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Qualities of Physical, Everyday, Interactive Things: an Exploration of Keys

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ABSTRACT

Daily interactions with things are becoming increasingly virtual and hidden, tucked away in minimalist UI's or dependent on clear voice commands. Motivated by a love for physical interactions, this work uses keys, a mundane, everyday technology, as our object of study, identifying what is being 'designed away' in the process of digitalization. This is achieved through a collection of found objects, material samples, and design probes. We present a visual exhibition in pictorial format, where each piece represents material qualities of physical, interactive artefacts. We conclude by discussing how the embodied qualities of these artifacts can be extended to the broader landscape of everyday physical things. Our work contributes to the TEI community through both the tangible artifacts and the identified qualities for designing future *physical, everyday, interactive things*.

Authors Keywords

Key; interaction design; fabrication; collection; tangible interaction; craft; research through design

CSS Concepts

• Human-centered computing~Human computer interaction (HCI)~Interaction devices

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INTRODUCTION

Keys are interactive artifacts embedded in our everyday lives; we carry various forms of physical keys with us to access our homes, workplaces, and vehicles. In the last decades, our pockets have been increasingly filled with plastic access cards and tags: lifeless, nondescript objects that break and get lost, further replaced by electrophysical entanglements with minimal material interactions, such as passwords and fingerprint readers. These shriveling interactions, mandated through access and security systems, both enable and control our everyday movements in and out of spaces. Although a symbolic power, for example, in language, keys seem to be disappearing, replaced by meaningless and sometimes uncomfortable interactions [36].

We present a curious exploration aimed at understanding the gap left by physical keys, an exploration of what is being *designed away* from access artifacts [63], and what is possible in this space. Here, we present explorations of what we find "aesthetically pleasing physical engagement" [46] through speculative design of digital keys. Following a research-through-design (RtD) process common in HCI [24], our work included using and reflecting on found pieces, making material explorations, and designing pieces closer to research products [44].

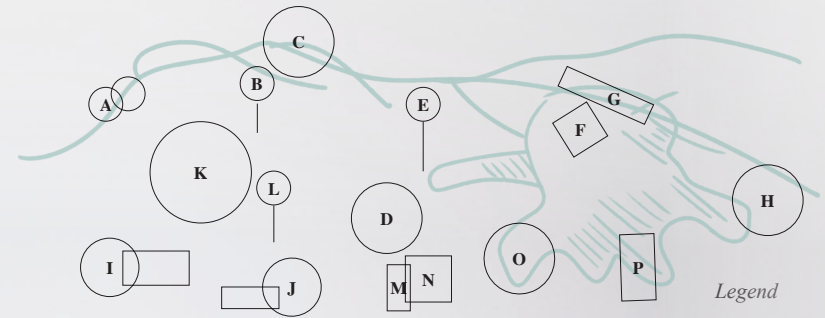
The found objects impacted our process by embodying material qualities that we often find lacking in common digital keys. The materials samples reflect explorations of the possibilities of different making processes, and the final set of products represents designs that we personally would want to use. Each object has been evaluated hands-on in

terms of its qualities, and some as part of everyday life. Using a visual analogy of an exhibition, we first show the full collection of artefacts (Fig. 2), then the found objects (Fig. 3-6), followed by material samples (Fig. 7-10), and design probes (Fig. 11-20). The images are accompanied by descriptions, the connected quality, and, where relevant, stories of their making and use. Furthermore, we unpack these design qualities as embodied in each artifact, then discuss these aspects in terms of what is *designed away* in physical, everyday, interactive things.



Figure 1. Teaser image. Partial view of the full collection, with a number of artifacts shown against a light background, and with branches to provide support. The picture is annotated with explanations of the format, with qualities highlighted in green.

THE COLLECTION



A. Tag enclosures

Leather, fabric and bioplastic. Fig. 19

B. Product key

Electronics and 3D printed plastic. Fig. 11

C. Amulet key

Soldered silver wire, cut glass stone, resin. Fig. 14

D. Ceramic bracelet

3D printed ceramic, glazed. Fig. 18

E. Floral key

Found object, probably late 20th cent. Fig. 4

F. Clay form study

Hobby grade air-dried clay. Untreated. Fig. 8

G. Recycled bracelet

Molded and 3D printed PLA plastic. Fig. 8

H. Solid plastic bracelet

3D printed ASA plastic, magnetic closure. Fig. 10

I. Vintage padlock

Found object, probably early 20th cent. Fig. 3

J. Glass form studies

Made in a traditional glass forge. Fig. 7

K. Concrete bracelet

Molded and reinforced concrete. Fig. 9

L. Key pendant

Found object, nickel plated, cont. Fig. 5

M. Digital security key

Gift, commercially available [52]. Fig. 6

N. Metal form studies

Steel and brass. Cut and sanded. Fig. 4,7

O. Copper bracelet

Cold forged, untreated. Fig. 15

P. Wood form studies

Ash and oak. Oiled. Fig. 7

Figure 2. The collection.

BACKGROUND

Keys and locks have been around for a very long time, with historical finds present all over the globe, and pieces dating back to ancient Egypt, circa 2000 B.C. Keys vary in form and feature, from toothed metal pieces that need to be inserted and turned to contemporary cards and tags that need to be presented to or simply detected in the vicinity of a reader. In this collection, we focus on keys typically used in and around the home, part of everyday life. In the context of interaction design, there are many reasons why we keep some artifacts in our lives beyond being practical or useful, including notions such as preciousness [64–66] and heirlooms [4, 10, 34, 46], functional and material qualities [70], craftsmanship [10], physical engagement [46], and intimacy over time [5]. Among them, jewelry is an interesting notion in this context, which, from a research perspective, has been addressed as “enhanced” [50] or framed as a memento [71], with designs focused on expression [73], or made “durable” [4], where most focus on practical, rather than experiential qualities in the interaction.

From the perspective of tangible interaction research, the everyday is constantly being reimagined for “sensory enrichment” [28], adding feedback in the form of sonics [43], pneumatics [56], and thermals [29] or sensing capabilities [55] to enrich the experience. Contactless interactions have been extensively explored; in particular, RFID and NFC are well established [42], e.g., added to nails [68, 69], enhanced [58], and used in a variety of interfaces [2, 33, 35], showing emergent and sometimes unwanted interactions as a result [36].

Found pieces has shown generative in research both as craft material [11], and for its symbolic value [51, 52]. Further, material explorations are common in tangible interaction research [6, 13, 14, 32] and, finally, high-fidelity prototypes used in everyday life that draws from the notion of *research products*, [44], to examine and unpack qualities emergent when living with these artifacts [48]. We present this collection as design speculations on everyday things [8], ultimate particulars [60], consisting of keys and their inherent action [72] of unlocking.



Figure 3. Vintage padlock. Found object. Probably produced around the turn of the century. It's heavy, made of carbon steel, and has a particular pleasurable click when turned. While practical, this lock still has balanced proportions, and the key has some decorative features.



Figure 4. Floral key. This key, with floral embellishments and simple teeth, is a type commonly used to lock bedtable and chifonier drawers, a more intimate use. The floral pattern forms the handle of the key, becoming both a visual and haptic part of the interaction, while that area is worn shiny by use.



Figure 5. Key Pendant. This is a pendant for a necklace that is shaped like a key. With sparse ornamentation, and a polished nickel plating, this pendant is not a key in the functional sense, but uses the form of one for decoration. It's a key-as-embellishment, in contrast to the embellished keys above.

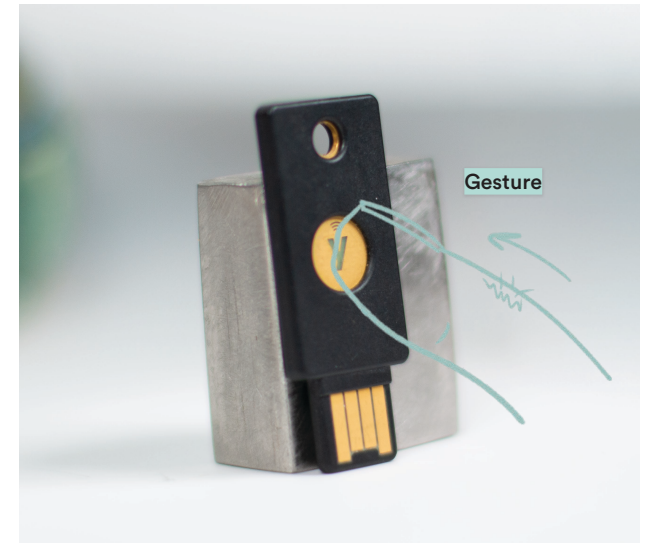


Figure 6. Digital security key. A contemporary commercial product [42], received as a gift from a neighbor when talking about this project. A device for two-factor authentication, it must be touched to activate, using its own materiality as a resource for security. Behind is a metal for study based on the shape of old lighters.

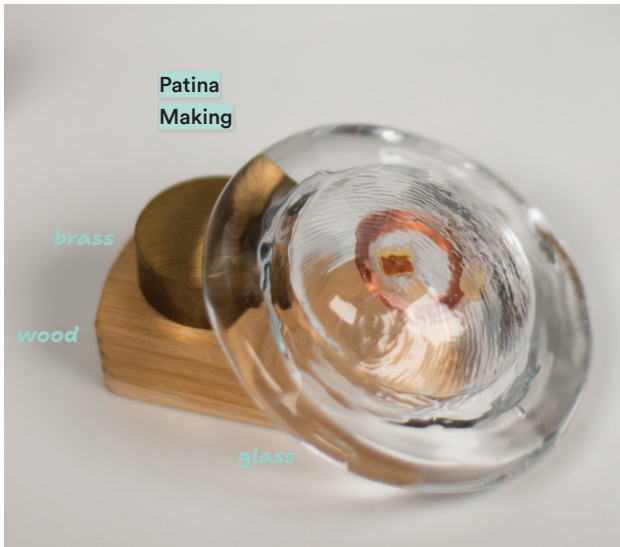


Figure 7. Material form studies. A large round glass tag, with a central copper antenna resting on two material samples of wood and brass. The glass is massive, with a soft ring around it. The wood is solid, reminiscent in proportions of a modern car key, and the brass is a short cylinder, like a stack of coins.



Figure 9. Concrete Bracelet. A massive bracelet in concrete made with soft and rounded shapes. Visible details are lines from the 3d printed and parting line of the mold, pitting from the rough cast, and a rough surface on top where the antenna was inserted in the pour.



Figure 8. Clay form study and recycled bracelet. A key tag in clay and a segmented bracelet in solid plastic. The tag is simple in form and thin enough to be worn as a necklace. The bracelet is bigger, with an elastic string connecting each piece. The swirling pattern of the plastic tells of the manufacturing process, upcycling 3d printed PLA.



Figure 10. Black Plastic Bracelet. A solid, slightly convex cross section, the hinge, lock and antenna slot visible, but following the surface. The wide proportions are more akin to a watchband or cuff, while the polished and scratched plastic is more akin to older bakelite products.

METHOD

Using a research-through-design approach, well-established in HCI [24], our process reflected stages of collect, craft, experience, curate, and construct.

First, the collection of reference pieces is common in both design and craft. Examples include mood boards for visual media or having garments and fabric samples on hand in the fashion industry. Our found pieces were gathered slowly over several years as we set out in this exploration, including one bought at a car boot sale (Fig. 3), one found in a flea market (Fig. 4), and one received as a gift from a neighbor when sharing about the work (Fig. 6).

The crafting, across different levels of fidelity, demonstrates our engagement with materials as designers, both in the crafting process itself and in how they, as artifacts, embody certain ideas (or not). This is common in tangible interaction design, where open-ended explorations lead to insights about the material, a process, or its application [14, 6, 13, 32]. The higher finish pieces were used in real-life situations to experience them in an everyday context, including secondary interactions like carrying them on one's person. As the total amount of collected and crafted pieces surpassed the scope of this pictorial, and many pieces were similar, we curated this set. For example, one piece of clay of 40 was selected, and we focused on keys rather than full lock systems.

Finally, by using the artifacts, staging the pictures taken for this pictorial, and reflecting on their use, we constructed a set of qualities that were explicitly missing in digital keys, highlighted in the descriptions. Therefore, these qualities are based on both how we experience these artifacts as part of our design work, a core aspect of the practice [23], and on utilizing our experiential sensibilities, as established in HCI [25, 41, 48]. We consider each an *ultimate particular*, that is, “a singular and unique composition or assembly” [54], contributing to the mapping of design qualities in this space. This pictorial follows the genre of image-first contributions in HCI [7], adhering to traditional design practices [9] and emphasizing the materiality of the process [31].



Figure 11. Product Key. This key, inspired by late 90's product design, is a device that can hold several stored RFID-keys, and allow the holder to activate and switch between them by turning the top.

Product key

This key (left) came about from trying to keep the familiar gesture of the vintage padlock (Fig. 3) in a digital key. Its activated by turning the front where a specific key can be selected, inspired by earlier work on building RFID devices [18, 26, 33]. A switch is embedded in the handle that can toggles between multiple circuits and the antenna. The key is made from 3D printed resin and

finished with a matte varnish, inspired by 90s technology. The padlock inspired the gesture of the product key: the familiar turning-to-unlock motion. In the product key, this gesture is instead used to activate and select the correct digital key. One hand holds the key handle and turns, and the other cradles and provides a solid resistance to turn against. Similar to 'transfer scenarios' [25], this design is not a simulation of a padlock, nor all the literal steps being

transferred (Fig. 12), but the underlying desire for clear physical feedback in the interaction that has been designed for. In this case it's a physical switch component, but it could also have other ways of mediating the selection, like haptic drivers. This key traces traditional industrial design practices, encapsulating technology in easy-to-use shapes and gestures with a visual and interactive 'hook' and a soft silhouette, a candy-like abstraction of a key. The material is a semi-opaque plastic, giving some hints of the internal components and referencing early 00s trends. The switch and antenna is visible inside, along with some cables.

The prototype also tells of its use, wear is visible along the bottom 'cap' and the circular seam where the rotation occurs, contrasting with contemporary aesthetic ideals of clean and high-finish products. This key was carried for about three weeks by Author 1, and while it captured some aspects of physical locks, the small exertion in the turning, a lack of physical feedback in the actual unlocking became apparent in contrast, similar to other access cards and fobs.



Figure 12 Padlock Gesture. This image shows the Product key in use, the top is twisted, reminiscent of the gesture of using a padlock.

Amulet key

This key (left) is in the form of an amulet, with four separate RFID circuits framing a central piece of cut glass. The amulet is bulky and catches attention, in contrast to modern hidden, discreet, or embedded keys. This piece was made inspired by the decorated floral key (Fig 4), decorated as a piece of jewelry. The centerpiece is cut glass, a type used to practice cutting emeralds, and patina in the form of acrylic paint adds depth to the piece. The amulet have been used for a small number of days by Author 1 as a key to their home.

This piece is inspired by bigger jewelry pieces from the last century. The main structure is silver wire with soldered joints, a circle, and a dome holding a cut stone at the center. The big stone catches light, surrounded by the green of the antenna tags, which allows the copper to shine through. The structure adds depth to the piece, and allows the four antennas to be used separately. It also shows its make and use. The solder is rough and lumpy. There is a patina and dirt on the piece, making recesses and corners dark, while



Figure 13. Amulet Gesture. In use, the amulet needed to be reached for, either leaning down towards a reader unit or taken off.



Figure 14. Amulet Key. This amulet, inspired by old jewelry, is made from soldered silver thread, and holds a green gem from cut glass, and four RFID units encased in green resin.

more exposed areas shine. Traces of fingerprints can be seen, and tiny bubbles, marks, and inconsistencies on the resin casing for the antennas. When carried on one's person, the expression of this piece is heavy enough to remind one of its presence, and the size of it claims space on the body, physically, interfering with other pieces or garments, and visually, catching light. When used, the movement of leaning in and setting the amulet to a reader

clashed with the aesthetics of the amulet, instead leading to a slow and ritualistic gesture in taking the amulet off and using it, before putting it back together. This way of wearing it contributed to a sense of slowness and caution.



Figure 15. Copper bracelet. A bracelet made from a copper pipe, with a rough surface and sanded edges.

Copper bracelet

Inspired by the weight of the material samples and the massive concrete bracelet, this bracelet (left) was made from copper pipes harvested from a demolished motorhome in 2016, the material having rested in storage since, inspired by contemporary brutalist jewellery by Evan Sugerman [2] and Kenji Shimizu [46]. Through cold forging and annealing the metal when it work hardened,

this copper bracelet was made in a morning using an anvil and a smithing hammer. The key functionality was added using a round vinyl sticker to attach the antenna and circuitry. The copper bracelet was made after the concrete one, using metal to keep the experience of weight, while making it more compact and practical. In use, it reminds us of its weight, by the presence on the wrist, and by a slight fatigue after a full day of wearing it. Its resulting

gesture in use more modest than the concrete one (Fig. 9), that resulted in a peculiar gesture in use, where the weight could be used to swing and position the arm and bracelet both when aligning it to a terminal. For those reasons, we connect the copper bracelet to many of our qualities; expression, patina, carry, making and exertion.



Figure 16. Handling the copper bracelet. This image shows the copper bracelet on the arm of Author 1, showing the scale of the piece in contrast to the hands and wrists. Other jewellery is also visible, showing the aesthetic context this artefact was used in.

Ceramic Bracelet

Inspired by recent work on ceramics and 3D-printing in tangible interaction design research [9, 31, 36], we explored 3D-printing as an approach to make personalized jewellery. This 3d printed ceramic bracelet is a bangle, the shape referring to modern handmade pottery the form being unsuitable for modern mass production methods.

The glazed finish throws sharp highlights, telling of both its hardness and its brittleness, and the color reflects a contemporary aesthetic. The ceramic bracelet also carries traces of its making, both in inconsistencies in the print, unevenness of the glazing, the shrinking during the firing, and one edge left from the printing process, where the structure collapsed and was manually saved by intervening in the print when the machine was running.

Using a modified hobby-grade printer, we modelled and printed a blank (Fig. 17), then burnt and glazed it in a ceramics shop. While this bracelet (Fig. 18) is uneven, rough, and shrunk to a degree that it would not fit all the

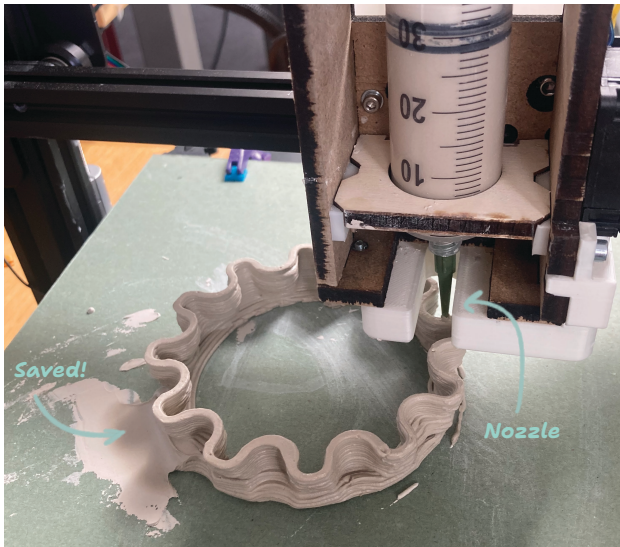


Figure 17. 3D-Printing Ceramics. Image shows a close-up of the syringe laying down ceramic paste. An experimental and analogue process, mixing the clay and setting up the syringe, reminiscent of early hobbyist 3D-printers.



Figure 18 Ceramic Bracelet. This image shows a close up of the bracelet, showing the highlights of the glaze, the printlines and mistakes.

authors, it was chosen for this collection as the hard ceramic is pleasant to hold and manipulate. Working with ceramics in this way is also notable, as the liveliness of the material and care needed in the process build an appreciation of the object. Creating the right mixture of water and clay and the unpredictability of extruding a liquid material that can dry when exposed to air make this process challenging. Both unpredictable and rewarding.

As noted by Author 4: “You get those crazy ‘failed’ prints that are actually beautiful.” Consequently, we relate this bracelet to the qualities of **expression**, and **making**, through the resulting material gestalt, and the involved hands-on process.



Figure 19. Bioplastic and leather tags. This image shows the tags post-use, accruing patina and eventually breaking altogether.

Bioplastic and leather tags

Drawing from recent work on leather and biomaterials in interaction design [65, 68], we also experimented with their use for everyday applications, making holders for circuitry used in common key tags (Fig. 19), that was then used for about two years each. The bioplastic tag was made using a recipe of Alganyl [68], but using it as a matrix, with a scrap piece of wool fabric for added strength, and

stitches inspired by a hand-sewn leather wallet (Fig. 20). In use daily by Author 1 for about two years, both tags aged in different ways. For the bioplastic, the alganyl initially provided stiffness and protection against wear, but as it slowly wore off, it eventually led to abrasion on the fabric itself. It was finally disassembled when the tag failed. For the leather tag, it first gained a deep patina, and finally, the glue failed, and the circuit broke as it fell out,

instilling a sense of having ‘used up’ the materials. These two tags are, to their apparent shape and function, identical to commonplace digital tags used for access worldwide. However, they differ by their make, material, and patina. One is made from a rough woven wool fabric, previously imbued with alganyl, a biodegradable bioplastic [68]. In the image, most of this matrix is gone, leaving a worn fabric patch with shredded edges. Even the brass coating of its ring is gone. For the leather tag, it has gained a deep patina, turning almost black from the water and oils of use in contact with the body. One can also see some stretch marks around the ring repaired and pressed together.

Through these qualities of **patina** and **making**, we reflect on the eventual breaking of these tags not as failures, but as end of a life. This represents a view of technology as something else than an object to be discarded once broken, instead something that can be made, remade and used up, more similar to how one might view traditional craft, or food, and aligned with circular views on technology [18].



Figure 20. Newly made tag. This image shows the bioplastic tag just as it was made, resting on top of a leather wallet that inspired it and some material and thread cutoffs from the process. Here the dark brown biomaterial is clearly visible, giving a dark matt finish to the fabric, and the edge stitching, unravelled later (Fig. 19), is fully present.

DESIGN QUALITIES OF PHYSICAL KEYS

In this section, we present and unpack the design qualities constructed after collecting, crafting, and experiencing.

Expression

With expression, we refer to a distinct visual quality when worn or displayed, as manifested in its colors, forms, or proportions. Objects tagged with this quality were one's we found doing this in very explicit ways. The black and copper bracelet (Figs. 10 and 15) and the key pendant and amulet (Fig. 5 and 14), were for instance used explicitly for personal styling during this work, as their way of catching the light and proportions make them stand out when worn, becoming both showpieces and functional keys.

Some pieces simply stand out to us by how they *look*: the green of the amulet (Fig. 14), the glazing of the ceramic bracelet (Fig. 18), and the swirling pattern in the recycled plastic (Fig. 8). These material qualities, resulting from the execution of the design, align with earlier perspectives of preciousness in research [48, 67], inspiring durability and a sense of attachment.

Gesture

For the second quality, *gesture*, we refer to the movement or manipulation of the pieces in use that felt good, generative, or made sense in the context of access in comparison to traditional physical locks. First, the product key (Fig. 11) is turned to activate (Fig. 12), much like the gesture of the padlock (Fig. 3). Second, the amulet (Fig. 14) requires removal for use, and the gesture adds a ritual quality through its slowness.

Thirdly, the digital security key, by its simple function of providing a physical touch-based interaction as a security measure, proves that physical interactions have a place also by reason of security. Finally, the raw weight of the concrete bracelet (Fig. 9) resulted in a distinct swing of the arm, achieved by “throwing” it using the hip. Therefore, the materiality of these keys contributed to a quality of use-in-motion, using a sense of kinesthetic experience seen previously in HCI [28], and in the onboarding of digital payment technologies [38].

Carry

With carry, we mean that the piece has a certain quality in how it is being carried, held, or worn. All the handheld keys resulted in a specific grip, not only at its moment of actual use with a lock. First, the ornamental key (Fig. 4) places the holder in direct contact with the embellishments, instead of shielding them from use and wear. This makes them present also when held, not only when seen. Similarly, the product key (Fig. 11) has smooth, friendly shapes that are easy to pull out of a pocket or purse.

Through its sheer mass, the concrete bracelet (Fig. 9) was hard to wear, it would chafe and pull on the arm, but the copper bracelet (Fig. 15) struck a balance, not too big for a bracelet while making itself known also in everyday gestures like greetings or pouring coffee. The pendant and amulet keys (Fig. 5 and 14) were less present in this regard, being light and unobtrusive when worn. The quality is similar to the gesture above, but concerns the mundane movements that occur outside the “interaction” of unlocking.

In contrast, some artifacts that seemed promising in the gesture turned out less so through their qualities in as carried, notably the recycled bracelet (Fig. 8) would rattle and move to a degree it was not used for long, instead ending up in a pocket or purse when used.

Patina

The fourth quality, *patina*, refers to how objects can age with dignity, or need it for a unified expression. Some of the keys in this collection acquired patina over time, as evident in the copper bracelet, which became stained and stained its wearer (Fig. 15), and the tags (Fig. 19), which slowly unraveled, eventually requiring remaking. As described above, this was perceived not as a failure, but as meaningful, and a fundamental quality of a material world in need of care [49].

Similarly, the patina on the ornamental key (Fig. 4) and the padlock (Fig. 3) told a story of their use. In contrast, the amulet (Fig. 14) looked ‘naked’ when freshly made, and patina was added to blend the look together, resulting in

a more complete expression. Further, different materials age differently; for example, glass (Fig. 7) would not age the same way as leather (Fig. 19) and wood (Fig. 7), which stain with use, while they might be scratched or dulled instead.

Making

For our fifth quality, we would like to highlight the crafting process in the *making* of these artifacts. Hammering copper, recycling plastic, pouring concrete, melting glass, working clay, and also the many manual actions involved even in so-called smart fabrication processes. To feel the materials, changed by our hands, brought meaning to the final objects, now embodying the labor of their making. This sensitivity to materials, evident in the reflection on clay printing above, is also present in research, as seen in the classic example of sawing a plank [32], and in the context of jewelry [67] and crafting [41] in HCI.

Exertion

Finally, we present the last quality, *exertion*, the sensation of engaging physically in an interaction, and the body's response. As anyone who has experienced a physical door knob, the physical exertion sometimes involved in unlocking can be both pleasurable and rewarding. This quality is also present in interesting ways in the weight of the concrete bracelet (Fig. 9), as well as the copper (Fig. 15) and glass (Fig. 7) pieces. Another form is in the gesture of the padlock (Fig. 3), where the spring of the mechanism first pushes back then leaps forward, as reflected by Author 1: *“While the steel of the vintage padlock feels nice resting in my hand, it's at the turning of the key that makes this interaction. The key, being small and light, is turned, then, turning something heavier, the bolt travels against the spring. As it passes a certain point, it snaps open, releasing its stored energy in a satisfactory deep click.”*

This also informed the design of the product key, using the turning motion and haptic feedback.

We consider this a mundane instance of the joy of exertion, also seen in the context of sport HCI [64], but also why designers turn to physical interfaces to build meaning [46, 50], aligning with previous research on heirlooms [5].

DISCUSSION

In this section, we discuss the implications of our work, beginning with the qualities, their potential, and how meaning is embedded. Further, we reflect on the work through its format, use of artefacts, and its applicability.

Entangled and endangered material qualities

In late 2024, the American technology news website The Verge stated that “2025 will be the year of the smart lock” [1]. In this process, many qualities of traditional keys are currently being *designed away* [65]. Yet, materiality is inherent in interaction design, it’s only the forms that are shifting. Color, expression, form, patina, resistance, sound, surface, and weight are all aspects that seem to be avoided in digital keys, as they follow other trends in tangible products towards minimalist expressions and convenient use. Further, modern digital access systems increasingly rely on other technologies, such as key cards, smartphones, or biometrics, that shift the *task* of the key to another body. For keys, this represents a shrinking design space, ultimately leading to what Redström calls a *no-future* scenario [56]. Instead of passing judgment on the future existence of keys, we consider this trend.

Along with evident advantages in terms of convenience and costs, there might be other explanations for why these tangible qualities are being neglected. We draw a parallel between the disappearance of keys to the descriptions of *chromophobia*, a lurking fear of color, as explained by David Batchelor [4]. We speculate that, in the context of keys, this includes a reticence towards tangible qualities, such as wearing things on the body, engaging in manipulations, resistance, and adding weight to artefacts, etc. However, there are alternatives, even within our own field, with arguments for exploring alternative aesthetics [18], which involve admitting limits and finitude [20]. We frame our keys in this work as examples of such alternatives.

By explicitly incorporating historical and found pieces, this collection illuminates design as a continuous and unfolding practice of culture, where each new thing exists in the context of the last, expressing new desires and

values. We do not advocate returning to the past. Instead, this work highlights the material reality of everyday technologies, shows material qualities that risk being lost, and suggests future possibilities.

Aesthetically pleasing physical engagements

Aesthetic qualities are sometimes reduced to embellishment or garnish, usually referencing only the visual ‘look’. However, this ‘sensory enrichment’ [30], in everyday use, revealed a form of interactive embellishment that built meaning over time. For example, the turning of the product key (Fig. 11), the weight of the concrete and copper bracelet (Fig. 9 and 15), or the form of the amulet (Fig. 14). Thus, by highlighting the sensory qualities in use, this collection shows how research on ‘sensory enrichment’ can be applied to a specific object of interest and be generative in terms of design.

Our work suggests that these qualities can be used to generate new designs. For example, using the mapping of materiality to the type of access, if done appropriately, then this interactive engagement could be heightened. Access to a precious building, like a library, could be represented by a glass key through its fragility, or temporary spaces, like festivals or construction barracks, through recycled paper keys, whereas a child’s first key could embed aspects of a family heirloom as a partially self-made piece, embedding qualities of care and community.

To elaborate, different qualities were found meaningful in different ways. The amulet (Fig. 14) uses the notion of heirlooms, the copper bracelet (Fig. 9) uses inherent material qualities, while the product key (Fig. 11) is physically engaging, drawing from the vintage padlock (Fig. 3), and the bio-tags (Fig. 20) build an intimacy in their use over time. Thus, what might otherwise be called embellishment in a derogatory meaning, here it contributes to meaningful relations with the artifacts, based on the composition and nuance of their interaction design, or, as Will Odom puts it, “aesthetically pleasing physical engagements” [48]. In the following section, we will examine how these engagements play a distinct role in our daily lives.

Meaning in physical, everyday, interactive things

Keys are meaningful, not only *through* their materiality but also *beyond* their physical shape, aligning with previous research on interactive jewellery [67]. Beyond our explorations in this work, we have encountered many stories of people being locked out, system failures, as well as joy in receiving the keys to their first home or car. This makes keys a rich site for interaction design research, as they mediate access both through their physical shape and the way they are carried and used.

Further, meaning was found in qualities that do not necessarily aim only to reduce friction, which is in line with concepts of slow technology [23] and seamful design [13]. For example, through *making*, *exertion*, and *patina*; the reflections of the amulet (Fig. 14) and glazing of the ceramic bracelet (Fig. 18), or weight in the copper bracelet (Fig. 15). Not all tangible interactions need to include friction; rather, we aim to make explicit how these qualities are being *designed away* [65] while they sometimes can contribute to more meaningful, felt physical interactions.

Keys, can be considered an instance of *physical, everyday, interactive things*. What makes this category unique in terms of tangible interaction design is its prolonged and repeated use, as well as how we carry them with us and interact with them in our lived spaces, eventually not noticing the interaction until it fails. This *habitual use*, in anthropology called *material motions* [39], of keys, impacts our fundamental thoughts and behaviours, as highlighted in the 2024 TEI opening speech by Adrien Segal [59].

Hence, keys are tools that help us make sense of our world, our movement through it, and our access to spaces. Such physical objects are therefore inherently loaded with meaning (cultural and emotional), and interrupting or removing these interactions causes a sense of loss. We therefore argue that design in such spaces, where *physical everyday interactive things* are being *designed away*, should be done with care and consideration, lest we find ourselves in a *no-future* scenario of design, without alternative or future ways of being.

Reflections

Looking back on our work, we reflect on the different impacts of the artefacts, the visual format of a pictorial, and how our contribution might be applied for future research.

Starting with the artefacts in our work, they range from low to high fidelity, and they also differ in their *use* and *impact* on the process. Some contributed mainly through the material engagement with the material, through their crafting process, akin to the practice of making material samples, while others were found generative also through use, similar to previous work on slow design [23, 50], or through their handling (Fig. 21).

Our instincts as interaction designers to attend to the artifacts in use and in context, were sidestepped by a process that of engaging with keys-in-themselves, which we found extremely interesting, from another perspective of interaction which is often neglected but fundamental when it comes to what we appreciate with physical things - their offline qualities. On a philosophical note, this made us reflect on the keys through Kantian notions of the thing-in-itself, and how designed artifacts only exist within specific historical, technological, and cultural contexts. Meanwhile, future work could map and disseminate the differences between material samples, research prototypes, probes, and products.

Reflecting on the format, using the visual language of an exhibition lends the pieces space and clarity, while inviting the viewer to imagine how they might use, carry, and move with the pieces. The use of this format highlights the materiality of artifacts [33] and subverts the traditional use of imagery in product design, centering solutions and selling products, instead, to showcase the objects, their imperfections, and patina. By displaying the artefacts explicitly “out of context”, we reflect a sense of nostalgia that we feel towards the loss of physical interaction. The artifacts in this pictorial, like museum objects placed behind glass to be seen but not touched, speak to interactive affordances at risk of becoming extinct.

Continuing to our claims, our curated selection of keys shows how we have attempted to articulate the qualities of keys through *our* making and *our* sensibilities. The value of these qualities is inherently subjective, relying on taste, desire, context, and interest. This is also reflected in the contributing factors to the ‘heirloom’ status of previous research [47]. For example, simply adding weight to an artefact might not make it more meaningful, as seen in the concrete bracelet (Fig. 9), however, with balance in the interactive composition, weight contributed to meaning in the copper bracelet (Fig. 15) for the first author.

The value of research for designers lies in its capacity to inform or inspire future work [56], why we frame our contribution as artefacts, instances of design work, *ultimate particulars* [56]. Further, we encourage future research to further explore the embedded meanings in keys and access systems, examining what these meanings mean for our everyday lives, and to suggest alternative ways of being.

CONCLUSION

In conclusion, we have presented a collection of found objects, material samples, and design explorations as well as discussed the surfaced material qualities and the disappearance of the same. We frame keys as interactive everyday things, and point out how they contribute to meaning-making.

Finally, we see the design of keys as a rich space for design research as it comprises and intersects with the material and the mundane, concerning the materiality of keys, how the design plays out in everyday use, and what is being designed away.

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Figure 21. Behind the scenes. This image shows Author 1 setting up the photoshoot of the collection, showing the inherently embodied work of selecting and documenting the collection.

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