

Beyond Function: A Multi-Platform Analysis of DIY Prosthetics and Maker Narratives

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Abstract

This paper investigates the motivations, practices, and functional adaptations within DIY prosthetic-making communities. We analyze 80 publicly shared prosthetic artifacts across open-source platforms and 26 maker-generated videos from global creators. Through inductive thematic analysis and artifact coding, we identify six key motivational categories: comfort and adaptation, functional empowerment, aesthetic integration, emotional healing, task-specific design, and cost reduction. Our findings highlight how users and caregivers modify or build prosthetics not only to regain physical ability but also to reclaim agency, express identity, and adapt to specific life scenarios. Together, these findings illustrate how grassroots innovation reimagines prosthetic design as a space for creativity, community exchange, and resistance to one-size-fits-all approaches. This study contributes to accessibility research by deepening our understanding of user-driven prosthetic design and demonstrating how personal fabrication tools empower people with disabilities to address complex needs often overlooked by clinical and commercial systems.

CCS Concepts

• Human-centered computing; • Accessibility;

Keywords

Prosthetics, DIY, makers, customization, digital fabrication

ACM Reference Format:

Mingqi Wang and Leila Aflatoony. 2025. Beyond Function: A Multi-Platform Analysis of DIY Prosthetics and Maker Narratives. In *The 27th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '25)*, October 26–29, 2025, Denver, CO, USA. ACM, New York, NY, USA, 7 pages. <https://doi.org/10.1145/3663547.3759717>

1 Introduction

Prosthetic devices are essential tools that support not only mobility and independence but also emotional well-being and identity [1, 3, 11]. However, the global market for commercial prosthetics remains limited by high cost, lack of personalization, slow distribution channels, and dependence on medical infrastructure [2, 18, 25].

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ASSETS '25, Denver, CO, USA

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ACM ISBN 979-8-4007-0676-9/25/10

<https://doi.org/10.1145/3663547.3759717>

These challenges have prompted a growing movement of do-it-yourself (DIY) makers and designers to explore alternative methods for fabricating and sharing prosthetics [5, 16]. Online communities such as Thingiverse, Instructables, and e-NABLE host hundreds of open-source prosthetic designs, varying in fabrication methods, cost, and intended use [7, 9, 27]. DIY prosthetic designs demonstrate a wide range of functional goals, from basic grasping and gripping to fine motor dexterity, rotational or translational movement, sports-specific support (e.g., impact absorption or load-bearing), and even mobility prostheses for lower-limb users [23, 28]. Some designs focus solely on aesthetics or fashion, serving as wearable expressions of identity or style rather than assistive tools [4, 29]. Across this landscape, there is an increasing attention to aesthetic customization and self-expression, where users integrate engravings, textures, cosplay elements, or fashion features into prosthetics to reflect their personal or cultural identity [21, 26].

As personal fabrication tools become increasingly accessible, DIY makers have also innovated in areas such as cost reduction, modularity, and material adaptability [17, 30, 31]. From 3D-printed and recycled materials to soft robotics and inflatable structures, users are devising creative solutions to reduce cost while enhancing comfort and adaptability [8, 18]. Some projects focus on task-specific customization, such as prosthetic tools for musical instruments, gaming, swimming, or weightlifting [22, 23]. Others introduce automation and sensory augmentation, integrating features like motorized joints, temperature sensing, or haptic feedback to improve usability and perception [10, 20]. Despite this flourishing ecosystem, little is known about the motivations behind these designs, how users navigate trade-offs between form and function, or how open platforms shape design dissemination and remix culture [4, 24, 32]. Moreover, while much research has focused on the potential of maker culture and open-source AT, few studies examine these practices across artifact and narrative forms [6, 18].

This study addresses existing gaps by analyzing 80 DIY prosthetic designs alongside 26 maker narratives sourced from open-source repositories and video-sharing platforms. Using a combined approach of artifact analysis and thematic coding of video data, the study investigates how makers negotiate trade-offs among functionality, aesthetics, power, cost, and customization within the DIY prosthetic ecosystem. The findings aim to elucidate the user values embedded within DIY prosthetic innovation and to inform design recommendations for developing more inclusive, expressive, and adaptable solutions.

2 Related Work

The maker movement has enabled new modes of design participation, particularly in assistive technology (AT) and prosthetics, by lowering barriers to entry through accessible tools such as 3D printing and open-source sharing platforms [6, 18]. DIY-AT refers to AT solutions created by non-professionals, often users themselves or their close networks, as an alternative to standardized assistive devices. These solutions address gaps in affordability, personalization, and responsiveness to specific needs [12]. Much of the literature on DIY-AT emphasizes its potential for empowerment and customization. Making plays a key role in fostering self-efficacy among people with disabilities, while volunteer-based communities such as e-NABLE facilitate the large-scale distribution of prosthetic designs [14, 33]. However, these platforms often privilege technically skilled volunteers, which raises concerns about the exclusion of disabled users from meaningful participation in design [14, 19]. Several studies have pointed to the limitations of commercial prosthetics and the high rates of abandonment due to discomfort, social stigma, or mismatch with user needs [11]. DIY efforts aim to address these issues through both functional and symbolic customization; however, the risks associated with non-clinically tested devices remain a concern for both practitioners and users [8, 34].

A parallel body of work has examined the role of platforms such as Thingiverse in promoting open-source prosthetic innovation, noting that many assistive devices are designed and shared by non-professionals motivated by personal needs or the desire to help others [7, 13]. Remixing, a key feature of these platforms, can accelerate design iteration but may also dilute design quality or obscure original intent, particularly in the absence of user feedback [17]. Other research has explored how volunteers and clinicians navigate design tensions in collaborative projects, revealing gaps in expertise, risk perception, and communication [13, 30]. Despite growing interest in individual and volunteer-led DIY-AT efforts, there remains a lack of artifact-based and cross-platform analyses that examine broader patterns in maker motivations, material practices, and the emotional or symbolic dimensions of these designs [31, 35].

3 Methods

This study used a qualitative, cross-platform analysis of user-generated open-source prosthetic designs and maker videos. Both artifacts (physical and digital designs) and narratives (video testimonies) were examined to explore the motivations, strategies, and emotional values embedded in DIY prosthetic practices.

3.1 Artifact Analysis

We collected a sample of 80 prosthetic artifacts from open-source platforms, including Thingiverse, Instructables, Hackaday, Hackster, and e-NABLE. Search terms included variations of “DIY prosthetics,” “prosthetic hand,” “arm,” and “leg.” Artifacts were included if they were clearly labeled as upper- or lower-limb prosthetic designs, featured images, or build documentation, and showed evidence of intended use. Each artifact was reviewed and recorded with five attributes: main materials, fabrication methods, limb type, control type, and functionality. Data was extracted into a structured

spreadsheet that included: name, source platform, year, link, main materials, fabrication methods, limb type, control type, functionality, stated motivation, popularity metrics (likes/downloads). We then coded each artifact using an inductively generated schema that was iteratively refined throughout the analysis process. We then analyzed the artifacts and summarized the trends in material, fabrication methods, and functions. Codes emerged through repeated examination of documentation and images, refining definitions until they consistently captured the main characteristics of each artifact.

3.2 Video Analysis

Alongside artifact analysis, 26 maker videos were collected from platforms including YouTube, Bilibili (known for technical, longer content), TikTok/Douyin, and Rednote (featuring shorter, reflective narratives) using keywords related to DIY prosthetics and amputee life. Videos with maker narration or device demonstrations were included, showcasing individuals who built, modified, or reflected on prosthetic use for themselves or others. Multiple videos by the same maker were thematically consolidated, while distinct design cases were coded separately when relevant. Transcriptions were generated using automatic captioning tools and manually verified for accuracy. Quotes from M6, M14, M21, and M26 were translated into English.

3.2.1 Thematic Analysis of Videos. The qualitative data from maker-generated videos were analyzed using an inductive thematic approach following Braun and Clarke’s (2006) six-phase framework [6]. The first author led the analysis, with regular peer debriefing by the second author to enhance clarity and consistency. Analysis began with repeated readings of video transcripts to familiarize with the data. Initial codes captured recurring patterns related to design motivations, challenges, symbolic meaning, customization, and community interaction. Metadata such as speaker identity (e.g., user, parent, volunteer), design type, and aesthetic expression were also recorded. Coding was managed in spreadsheets, with rows for artifacts or quotations and columns for codes, notes, and emerging ideas. Codes were grouped into candidate themes based on semantic and conceptual links. To ensure rigor, analytic memos documented interpretations and theme development across iterations. Themes were refined through multiple reviews and axial coding into five core categories, detailed in the following section.

4 Findings

This section presents key themes from the thematic analysis of 26 maker videos (M1–M26) and 80 open-source artifact designs. Videos provided rich insights into emotions, motivations, and design intent, while artifacts revealed material strategies, mechanical functions, and structural innovations. Together, the datasets triangulate findings, with video quotes clarifying patterns seen in the artifact designs.

4.1 Artifact Analysis Findings

The artifact dataset highlights diverse, user-driven prosthetic innovations, ranging from grasping aids to yoga feet, that prioritize accessibility, affordability, and contextual fit. Often absent in commercial offerings, these designs reveal shared practices, fabrication



Figure 1: From left to right: (a) Prototyping Toolkit for Prosthetic Arm Extensions on Instructables ©Robbe Terryn; (b) 3D Printed Prosthetic Leg on Thingiverse ©Incept_3D; (c) Casting Detailed Parts: Prosthetic Fingers (That Glow, Change Colour with Heat, and More...) on Instructables ©Jude Pullen; (d) Solo Finger Pen on Thingiverse ©Bernie Solo

strategies, emerging norms, unmet needs, and grassroots ingenuity within the global DIY prosthetic community.

4.1.1 Materials, Fabrication Methods, and Condition. Most artifacts were 3D printed, primarily using PLA or ABS, with some employing TPU for added flexibility in wearable components. About one-third integrated electronics, while others incorporated mold casting, manual fabrication, thermoforming, or sewing—often in hybrid forms. The majority focused on upper-limb prosthetics, particularly fingers, hands, and wrists; lower-limb designs were less common. Body-powered systems (e.g., cable-driven, elastic tension) were most prevalent, followed by electronic, hybrid, and passive designs. Unlike the video dataset, few artifacts emphasized aesthetics, suggesting a technical, performance-focused orientation among platform contributors.

4.1.2 Functionality and Design Motivation. We define functionality as the primary use case or intended purpose embedded in a prosthetic’s design, encompassing both its practical mechanical outcomes and the maker’s underlying motivation. This definition aligns with the thematic categories identified in the video analysis and supports cross-comparison of design intent.

Grasping and General Grip: Many upper-limb devices support everyday grasping tasks, such as power grips or holding medium-sized objects. For example, the *Prototyping Toolkit for Prosthetic Arm Extensions* is a modular system for testing and iterating various grip configurations (Figure 1.a). These designs prioritize extensibility and replicability, offering functional support for routine activities such as eating and writing. Some artifacts, especially those with electronics, focus on fine motor control.

Mobility: Lower-limb prosthetics were less common, likely due to the limitations of low-cost materials in supporting body weight. However, several strong examples emerged. The *3D-Printed Prosthetic Leg* by Incept_3D features an adjustable socket, pylon length, and ankle articulation (Figure 1.b). The socket interior is also wrapped in soft internal lining for improved comfort. This project highlights the attention to user adjustability.

Passive Structural Support: Some designs function as non-powered anatomical supports or visual enhancements. The *Casting Detailed Parts: Prosthetic Fingers* project uses color-changing, glow-in-the-dark, or mixed-material casts to enhance both tactile experience and environmental feedback (Figure 1.c). These designs enhance practical use by incorporating features such as visual

temperature cues or visibility in low-light conditions, supporting multimodal sensory feedback.

Task-Specific Adaptation: Unlike most commercial products, many DIY artifacts are tailored to specific activities. The *Solo Finger Pen* aids handwriting for users with partial hand loss (Figure 1.d), while the *Prosthetic Foot* for Yoga offers a wide base for balance and stability. These examples show how users develop specialized tools for sports, work, or creative hobbies, where generic solutions often fall short.

4.2 Video analysis Findings

This section presents findings from the thematic analysis of 26 DIY prosthetic maker videos, summarized into five major themes: Comfort and Everyday Adaptation, Functional Empowerment, Aesthetic Integration and Identity, Emotional Healing, and Cost.

4.2.1 Comfort and Adaptability in Everyday Prosthetic Use. A central motivation expressed by several makers was the pursuit of comfort and adaptability in everyday life. Rather than viewing prosthetics as fixed devices, these makers emphasized the importance of user-defined use cases, with designs that could be swapped, adjusted, or removed depending on the context. In several cases, these changes were not about technical enhancement but about relieving physical discomfort, enhancing usability, or reclaiming bodily agency. One maker with above-knee amputations on both legs uses two different sets of limbs: tall prosthetic legs for walking and minimal plastic pads at home. This ability to switch configurations on demand reflects a need not only for efficiency but for bodily relief, as M1 stated, “I walked over 16,000 steps yesterday. [...] Now taking my tall legs off because they’re filthy and I don’t want to track dirt in the house. It’s like having a pair of slippers constantly that I can just put on makes life easier, a little more comfortable.” For other users, everyday comfort depends on the ability to quickly remove or change prosthetic components to accommodate shifting activities throughout the day. As M6 described: “With this little accessory, we can unlock a lot of different usage scenarios. Going through security checks, for example, is no longer a problem, you can do a quick-release in just one second and hand it to the staff for inspection. No need to unscrew anything, and attaching it again doesn’t affect the alignment of the force either.”

Makers also developed accessories to meet sensory comfort needs, especially under cold or wet conditions. M11 recalled sewing custom “toe cozies” for warmth: “When I first started wearing a

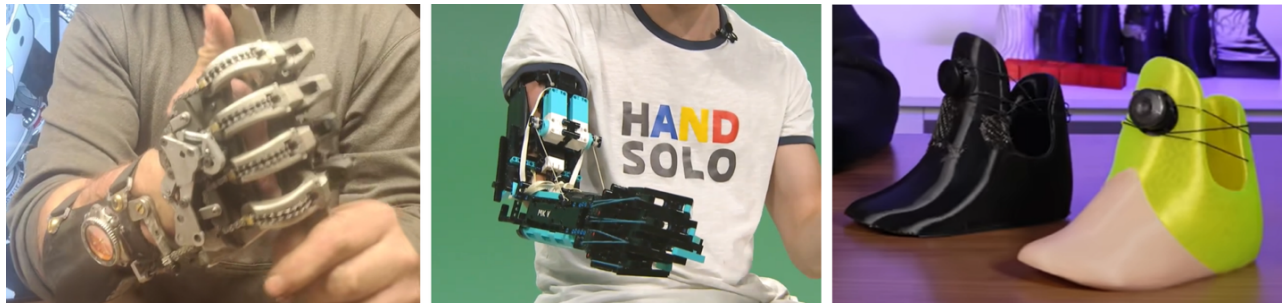


Figure 2: From left to right: (a) a fully mechanical prosthetic hand built for both power grip and precise manipulation on Tiktok ©Ian Davis; (b) a prosthetic arm constructed from LEGO bricks on Youtube ©World Intellectual Property Organization, featuring David Angular; and (c) a prosthetic foot designed for improved comfort, light weight, and affordability on Bilibili ©Owen来造.

prosthesis, my grandma came up with the brilliant idea of sewing toe cozies. They're just little foot coverings made out of any fabric that I picked out myself. And then she would sew it so that it would fit over the top of my prosthesis and my foot wouldn't get cold or wet." Several makers also linked comfort to custom fabrication techniques, especially through 3D printing. M14, who developed a lightweight and smaller prosthetic, stated: "Earlier this year, I made a 3D-printed prosthetic leg for the father of one of my followers. Compared to traditional prosthetics, it's smaller, lighter, and more comfortable and natural to walk with. But the question is, can a 3D-printed prosthetic really stand up to the demands of daily life?" These examples show that comfort is not just about fit or form but is a dynamic process influenced by environment, sensory needs, routines, and personal expression. Unlike traditional prosthetics with fixed designs, DIY makers view comfort as something to continuously negotiate, redesign, and adapt according to their own needs.

4.2.2 Functional Empowerment in Task-Specific Prosthetics. While commercial prosthetics often support general functions like walking or gripping, they frequently fall short in task-specific contexts such as sports, fine motor manipulation, or environmental adaptability. In response, DIY users develop targeted improvements that reflect both practical needs and their own creative or engineering capabilities. These adaptations range from technically sophisticated systems to simple, elegant workarounds. For example, M1, a mechanical engineer, developed multiple iterations of fully mechanical finger prostheses. His design achieves both a secure grip under load and the ability to manipulate small objects, such as items a quarter-inch wide: "[...] I've been working on being able to grip tiny things. This won't matter to people who have all their natural parts, but check that out, that is roughly a quarter of an inch I'd be able to pick up."

In a related project, the same maker constructed a prosthetic golf adapter for a bilateral upper-limb amputee. His design allows for a repeatable swing motion and precise angular control: "So here it is, version three of the golf gadget that I'm building for a local amputee. [...] Moving down the bracket brings us to a super beefy four-plate hinge that allows the motion usually afforded by the golfer's wrist. The next feature of this bracket is the radial locking

plate. This establishes the angle of the club in relation to the golfer's forearm." In similar cases, prosthetic innovation was driven by the need for automation or precise mechanical control. For example, M15 used LEGO bricks to build a strong and advanced prosthetic arm with a button-activated mechanism that improves range of motion with minimal physical input (Figure 2.b). Upper-limb users also described the physical effort required to operate devices during exercise. To address this, M18 developed a barbell-gripping solution with a locking function and modular harness designed specifically for upper-body workouts. M25, a maker with a background in snowmobile racing, constructed a prosthetic leg modeled after a shock-absorbing suspension system, allowing him to return to dirt biking and snowboarding: "I faced a clear problem: I needed to absorb impact with my prosthetic leg the same way my quadriceps muscles used to. Since I was familiar with suspension components from dirt bikes and snowmobiles, I began to think of my prosthetic as a kind of suspension system [...] Seven months after my accident, I was racing dirt bikes on a leg I built in my garage." These examples illustrate how users move beyond conventional function restoration toward performance-specific optimization, emphasizing agency, creativity, and technical responsiveness to lived experience.

4.2.3 Aesthetic Customization and Identity Expression. While some prosthetic users prefer understated designs, others prioritize visual customization to express their individuality and make their devices feel more personal and seamlessly wearable. M4 shared how she layers a dress sock over her prosthetic to improve its appearance: "I have two prosthetic legs, but this is how I make them look fashionable [...] So what I do is I get this sock, it's just a dress sock from Target, and I put it on, I cover all my socks, I cover my liners with it, and this is how it turns out." M5 described gluing artificial toenails onto her prosthetic foot to match the appearance of her other foot: "Now, this is such a little thing that you can do with your prosthetic feet, but if you saw me walking down the street in sandals, unless you're staring at my feet, you wouldn't know that this is fake. And that is partly because I glue fake toenails onto my prosthetic foot."

M21 framed prosthetics as positioned between function and decoration. Their design for a specific user aims to make the prosthetic feel more meaningful: "In our earlier personal works, we had already explored the idea of prosthetic design. Prosthetics occupy a blurred

space between the body and jewelry—they are part of the body, yet they can be freely decorated. This ambiguity has been an endless source of inspiration for us.” Together, these examples show how visual choices help users make their prosthetics more wearable, presentable, or personally meaningful—even when the changes are simple or purely decorative.

4.2.4 Emotional Healing Through DIY Prosthetics. Amputation or congenital limb difference often brings emotional and social challenges. For some individuals, designing and building their own prosthetics is not only practical but also emotionally restorative. Creative engagement can help them regain confidence, navigate identity, and respond to stigma. M6 designed a 3D-printed shell to prevent the pants leg from collapsing and to help users feel more confident: *“This shell can meet many people’s personalized needs, and its main function is decorative. It also helps fill in the prosthetic and supports the pants—especially when wearing long pants. When the wind blows, it can look really awkward and empty without it. Why do I say this? Because many people who are injured, friends who are amputees, at first can’t accept themselves. But after having a shell like this, maybe they’re more willing to show their prosthetic and more willing to accept themselves.”*

M15 described how, after being bullied at school, building a LEGO prosthetic became a personal tool for self-empowerment and social acceptance. What started as a coping mechanism became a way to demonstrate his capabilities to others: *“When I was younger, I used to get bullied at school because I was a different guy. I was born with a genetic disease called Poland Syndrome, which is basically this I’m missing my right forearm. And then I played a lot with Lego bricks. That was my main escape route. And I decided to keep using those as innovation tools. So I built, when I was nine, my first Lego prosthetic to show the others that even with one arm, I can be equal to them.”* These examples highlight how DIY prosthetic creation serves not only functional needs but also fosters emotional healing, self-expression, and social empowerment.

4.2.5 Low-Cost Innovation and Self-Sufficiency. Cost remains a persistent barrier for many prosthetic users. Without insurance or institutional support, commercial devices are often prohibitively expensive, making affordability a common motivation for turning to DIY solutions. M10, an engineer, began designing a body-powered finger prosthetic for a family member after learning how costly even partial finger replacements could be: *“Unfortunately, only a few prosthetics companies manufacture body-driven prosthetic fingers, and they are often made of expensive materials offered at inflated prices. A single finger can cost thousands of dollars and is not an option for users without health insurance or with other complications, so a low-cost alternative is desperately needed. The goal of this project is to design a low-cost body-powered finger prosthetic that restores finger motion and function to the user.”* M14 echoed this sentiment: *“Why pursue 3D-printed prosthetics? What’s the real advantage? First and most obvious: cost. Of course, the design cost might not be cheap—but we’re talking about digital 3D data. These designs and solutions can be shared and adapted across similar cases—no need to start from scratch every time.”*

Several makers also voiced frustration with the disconnect between expensive, high-tech devices and the day-to-day realities of prosthetic use. M24, born without legs, described how commercial

options imposed unnatural movement patterns and costly repairs. In response, he built affordable alternatives using widely available materials: *“A prosthesis tethers you to the doctor or hospital that made it, which contradicts the idea of independence. [...] We built a solution. Our design principles: use parts you can buy on Amazon or at hardware stores. Keep it simple and standard. And liberate ourselves from the need to look ‘normal.’ Many disabled people walk differently—it’s called gait. Prosthetics tried to force me into marching like everyone else, which felt weird and unnatural. So instead, we kept my movement patterns and center of gravity the same, ditched normality, and focused on making me move faster for cheaper.”* These cases show how cost motivates designs that are not only affordable but also adaptable and better suited to daily life, bodily changes, and long-term use.

5 Discussion and Future Work

This paper presents a cross-platform analysis of DIY prosthetic designs and maker narratives to understand how and why amputees and caregivers engage in personal fabrication. Drawing on open-source artifacts and video-based thematic coding, we find that DIY prosthetics address a wide range of physical, emotional, and social needs. Makers modify designs not only for comfort, task-specific functionality, and cost reduction, but also as a means of self-expression, agency, and healing.

DIY efforts extend beyond replicating commercial devices; they represent personalized adaptations shaped by lived experience. While artifacts reveal structural trends and fabrication strategies, videos foreground user voices and motivations often absent from technical documentation. Together, these datasets show how DIY practices reimagine prosthetic design as a space of creativity, community exchange, and resistance to one-size-fits-all approaches. This research contributes to HCI and AT by centering user-led innovation and offering an empirically grounded view of how prosthetics are conceptualized, built, and experienced across contexts.

Our findings align with prior research showing that maker-led AT production often operates outside traditional clinical pathways, balancing innovation with practical constraints [13, 21, 30]. At the same time, studies suggest embedding maker skills into clinical practice to improve customization and responsiveness [15] and emphasize the need for governance models that balance rapid prototyping with regulatory and safety requirements [14, 17]. Although safety is a critical factor in prosthetic design, it was rarely mentioned explicitly in our dataset. While makers value the open sharing of designs, this raises questions about quality assurance and regulatory compliance that echoed in Lakshmi et al.’s (2019) study of point-of-care manufacturing [17]. Informal testing and peer feedback were common, but formalized safety checks were rare. This absence may be due to the nature of maker platforms, where creators showcase completed designs rather than document risk assessment processes. The projects and videos published online stand out more in their creativity and customization rather than technical assessment.

Future research should explore how DIY prosthetic practices can be supported, scaled, and sustained while preserving the creativity, adaptability, and user ownership that define grassroots innovation.

This includes investigating how makers navigate safety and durability concerns throughout the prototyping and usage lifecycle, and identifying community-driven strategies for informal quality assurance. Building on the strong culture of customization observed in this study, further work could examine how design-sharing platforms, modular toolkits, and open-source standards might lower barriers for newcomers while fostering knowledge exchange among experienced makers. Longitudinal studies could track how designs evolve in response to wear, feedback, and changes in the maker's needs or environment, providing insights into long-term usability. Additionally, cross-regional comparisons could reveal how cultural norms, infrastructure, and policy environments shape the accessibility, dissemination, and sustainability of DIY prosthetic innovation.

Limitations include a bias toward technically skilled users who share their work online, limited linguistic and geographic diversity in the video sample, and reliance on public-facing content that may obscure nuance without direct interaction. Future work will involve direct engagement with DIY makers, clinicians, and end-users to deepen understanding of design processes, community dynamics, and the translation of open-source prosthetics into safe, sustainable real-world use.

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