic approaches to co-Ability. The term 'co-Ability' is rooted in the critical approach of posthuman disability studies. It serves as a broad umbrella term under which we can reconsider the potentials of various entities (biological and artificial) that enhance the shared competencies of those entities rather than dwell on the oppressive nature of human-centred norms. In this research, the discursive prosthetic prototypes thus carry a profound and integrative argument that significantly connects with the general viewer and represents the theory development.

Research through Design; co-Ability; discursive prototypes; prosthesis; disability studies

The aim of this paper is to outline the role of prosthetic prototypes developed during my doctoral research (completed in 2022) in generating new critical and new insights into our value system concerning human-centred societal challenges. This research began with a focus on the caring attitude to prosthesis development inspired by the work of Peter H. Jones. He endorses positivist certainties in contemporary digital technologies for inclusive and transitive approaches (Jones, 2013). From here, the initial task and concept were repositioned (conceptual repositioning in design) from a place of problem-solving to one of bringing the situational nature of the design prototype into focus (Buchanan, 1992). I settled on the framework of a single design case study project that aimed to use digital technology to design an upper limb prosthesis for the artist Luca Szabados; this progressed to an argumentative co-design development process that used prosthetic prototypes. A discussion of the relationship between disability and technology invites a critical philosophical approach to posthumanism, questioning the complex phenomena of a normalised society, phenomena that affect not only marginalised populations but also every human being in contemporary society (Barnes, 1996; Braidotti, 2013; Campbell, 2012; Goodley, 2014; Mallett and Runswick-Cole, 2014; Shildrick, 2015; Wolfe, 2009).

In their 1973 paper, Rittel and Webber suggested that complex and fragmented social challenges can be defined as 'wicked problems'. These complex and often ambiguous problems with high degree of uncertainty are difficult to define, solve, or even fully understand. Therefore, taming such problems with novel research approaches can defy the boundaries of standard analytical and rational processes (Rittel and Webber, 1973).
At our first project meeting, Luca questioned our research's initial intention; and invited many new questions to understand Luca's personal needs and interests. We clarified that Luca does not need nor wish to have a prosthesis. Based on her experience, she does not like to move around with a prosthesis object attached to her elbow stump. Luca's responses to the initial questions repositioned the initial theories at another point in the research framework inviting literature analysis on critical disability studies and questioning the initial normative view on prosthesis design. 'Disability is but one cultural artefact that signifies the "demise of humanism"' (Braidotti, 2013, p. 151), precisely because disability demands non-normative and anti-establishment ways of living. To use the language of McRuer (2006), disability crips what it means to be a human being.

Figure 1: Luca Szabados at her workshop. Photo by András Ladocsi.

The aim of our collaboration with Luca extended into generating new shared understandings of disability, and abilities by reflecting on argumentative and collaborative prototypes. An essential aspect of these prototypes is their intentional open-endedness and inexpensive production, designed primarily to facilitate discussions and debates. Luca adopted a meaningful role in the ecosystem of the discursive prototypes and thus reinforced her status as a person with assets rather than a person with a lack of ability (Manzini, 2015; Munro, 2016). The methodology adopted

for this doctoral research thus enables an exploration of prosthesis design that is led by the tangible analysis of theoretical concerns. It engages in dialogue through co-design practice without the pressure of developing or commercialising a terminal design product. The prosthetic prototypes guided our reflections as a non-verbal modelling media and reflections on concepts of co-Ability. The role of prototypes encompassed not only the experimental and physical nature of the research but also presented links in the chain of knowledge development and carried evidence data.

Non-static and changeable entities in prototyping

The best way to understand the co-Ability phenomenon analysed in the research is by viewing the relational network that morphs and the changes in action generated by key elements within the continuously transactional activity. All the key players (biological and artificial) in this research considered as independent actors with agile and open collaborative actions. The designer researcher, a person with a disability, the digital manufacturing technology and the tangible artefact bring their own disciplinary perspectives on innovation and support the shared competencies in the network of collaboration. The interdependent network established by this research framework allows for divergence and changes in key aspects, aspects that are context-dependent and unstable over time. Posthuman studies advocate for an inclusive understanding of the network of interconnected elements and invite these elements to participate in a broader movement that addresses complex contemporary challenges, such as social policy, urban planning, healthcare, and environmental management. As Rosi Braidotti (2013) notes, the rapidly changing field of disability studies is emblematic of the posthuman predicament. In this research, I consider the knowledge-generating networks of four significant stakeholders to define four different principles of participation. Each physical element within the research frames a matrix of disciplinary knowledge and represents fragmented, novel, and complex issues affecting decision-making in prototyping. In the co-design approach used here, no single element possesses the independent ability to develop discursive prosthesis prototypes. The 'posthuman condition introduces a qualitative shift in our thinking about what exactly is the basic unit of common reference for our species, our polity and our relationship to the other inhabitants of this planet' (Braidotti, 2013, p. 2). The artificial and biological elements of the framework in relation, including the humans, as well as the digital technology and physical artefacts, are all interdependent actors in the network, and they all affect each other's activity even when they are not directly connected. This means that each of the elements in the network cannot generate new activity without considering the other contributing actors in the larger structure. Actor-network researchers such as Jim S. Dolwick (2009) and Bruno Latour (2007) propose to collectively view people, artefacts, and processes in socio-material political assemblies. In and upon the theory development, the prosthesis prototypes developed for this work were orientated as a basis of reflections, as 'object for discourse' that can 'talk back' in action through their physical presence (Mazé, 2007). A strong grounding in materiality and crafting through digital experience position the prototypes as a basis for reflection on design practice and research methods. This research has thus moved away from the classical linear supplier/consumer model for prosthesis development into the experimental Research through Design (RtD) model, in which variables situated in open research questions can controvert the predictive perspective of the initial hypothesis. The direct experience of a person with a disability in prototype testing offered internal critique from within. In human history, both disabilities and co-design methods possess a 'neverending' aspect that

connects them in this morphological network, our understanding and approach to them has changed over time.

Figure2: Discussive prototypes in action. Photo by András Ladocsi.

The prosthesis prototypes were an essential part of this research, and they embodied a collection of mediated messages that address social, cultural, and technological issues.

> *Prosthesis simultaneously occupies the space of artificial limbs, metaphor, and discursive framework. (Kurzman, 2001, p. 375)*

The understanding of the term prosthesis encompasses 'a rich visual, political, and material vocabulary' that includes the ideas of 'prosthesis as an artificial limb," "prosthesis as aid"

(i.e., aid to support an action), and 'prosthesis as metaphor' (i.e., an artificial body part that is 'integrated into the daily routines of the body') (Adams et al., 2015; Kurzman, 2001).

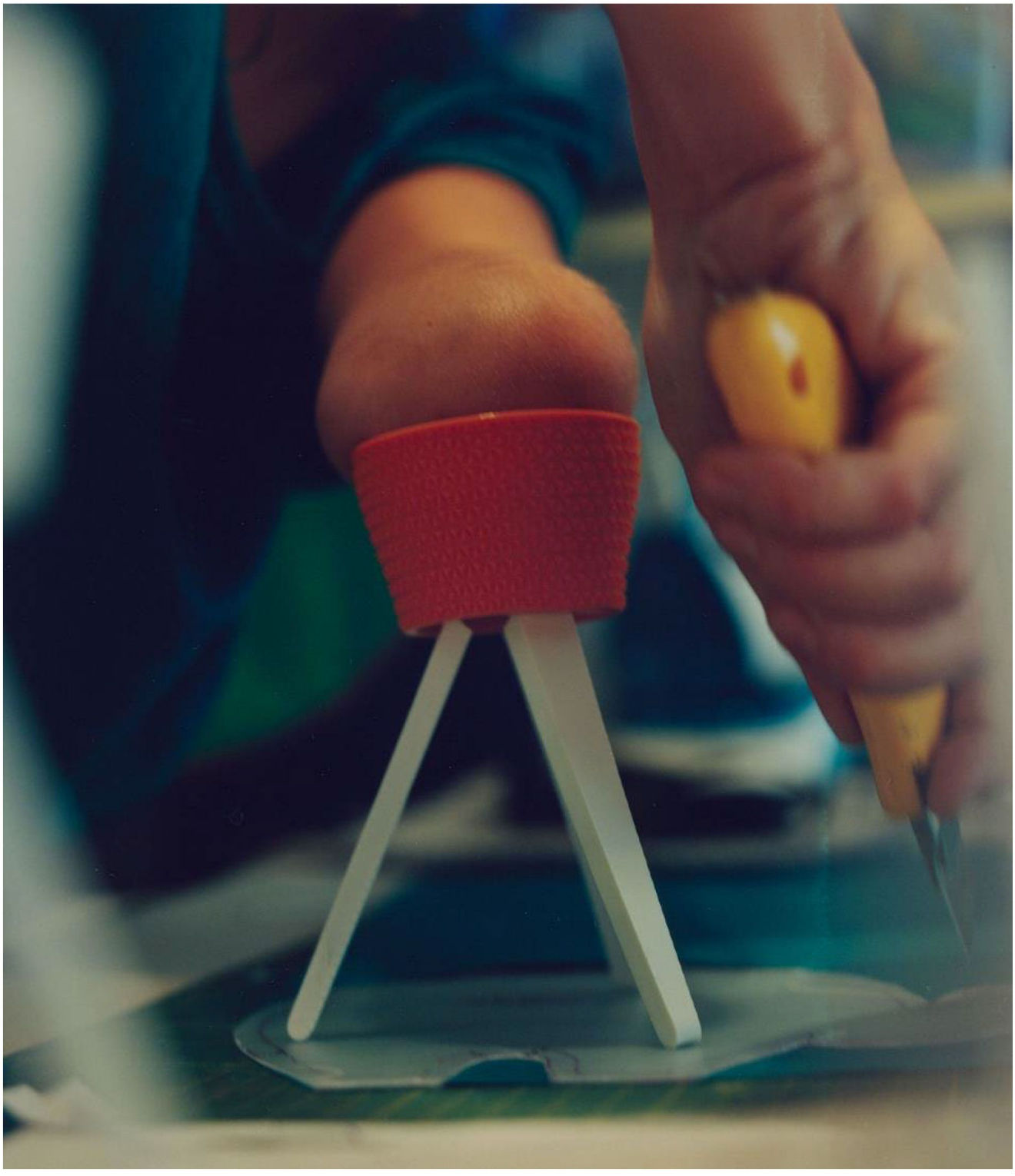


Figure 3: Luca Szabados testing the prototypes. Photo by András Ladocsi.

A bionormative model-led prosthetic design is an artificial interpretation of an anatomically intact limb. The denotative aspect of the prosthesis was challenged in the research by Luca's congenital disability and by contemporary disability studies. Rather than designing an artificial object to recreate a body part that has never been there, the intention was to

develop an entity that could help to overcome certain environmental, personal, or social limitations. In this way, a prosthesis can be understood as any tool created in design history extending the boundaries of the human body. According to Malcolm McCullough (1998), a handheld device is typically considered a tool that requires active physical engagement and imagination to operate. This direct object–body connection is essential in this situated discursive research method, which provides concrete feedback on personal needs. In addition, the social context of disability encourages broader critical discussions. Finally, examining a prosthetic as a tool that integrates with the human body can contribute to the exploration of embodiment, which challenges the boundaries of what it means to be human (Carruthers, 2007; Dartnall, 2004; Dourish, 2001; Haraway, 1987; Shildrick, 2015).

Exploratory prototyping technology

During the computational design workflow for this research, I followed a designer-based iterative development in opposition to a self-organisational process of Morphogenetic Design (Hensel et al., 2012). For the iteration sequences, I used an applied surface CAD modelling technique. The 3D modelling process reflected on the situated discursive feedback from the 3D printed prototypes without inserting automated or generative proces with a parametric algorithm. For this research, I decided to use desktop 3D printers as the manufacturing technology within the large spectrum of possible rapid prototyping. These 'desktop robots' are game-changing devices in prototyping that practically melt a solid thermoplastic material (filament) and deposit it layer by layer in a specific design pattern in a process known as Fused Deposition Modelling. Compared with some traditional manufacturing processes, 3D printers offer more economical production by enabling the production of a model in a single process with a short build time, thereby offering the possibility for lightweight objects and a reduction of waste. Digital manufacturing allows for every piece of prototype to be differentiated in terms of size, proportion, and details while the general design and the purpose of the created object remain static. The economic and adaptive aspect of the desktop 3D printer is valuable not only in design development but also for future use for a larger audience with global filesharing local printing possibilities. Considering the material as the media in this process, there are also drawbacks to desktop printing. Working with a rigid material imposes limitations on build size and can have an impact on the accuracy of the part. Moreover, the size of the elements is constrained by the dimensions of an average desktop 3D printer's bed. However, micromechanical structures can influence the flexibility of a rigid material and improve its performance with regard to the body–object relationship. The work of design innovation firms such as Studio Bitonti-UNYQ and Nervous System, as well as individual designers such as Behnaz Farahi (2017), are leading inspirations in micromechanical structures for orthopaedic and prosthetic products. Unfortunately, desktop 3D printing technology has such physical limitations that prevent the creation of micro-sized and sophisticated geometry for the prototypes. Despite this limitation, to improve the body–object performance altering a material's geometrical configuration is still possible. I strategically selected geometries to showcase dynamic behaviour, such as enlarged one-ball rotational bearing gear, and flexible adaptive side pieces. In addition, the desktop printing process provides the opportunity to create an interlocking design that can be leveraged to produce a pre-assembled object capable of supporting certain bodily movements.

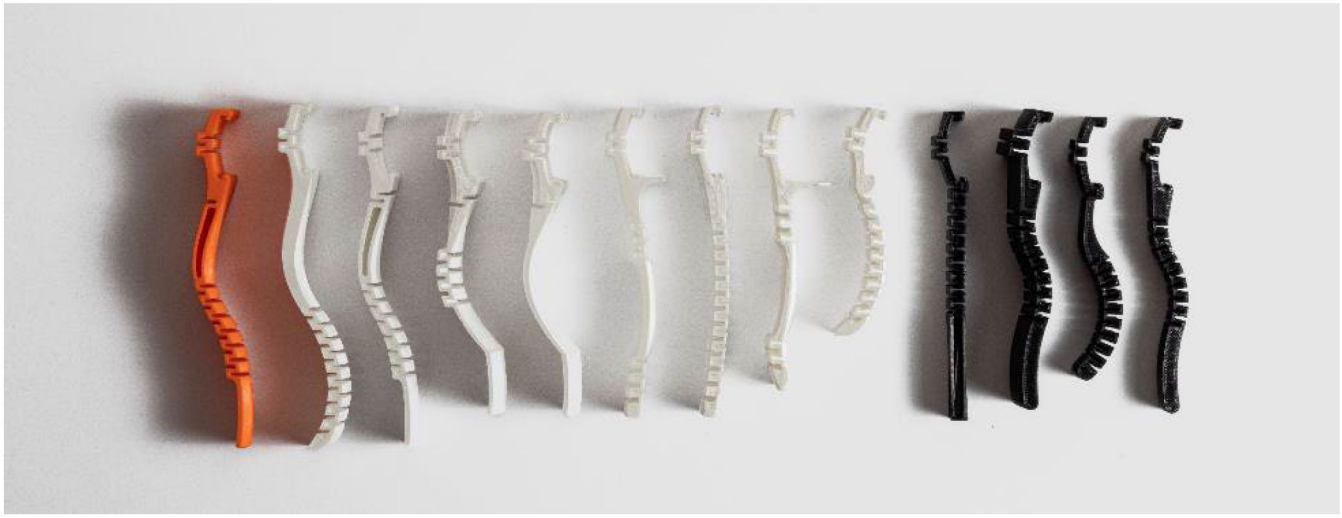


Figure 4: prototype iterations. Photo by Marcell Kazsik

The most important element of this designer-based iterative development with digital prototyping technology during the alteration process is the mutation of temporalities in 'material practice' with the resultant changes in the formation of 'participatory practice'. These alterations in the concept of 'becoming in the making' affects 'futurity' and the current and sublimed values as a cultural, historical, and political matter (Agre, 1997; Bell et al., 2005; Mazé, 2007; McCullough, 1998).

> *Within RtD, the researcher and the objects created are entwined and cannot be separated, establishing knowledge through this relationship.* (Isley and Rider, 2018)

Martin Heidegger argued that the ontological structure of the world unfolds through interactions, an idea supported by Paul Dourish (1999), who argued that the world is not given or something to be discovered but rather something that unfolds in situations. The 3D-printed real-world prototypes developed for this project were examined as the best-structured information source of the theory development (rather than text-based information data source as in other sciences). Visiting and revisiting the tangible real-world material scene as the research changed and developed required Luca's experienced nature of the specific movements in the context, and this involved a consideration of how subjective illusion adapts dynamics into the cortical motor-loop-specific movements. Ontologically, the prototypes developed for this work have a probe and reprobe material data structure with dynamics and uncertainty that trigger the domain of human experience. To improve the prosthesis prototypes developed the information gathered by the response to action-oriented touch and vision – senses that extend perception. The 'exploratory tool of touch and animated vision' in digital craft are considered the dominant parallel sensory modalities with which also a designer works. These two modalities are closely related to the (body) image and the (body) schema in knowing ourselves and detecting the material environment. These two modalities are closely connected to the (body) image and the (body) schema in self-recognition. Through these modalities, we recognise both consciously and unconsciously the world around us, therefore affecting the basics of our culture (Carruthers, 2007). The implicit and explicit representations of sensory understanding of ourselves and the material environment (biological, artificial) in the process of prototyping are a vital part of understanding co-Ability theory in relation to how we connect with our material environment. Margolin and Margolin (2002) have discussed that as the 'broader understanding of how to design for social need might be commissioned, supported, and implemented' when the 'population in need' is

connected directly with 'design for development', the ideas are often borrowed from 'alternative technology movement, which has promoted low-cost technological solutions'. Recent years have seen designers attempting to develop solutions to a wide range of societal challenges. By incorporating the users' needs in the processes of design, workaround solutions can advance co-creation and co-production processes for innovation. In direct cooperation with Luca Szabados, we became partners in the design process, contributing our specific skills into the development process through discussions of Luca's lived experience. Interactive modalities in the prototypes were guided by Luca's personal sociopolitical needs and essential skills that are often implicit and non-verbal. The design process can mediate exploratory prototyping cycles of future possibilities with a 'plausible', 'possible', 'preferable', and 'probable' set of concepts of new social, economic, or political roles for all societies. Involving a person with a disability in research brings social sciences and critical philosophy in posthumanism into design discussions. Questions relating to how we might address issues for 'marginalised' populations invite a consideration of the historical foregrounding of complex phenomena of a normalised society affecting every human being (Barnes, 1996; Goodley et al., 2014; Gustavsson, 2009).

The methodological approach of the co-design framework

Understanding the dynamics of co-design was not a linear process, as it continued to evolve until the end of the research. Sanders and Stappers (2008) describe designers in the co-design method as facilitators in problem-seeking with the goal of bringing up new situations to move forward without a precise goal for a terminal problem solution. In co-design contexts, a designer's mental process is called a ‘neverending jagged line of opportunity-driven approach’ (Conklin, 2005). This constantly evolving process in the problem setting of social situations is influenced by time and progress. Therefore, it focuses on human aspects that are continuously evolving as well and attempts to align new challenges and environments with micro solutions. In this research, the co-design assemblage established the principle of knowledge by the four key players mentioned earlier. The four entities interacting on three different relational levels (layers of theories, competence and physical presentation) compass a micro-network articulating the theory development of co-Ability. The co-design case study method here situates the role of a designer not as an external expert but rather as a participant in the research (Cross, 1982; Höök et al., 2018; Tomico Plasencia, O. et al., 2012). Also considering the digital technology for co-creation in this project reflects on how data variables were mapped into the artefact while creating digitally crafted physical manifestations of the action-oriented data. The process was similar to a traditional crafting process, altered with a documentable data transfer between technological elements (computer, 3D printer machine) and humans. The process of transference between the visual and physical existence of the prototype alters the information data into a textualised code that controls the 3D printer's movements; this then produces the computed visual model and the physicalised prototypes, which are comprehensible to humans. After each printing session, the printed parts required hand-crafted post-production, which offered significant feedback through sight and touch as the physicalised real-world data were actively viewed and handled. Action-specific movements with interaction modalities (the animated vision and the exploratory tool of touch) enable a better understanding of the information manifested in real-world data of the tangible product (Ballard, 1991). The role of emergent knowledge in

prototypes becomes the extended organ of physiology for the designer in the co-creation phases of digital manufacturing; we adapt our actions in response to detected information using these extended organs of physiology in the material world that exists beyond our body. It is not easy to transfer nonverbal knowledge when the format of sharing is text-based, it is implicit owing to its physical nature, and errors such as long printing hours render it explicit again. Therefore, it is essential to dwell on errors and difficulties to continuously understand the working procedures, as Richard Sennett states in 'The Craftsman' (2008). The particularity of the co-design activities with Luca provided directions to situative reflective discussions on and physical investigations of prototype artefacts. Prototypes presented a new synthesis of the ideas that we discussed, taking into account a special kind of aesthetic that could function as both a social symbol and political emblem for Luca. The visual appearance of the prototype carried a more profound, integrative argument on stigma and divergence from the negative perceptions of difference (deviance). As a matter of principle, the testing of the prototype centred exclusively on Luca's experiences while I was in charge of transforming Lucas's experiences into explicit wisdom so that they could be implemented into tangible objects. The action of use defined the shape of the prototypes. As Longmore (2003) argues, 'The disability perspective, the insights, experience, and expertise of people with disabilities, must inform research, producing new questions and generating new understandings. At the same time, academic researchers can help bring new rigour to the disability rights movement's analysis and activism'. The unusual prosthesis shape affected and placed its representation that oriented new perceptions of the prosthesis prototypes. The meaningful character of social action of the co-design process was invigorated by material reality. The tangible reality of the prototypes strengthens the objectivity of the interpretive paradigm of social reality in research.

Evidence data in artefacts

> *Different types of research method can provide different kinds of evidence which, when seen as a whole, can provide a 'rich picture' of the issue being investigated.* (Gray and Malins, 2004).

The narrative of co-Ability phenomenon is supported by evidence provided by the prosthesis prototypes. The representation of the data evidence appears mainly in illustrative drawings, 3D models, photographs, and 3D prints. Two data sets with different prototype functions are discussed below. The first focuses on supporting a flat surface, and the second is an attachable modular grip element.

Figure 5: Large number of prototypes. Photo by Márk Lakos

The exploration of the complexity of a social phenomenon of Luca's lived experience generated a large number of prototypes with various levels of execution. The prototypes do not communicate the designer's excellence in the power of care for disability. The artefacts consist of the contextual and relational ambiguity suggested by (Gaver et al., 2003): 'Contextual ambiguity can question the discourses surrounding technological genres, allowing people to expand, bridge, or reject them as we see fit. Relational ambiguity, finally, can lead people to consider new beliefs and values, and ultimately their own attitudes'. The discursiveness of the prototypes points to the viewer's affinity towards normative expectation by deliberately pursuing Luca's functional needs with a non-bionormative, non-human design (Mori et al., 2012).

The central theme for the primer prototypes

Together, we outlined those elements of Luca's routine for which a designed aid might improve her performance in her work. 'Disability is not a personal characteristic but is instead a gap between personal capability and environmental demand' (Verbrugge and Jette, 1994).

Supporting a flat surface on a table could serve Luca while working with a utility knife. Using a cutter is a daily short-term work-related task for Luca. Whereas the design for upper limb prostheses is most commonly associated with grasp movement (e.g., to enable one to hold a cup or grasp a doorknob), we identified with Luca that a simple mechanical tool to support something on a surface would be more useful (e.g., for holding paper in place while cutting). To produce a tool for such a simple task, it was not necessary to involve cybernetics or bioengineering, both of which are often associated with prosthesis developments. 'Efforts to improve prosthetics and orthotics resulted in a speciality that adopted scientific principles and engineering methodologies' (Tate and Pledger, 2003). Digital technology affected the production time and the production of the artefacts instead. The prototype components were developed with rigorous technical practice to eliminate the necessity for any external materials such as glue or screws; instead, the objects were designed to be assembled by interlocking.

Figure 6: Luca Szabados testing the prototypes; cutting with a cuttler. Photo by Andras Ladocsi

Figure 8: Modular element for card games. Photo by Renáta Dezső.

A secondary theme for the prototypes

Patterns for future predictions on other situations in which an artificial tool could be useful for short-term use appeared throughout the course of the research. Several short-term activities were considered in playful discussions, such as food preparation or holding a card pack in card games. In light of this, a new secondary theme of prototypes emerged; these would require adaption to the elbow stump and thus presented alternative modularity for further developments. The aesthetic outcome communicates the complexity of the subject from contrasting angles, and the modularity encourages the exploration of alternative strategies in

additional design. The modular elements have a single ball as a rolling element that is locked into the central bearing bed.

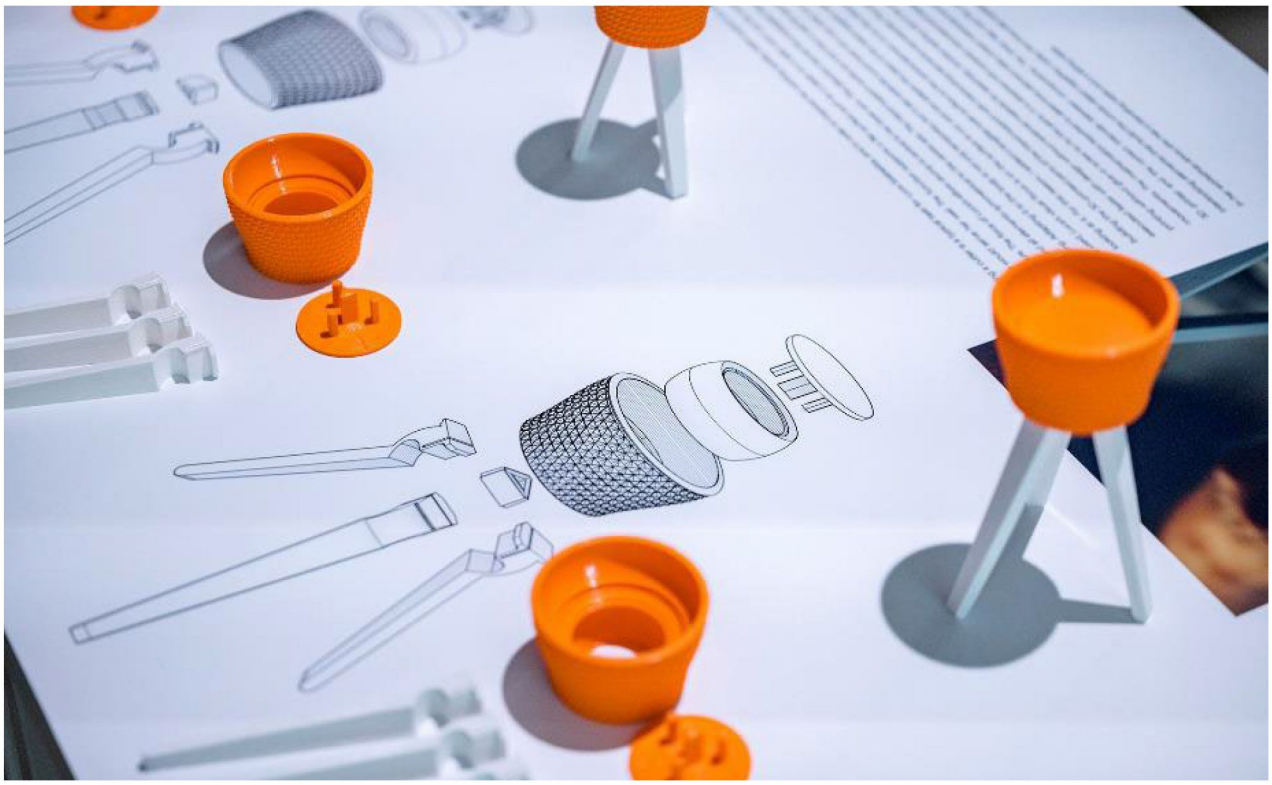


Figure 9: prototypes and technical drawings at the dissertation defence. Photo by Màrk Lakos

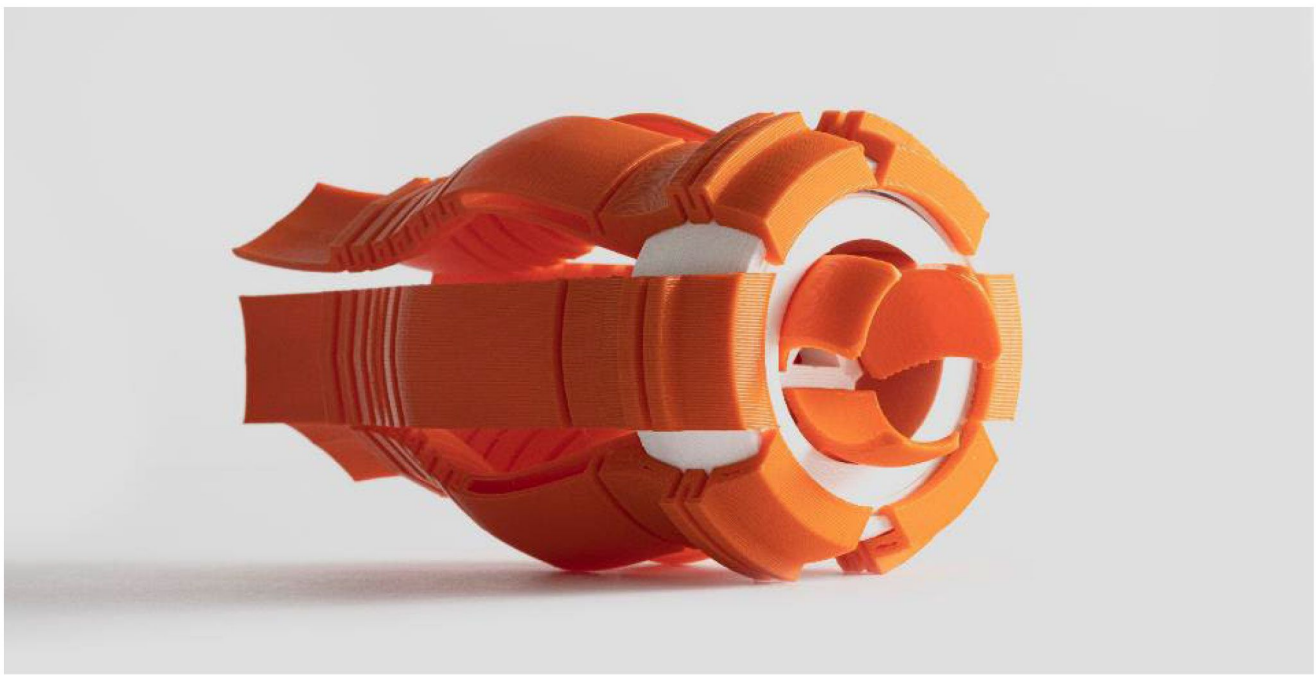


Figure 10: 3D-printed modular grip prototype. Photo by Marcell Kazsik

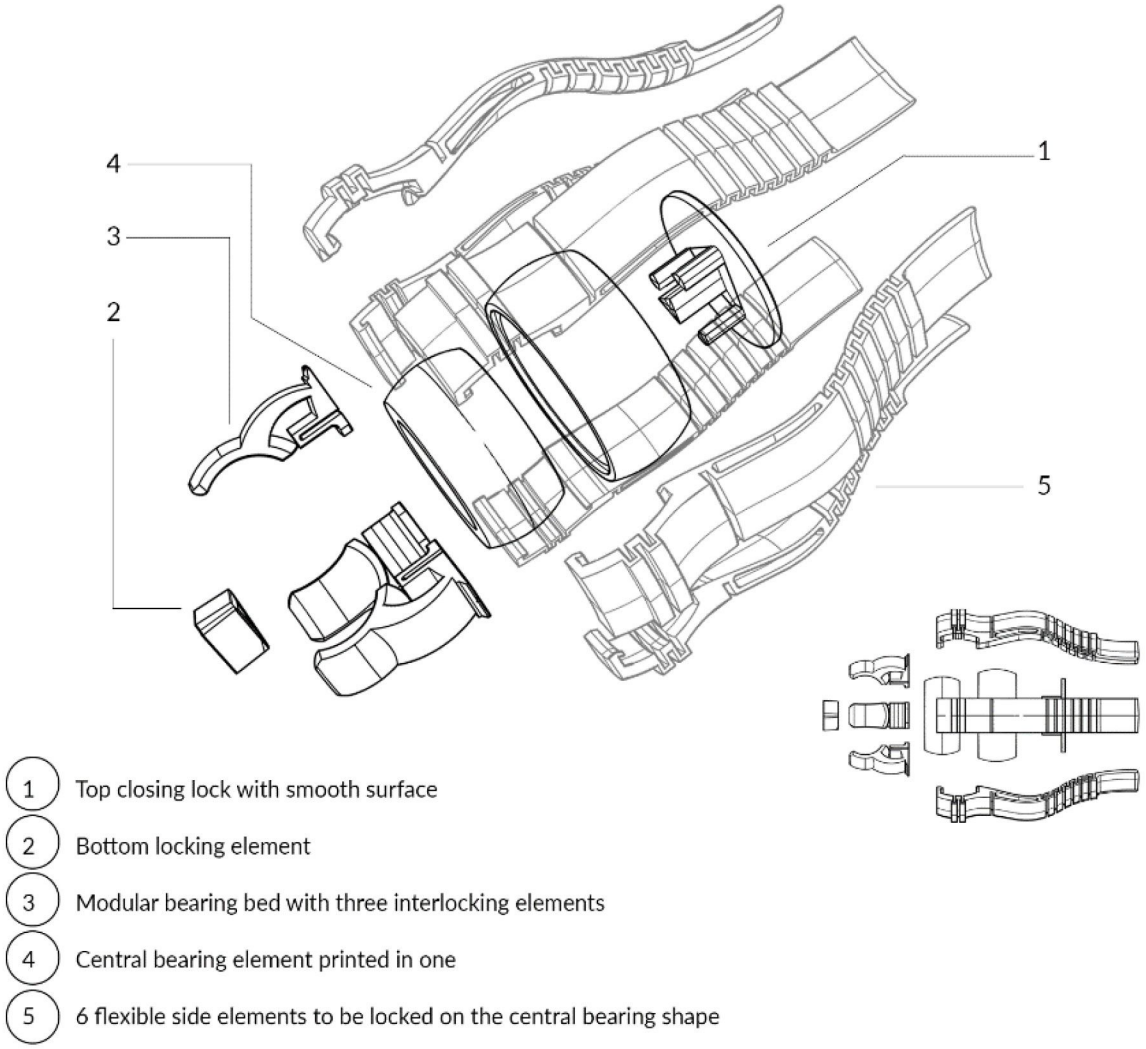
> *The more we examine our data from different viewpoints, the more we may reveal-or indeed construct their complexity.* (Coffey and Atkinson, 1996)

It is a challenge to adapt the design to an elbow stump shape that is constantly changing in movement, especially given the rigid nature of the material condition of Polylactic Acid Plastic (PLA) printed prototypes. Ideating from the double Gaussian curvature laser cutting wood

technique, I modelled a flexible attachable element that could be clicked on to the central bearing bed. With this adaptive element, Luca could take the prosthesis on or off in a matter of seconds without much attention needed.

Figure 8: 3D-printed modular grip prototype. Photo by Marcell Kazsik

Figure 8: Objects designed to be assembled by interlocking. Photo by Marcell Kazsik



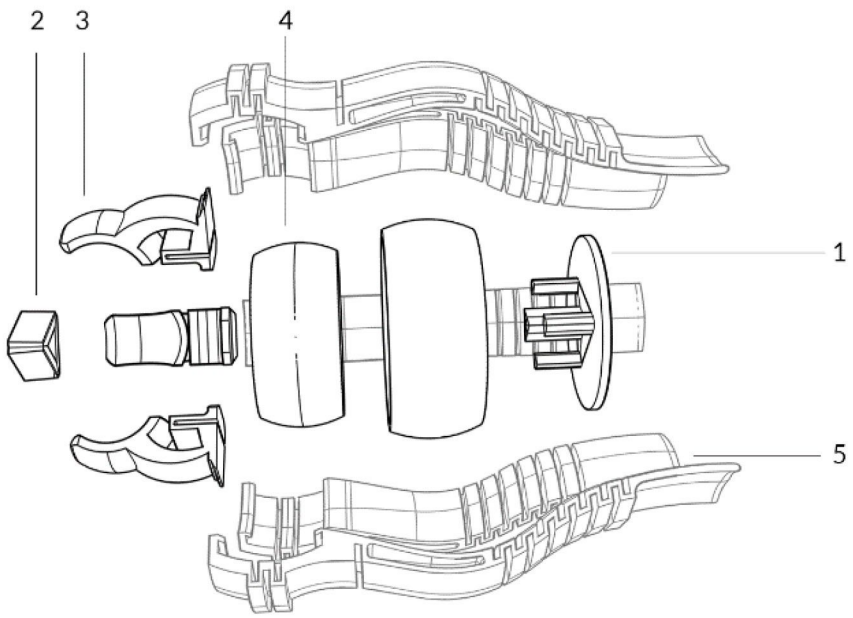


Figure 9: Exploded view of the central part of the modular model

To experiment with the idea of modularity, two directions were created. One is a general autoclip forceps; the second is a large mouth clip for card games, which was made especially at Luca's request.

Research through prototypes and conclusion on theory development

The empirical study for the theory development in this doctoral research includes an exploration of RtD methods (i.e., experimental research based on a case study) (Buchanan, 2007; Gaver, 2012; Koskinen et al., 2012; Zimmerman et al., 2007). Designing an aesthetically pleasing artefact or developing prototypes that lead to market-ready products was not the study's primary aim. Rather, focused research produced a chain of prototypes that supported the theory development and represented the thesis. As it has been argued elsewhere, 'The development of prosthesis created with collaborative design practice should not target only methods of solving design problems, but also informal and social interactions in posthuman collection' (Dezső, 2019). According to Visser (2006), an expression such as 'design is not problem-solving' is an abbreviated form of the idea that 'many design tasks constitute no problem-solving tasks for the designers in charge of these tasks'. Visser goes on to note that

> *The focus on 'real design' points toward design as performed in a designer's usual working situation—rather than in artificially restricted conditions, such as laboratory experiments. (Visser, 2006)*

The research framework is built upon the situated design perspective introduced by Lave and Wenger in 1991. This approach recognises the intricate interplay between the human context and the design process, a concept further developed by Terry Winograd in 1996. The research applies a situated approach that examines the interaction between the object and the body, drawing upon Schön's ideas of reflective practice, reflection-in-action, and knowing-in-action. Meaningful variation in secondary data present in the prototypes of this single case study, which provided two groups of datasets to be physicalised fast-prototyping. Transforming the view of 'forces of production', the tangible material conditions of the prototypes proved to be a reliable instrument for mapping out and building up a view of co-Ability. Entering into 'relations of production', the argumentative nature of discursive prototypes entails a better understanding of human-centred normative visions of our world. These prototypes are argumentative in nature, as they lay out the viewer's nonverbal, normative expectations and invite discussion. Prosthetic artefacts that combine contextual and relational ambiguity question the' discourses surrounding technological genres, allowing people to expand, bridge, or reject them as they see fit. According to Gaver et al. (2003), relational ambiguity can prompt individuals to reconsider their beliefs and values, leading to shifts in attitudes. Drawing on Carroll and Kellogg's (1989) argument, prototypes can be seen as a "theory nexus", encompassing the philosophical, functional, aesthetic, and social dimensions of design. I also agree with Kettley et al. (2015) that as design research becomes more involved in areas that affect our wellbeing, a structured approach can support researchers in their work.

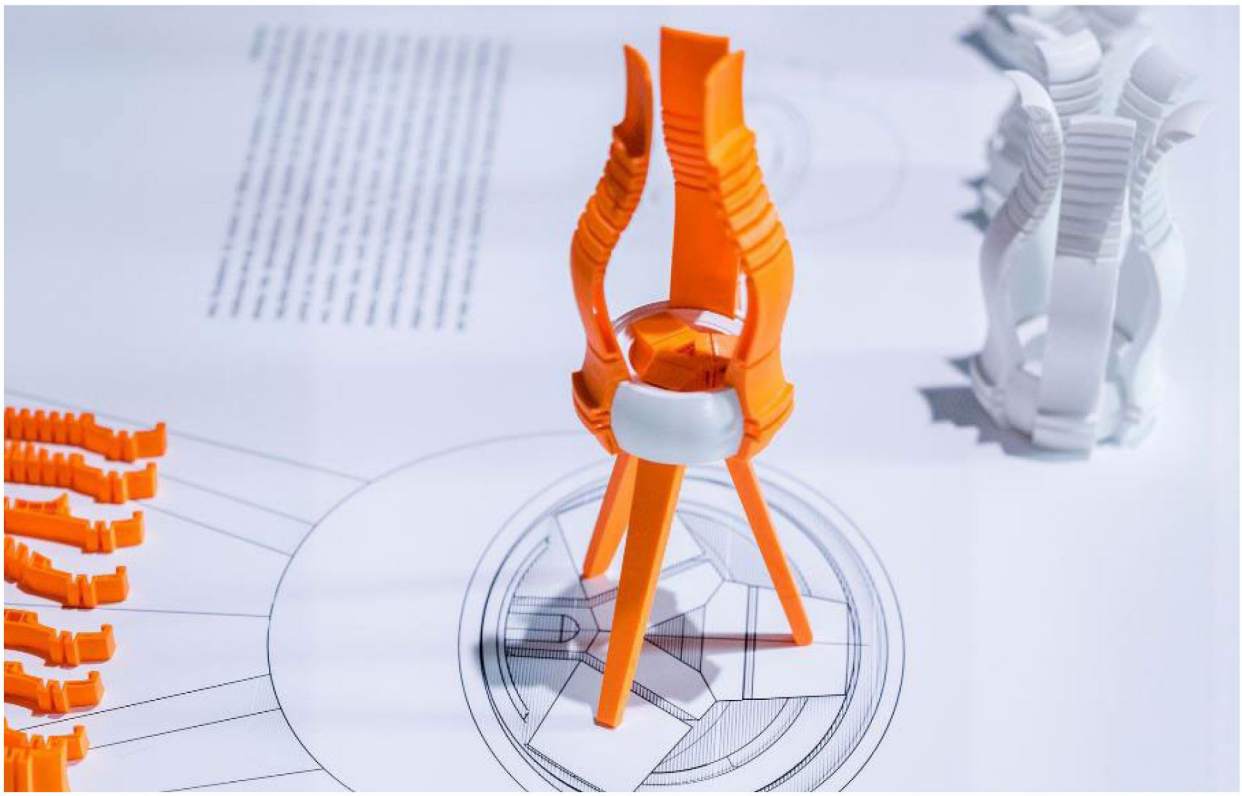


Figure 10: 3D-printed prototypes and technical drawings. Photo by Màrk Lakos

The analysis reveals that this research generated a corpus of data on design artefacts that enables one to engage with questions relating to the intersection of co-Ability and design. In light of the rhetorical approach, repeatedly creating and refining initial prototypes with multiple probes and reprobes until the prototype data become familiar is a necessary step toward action orientation. The practical action required in this context is represented in the prototypes. The 'rigour in research' is embedded in the chain of reasoning that emerged during the process documented in the prototypes (Biggs and Büchler, 2007).

Figure 11: 3D-printed prototypes. Photo by Màrk Lakos

The appearance of a prosthetic and its alignment with the perceiver's affinity with non-bionormative prostheses, which intentionally avoid a human-like appearance are interconnected. As Gray and Malins (2004) argue, 'The context in which the evidence [i.e. the artefact] is being used is important, as what counts as evidence in one particular context may be unacceptable in another'. To quantitatively validate the concerns in this paper, the research method does not necessarily need to be repeated, but the artefact/prototypes could be reproduced with further open-ended development.

The social design discussed in this paper focused on Design for Social Innovation and Sustainability (DESIS), a strand of design practice with objectives and processes that aim to lay the foundations for social change. The research focused on the relational network of elements while the attention shifted to instigating change for any community. To achieve sustainable social change, the paper suggests altering the patterns of what is considered "normal" by fostering new perspectives that take into account co-Ability. The term refers to considering the idea of 'ability' as a distributed phenomenon rather than an individualised trait. To trespass the normative vision of individual traits and promote shared competence in many occurring everyday life contexts could creatively and innovatively challenge human-centred societal issues with a high degree of uncertainty.

Overall, the paper emphasises the role of prototypes in promoting social change and offers insights into how design practices can be used to create more equitable and inclusive communities.

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