

Investigating Opaque Infrastructures with Discursive
Design

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School Of Art, Art History, Design

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Abstract

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The information we access on the Internet appears immediately but usually lives far away. A search for “holiday decorations” might take you from a server in Montana to India to Northeastern Canada. The Desktop Odometer is a device that shows users the distance they travel when browsing the web by tracking the total miles between their current location and the server from which they are requesting information. Upon connecting the Desktop Odometer to their computer via a web browser extension, users are able to see how far information travels while surfing the web in real time. The Desktop Odometer is a Discursive Design artifact that allows users to observe certain aspects of the Internet’s elaborate and largely opaque infrastructure in relation to how they use it. Recognizing the vast distances information travels while one navigates the web brings this facet of the Internet into the foreground of a user’s experience. I describe the three approaches I used to investigate opaque infrastructures: the first was making the Desktop Odometer itself, the second was selling the Desktop Odometer on Amazon.com as a way to elicit user-generated feedback about the inner workings of the Internet, and the third was gaining firsthand experience of the seller’s side of Amazon.com.

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Investigating Opaque Infrastructures with Discursive Design

*"The journey of a life time
starts with a single [search]"*

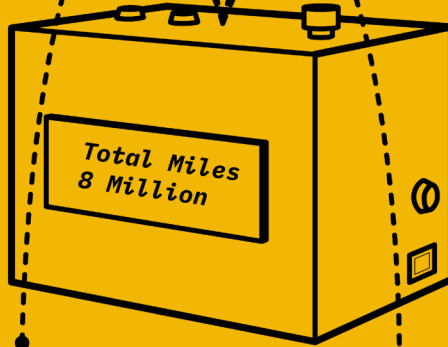
- Lao Tzu

Trip: 1.64 Million Miles
www.facebook.com
192.168.27.1:8000
Salt Lake City, UT, USA

*"Live with no excuses
and travel [the web]
with no regrets"*

-Oscar Wilde

Trip: 2.03 Million Miles
www.www.alibaba.com
192.938.87.1:8000
Lima, Ohio, USA



Trip: 2.16 Million Miles
www.dl.acm.org/dl.cfm
192.114.11.1:8000
Ballangen, Norway

Trip: 2.17 Million Miles
www.amazon.com
192.978.37.1:8000
Langfang, China

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**The Desktop Odometer
shows users the distance
they travel when
browsing the web.**

The incredible speed and efficiency at which the Internet works obfuscates its own mechanics.

01

Introduction

When I started this work in autumn of 2018, the Alaskan Way Viaduct, one of the primary bridges connecting downtown Seattle to the greater metropolitan area was demolished. The replacement would not be finished for months. Consequently, in a city already struggling with traffic congestion, delays were expected to increase significantly. This created an opportunity for designers to work with city officials to propose solutions. However, the city's response was uninspiring. One local news source described the plans by stating, "Local TV has been running countdown clocks, and city officials are urging anyone who can to work from home, switch up hours, or take time off" (Scruggs, n.d.). Instead of addressing the socioeconomic concerns and infrastructural failures, the city simply offered the Internet as a means to stay home and avoid the problem completely. The city asked the citizens of Seattle to forgo traveling to the office and instead connect using Internet-enabled technologies like video chat – they were essentially asking citizens to use the web as means of transportation.

The information we access on the Internet appears immediately but usually lives far away. A search for "holiday decorations" might take you from a server in Montana to India to Northeastern Canada. The Desktop Odometer (figure 1.1) is a device that shows users the distance they travel when browsing the web by tracking the total miles between their current location and the server from which they are requesting information. Upon connecting the Desktop Odometer to

their computer via a web browser extension, users are able to see how far information travels while surfing the web in real time. Initially, the Desktop Odometer was conceptualized as an augmentation of the city's response to traffic delays. In other words, the device attempts to show users that using the Internet is indeed a form of travel. Over time I realized that the ability to 'see' how far information has to physically travel gives users an opportunity to grapple with and realize facets of the Internet's infrastructure, a system whose inner workings are rarely noticed. I began to recognize that the Desktop Odometer could also be a useful tool to investigate opaque infrastructures, and as such, opaque infrastructures became the topic of this work.

The word "infrastructure" refers to a system or group of systems that both enable and control the operation of a society or enterprise. Opaque, then, is a quality that can be used to characterize an infrastructure whose inner workings are rendered invisible to the majority of users. In *Signal Traffic: Critical Studies of Media Infrastructures (The Geopolitics of Information)*, author Nicole Starosielski explains that opacity is not merely a likely characteristic in infrastructures but rather an inherent feature, claiming, "Infrastructures are defined by their invisibility: most of us hardly notice them until they fail or breakdown. Public access to technical knowledge about infrastructures is not equal; rather it is guided and constrained by social hierarchies of gender, race/ethnicity, class, generation, and nation" (Parks & Starosielski, 2015). Infrastructures such as the Internet have an extensive presence and influence over many people's lives. For most individuals the question is not if Internet-enabled technologies (e.g., tracking user data) will be integrated into their lives but how they will be integrated. Therefore, given

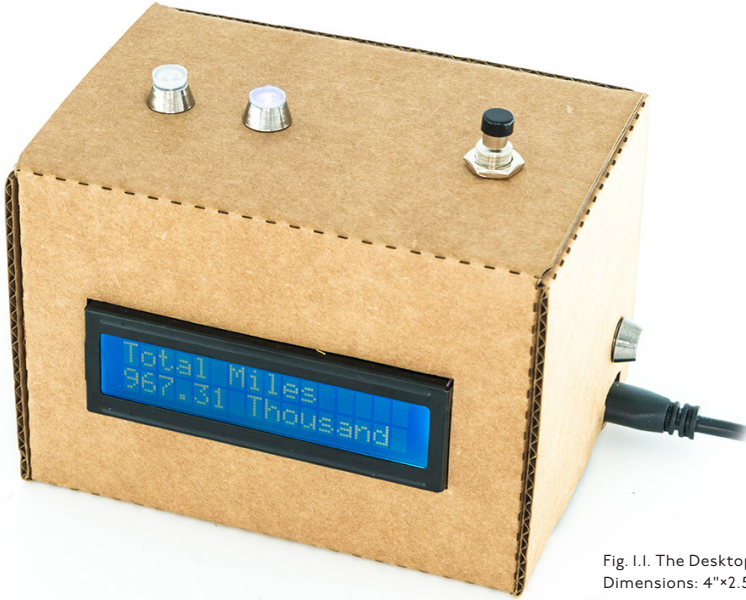


Fig. 1.1. The Desktop Odometer
Dimensions: 4"×2.5"×2.5"

the immense presence of these opaque infrastructures in society, researchers and designers must be able to investigate their inner workings. In my research, I examine how opaque infrastructures align with the values and aspirations of the people who use them, how opaque infrastructures shape the futures of the people who will be affected by them, and whose voices are and are not being considered in the shaping of them.

The Internet allows vast sums of information stored throughout the world to be retrieved almost instantaneously. The incredible speed and efficiency at which the Internet operates obfuscates its own mechanics. In this work, my goal was to create an artifact that would let people see part of those mechanics in real time. The Desktop Odometer allows users to observe certain aspects of the Internet's elaborate and largely invisible infrastructure in relation to how they use it. Recognizing the vast distances information travels while one navigates the web brings this facet of the Internet into the foreground of a user's experience.

I used three approaches to investigate opaque infrastructures: the first was making the Desktop Odometer itself, the second was selling the Desktop Odometer on Amazon.com as a way to elicit user-generated feedback about the inner workings of the Internet, and the third was gaining firsthand experience of the seller's side of Amazon.com.

In chapter 02, related works, I describe prior work studying infrastructure from researchers in the fields of *Design, Human-Computer Interaction (HCI), Science and Technology Studies, and Media Studies*. Chapter 03, Discoursing Through Amazon, offers an overview of my approach to studying opaque infrastructure. In addition, I situate my research methodology work within and relative to a larger body of research in the fields of Design and HCI. In chapter 04, Producing Discursive Design, I outline how I designed, produced, and distributed the Desktop Odometer. In chapter 05, Findings, I describe what I learned from customer reviews about the Desktop Odometer, as well as the research through design required to build and disseminate the Desktop Odometer. In the final chapter, 06, Discussion, I introduce a variety of questions about opaque infrastructure that require further attention. After introducing these questions, I discuss potential avenues to address them.

Infrastructure refers to the material and organizational structures that enable and control the operation of a society.

02

Related Works

Infrastructure refers to the material and organizational structures that both enable and control the operation of a society or enterprise. Infrastructure is deeply embedded in both material and immaterial facets of life. In this work, I analyze opaque infrastructures, such as the Internet. I begin this chapter with a brief description of how data is transmitted through the Internet's vast infrastructure. I then outline the processes by which the Internet has intentionally and unintentionally been made opaque. I finish this chapter by presenting related literature which investigates similar topics.

Internet Innerworkings

The Internet's elaborate infrastructure is distributed throughout the world. It is made up of many different materials, components, and systems, such as cell towers, satellites, antenna, fiber-optic networks, and data centers. The Internet allows for information to be stored and retrieved in spite of the immense physical distances between these processes. The transmission of this information is facilitated by a robust and far-reaching network infrastructure. Contrary to popular depictions, the Internet is a heavily wired system. Satellites, antennae, cellular networks, and fiber-optic cables are all capable of transmitting data, but fiber-optic cables have become the primary means of connecting users. As the demand for larger and larger files (such as high-definition video and high-resolution images) increases, the use of technologies such as satellites and antennae has diminished. Sending and receiving data with satellites and antennae is far slower than fiber-optic networks.

Even when using cellular networks, the transmission of information across vast distances is primarily facilitated by fiber-optic cables. For example, when an individual searches the web using a cellular network, first, a server is notified

of the request. Next, the server sends the information through a fiber-optic network until it reaches the cell tower nearest to the user. Afterwards, a cell tower transmits the information through the airwaves to the nearby user's cellular device, at which point the user can access the information they requested.

Why is Internet Infrastructure Opaque?

One reason that Internet infrastructure is rendered invisible to the majority of citizens is to ensure it remains safe and secure from outside threats. Events such as the Cold War and the September 11th attacks have prompted the government to use secrecy as a strategy to defend network infrastructure. While these events have resulted in hiding network infrastructure below cities and oceans as a means of protection, Nicole Starosielski claims, "the most significant and long-standing disruptions to [network infrastructure] have been caused by boaters and fisherman who drop anchors or trawling gear on the cable" (Starosielski, 2015). As this example indicates, strategies of infrastructural obfuscation often result in disruption at the hands of unknowing actors.

Hiding Internet infrastructure below ground is intended to be a means of protection, but in some circumstances it has ironically allowed deterioration. Describing the effects of hiding infrastructure, Nicole Starosielski writes, "If cables remain invisible to policymakers, government regulators, corporate customers, business managers, and politicians, then critical decisions about infrastructure funding – which could make our networks more robust and accessible – will continue to be uninformed" (Starosielski, 2015). Starosielski's claim encourages us to consider the ways in which hiding network infrastructure can be detrimental to its long-term health.

In certain cases the obfuscation of infrastructure has even been taken advantage of by private corporations. For example, in 2008, Verizon entered an agreement to build a fiber-optic network intended to serve all of New York City's inhabitants. Reporting on the roll-out of Verizon's fiber network, author and investigative journalist Ingrid Burrington writes, "Verizon concentrated primarily on integrating fiber networks in new developments and already wealthy or gentrifying neighborhoods, bypassing, and at times outright refusing, to provide service to other neighborhoods or buildings with no reason given" (Burrington, 2016). This example highlights the relationship between transparency and equality. By making these processes more visible, everyday citizens can become part of the conceptualization and integration of network infrastructure and thereby insure that they support desired social policy objectives.

In her book, *Networks of New York*, Ingrid Burrington reveals network infrastructure buried beneath city streets and subways in New York. Burrington assembles a list of visible above-ground indicators which can be used to identify the fiber-optic cables. Burrington's list includes spray-painted street markings, inscriptions on manhole covers and color-coded marking on the walls of underground subway platforms. These markings enable Burrington to identify information about fiber-optic cables, such as the year they were created, their owners, the type of information they transmit, and the depth at which the cables are buried. Burrington's work successfully makes visible certain facets of New York's opaque network infrastructure. In addition, her work highlights the hyperlocal nature of this infrastructure, and thus presents opportunities for establishing more accurate depictions of the web, which is often incorrectly portrayed as an equally distributed mesh, unaffected by the geography in which it is embedded.

Making maps of the Internet has become a common way for corporations, data analysts, designers, and artists to depict Internet infrastructure. For example, TeleGeography, a marketing research firm, created an interactive map of underwater cables that connect the global Internet (figure 2.2). While this map does present cable routes throughout the world, it also portrays these routes as highly organized. Maps like TeleGeography's cast an overly simplistic depiction of cable routes. Tech firms have also created maps of Internet infrastructure. One such firm, Twitter, has created an interactive map that illustrates which smartphones are used in different parts of the world to post on Twitter. In 2003, the artist Barrett Lyon created the *OpTe Project* (figure 2.1), a visual depiction of the Internet. In this work, lines representing communication between IP addresses form complex networks. Lyon's work offers abstract representations of Internet communication signals.

Other common maps intended to illustrate Internet infrastructure are those produced by large telecommunication firms such as Verizon and AT&T (figure 2.3). These ubiquitous graphics are used as a marketing tool intended to indicate the firm's robust network coverage. These maps present networks as frictionless meshes enveloping entire countries. However, these maps fail to depict the immense variations in coverage within specific locations. They also leave out the fragility of networks as well as the vast amounts of labor necessary to maintain these networks.

Realizing Infrastructures through Narrative

As author Nicole Staroskielski points out, stories about Internet infrastructure typically fall into one of two categories: narratives of *technological progress* and narratives of *disruption*. She claims that these only serve to further

conceal Internet infrastructure, writing, “our inability to perceive cables is structured into the very stories intended to communicate information about them” (Starosielski, 2015). Narratives that focus on technological development usually begin with the conceptualization of network technology by a single ‘heroic’ figure, and end with the creation and implementation of a network. *Disruption* narratives typically begin with an unanticipated break in the connection of cables, which threatens not only transmission of information but also a broader cultural order. Both narratives end when connectivity is established or reestablished. Starosielski claims that, “Since they fail to attribute significance to operational systems, these narratives actively obscure undersea cables in the public imagination” (Starosielski, 2015). The operational aspects of Internet infrastructures to which Starosielski refers include the actual signals used to distribute information, the various materialities that make up these systems, and the labor necessary to keep such systems functional. Narratives of *technological development* and *disruption* reinforce a collective false imagination of the Internet as frictionless, equally distributed, wireless, and non-local.

In order to complicate *technological development* and *disruption narratives*, author Nicole Starosielski proposes two alternatives, which she refers to as *nodal* and *transmission* narratives. *Nodal* narratives, “focus on a node in the system and chronicle the human and nonhuman extensions through it.” (Starosielski, 2015). *Nodal* narratives describe the network cables not as discrete objects but rather as dynamic actors with immense historical significance. *Transmission* narratives, Starosielski explains, describe “the cable station, the pressure points of cable landings, the islands that mediate network traffic, and the ocean environment



Fig. 2.1. Map of communication between IP addresses. Lyon (ca. 2003) The Opte Project.

itself.” (Starosielski, 2015). Whereas *nodal* narratives depict a particular node in the system at various moments in its history *transmission* narratives focus more on a particular node and its relationship to the surrounding ecologies (e.g., how it shapes and is shaped by the environment it has been embedded in) Starosielski argues that these alternative narratives “can show cable-using publics the realities of the system’s operation, the dynamics of its capacity and use, and intricacy of infrastructure protection. And in doing so, they help ground the political engagement of cable systems, including arguments for the development of alternative uses and for the production of more resilient and accessible networks.” (Starosielski, 2015). As is common of works in media studies, Starosielski expresses these narratives through the written word. Starosielski’s notions of *nodal* and *transmission* narratives present opportunities for more experiential ways of encountering these types of stories.

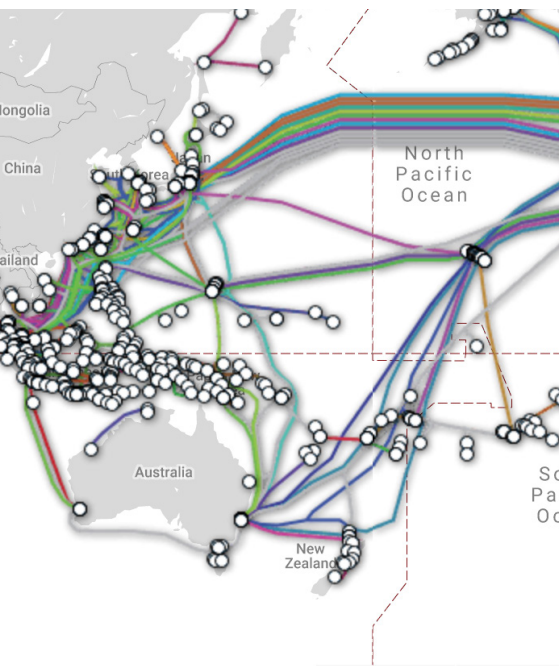


Fig. 2.2. Submarine Cable Map.
www.Submarinecablemap.com.
 PriMetrica, Inc., 2020

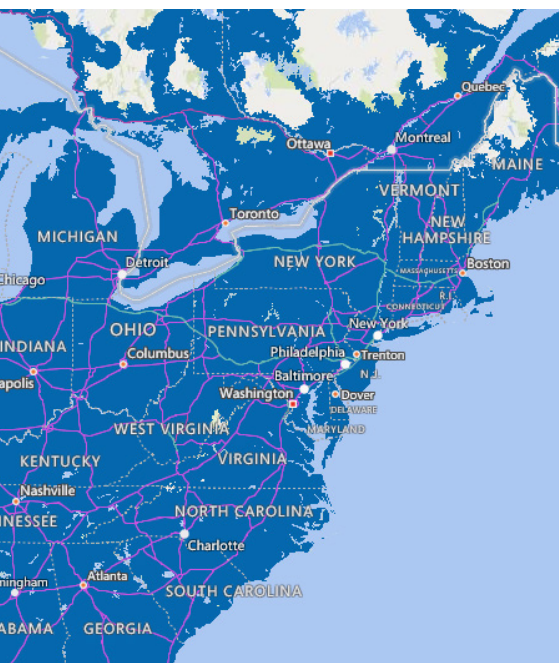


Fig. 2.3. AT&T 4G LTE Coverage Map
surecall.com/att-coverage-map.

Investigating Infrastructure: Looking at the Code

One approach used by researchers to investigate opaque infrastructure has been studying the software upon which these systems operate. As Tung-Hui Hu explains, “Focusing on digital culture’s media-specific properties typically involves examining the technological platforms within: Internet Protocol, lines of Java code, network cables or conventions for the Unix operating system.” (Hu, 2015). For Hu, understanding network infrastructures requires analysis of these platforms often invisible underlying code. To understand the invisible, underlying code of certain network Infrastructures I look Paul Dourish’s work on the *materialities of information*, Timothy Morton’s notion of *subject position*, and Tara McPherson’s analysis of the computer operating system UNIX.

In *The Stuff of Bits: An Essay on the Materialities of Information*, Paul Dourish examines the specific materialities displayed by digital objects such as spreadsheets. *Materialities of information*, Dourish writes, “are those properties of representations and formats that constrain, enable, limit, and shape how those representations can be created, transmitted, stored, manipulated and put to use” (Dourish, 2017). Dourish argues that social and cultural facets of the world are encoded into digital objects that significantly impact how information and systems are experienced. Dourish’s approach to understanding the materialities of digital objects is a useful approach to investigate the Internet’s complex infrastructure.

Dourish’s work shares a similar focus to the works of Timothy Morton and Tara McPherson. Timothy Morton’s notion of *subject position* is similar to Dourish’s work on materialities of information. Morton describes subject position as the



Fig. 2.4. This painting is an example of the use of vanishing point in a linear perspective painting. Here the vanishing point dictates the viewer's gaze and thus that gaze is encoded into the painting Seurat (ca. 1884) A Sunday Afternoon on the Island of La Grande Jatte.

“position or the attitude a work expects the audience to take towards itself” (Morton, 2011). Morton uses the metaphor of the vanishing point in a linear perspective painting to further explain his term. That is, the vanishing point dictates the viewer's gaze and thus that gaze is encoded into the painting (as is illustrated by Georges Seurat's A Sunday Afternoon on the Island of La Grande Jatte) (figure 2.4). Morton claims that it is the role of the humanities to identify the *subject position* and, in doing so, recognize the ideas which have been encoded into a particular artifact, system, technology, etc.

Tara McPherson writes about a similar notion as it relates directly to the underpinnings of the Internet. In McPherson's essay, *Why Are the Digital Humanities So White*, she discusses the computer platform UNIX, an operating system that was seminal in the creation of modern computing. UNIX was written prioritizing modularity, compartmentalization of function, and separation of interface from the engine. McPherson draws parallels between the modularity encoded into the UNIX operating system, and the societal compartmentalization happening in the US at the same time (the 1960s-70s), arguing that the two were both part of a larger historical shift. The shift she refers to

is the change in racial thinking from overt racism, as seen in Jim Crow policies, towards a covert attitude of systemic racism, still structurally oppressive but masked by pluralist messaging. McPherson stresses that these philosophies, while not overtly racist, encoded structural issues (compartmentalization, assumptions of simplicity) analogous to those found underneath shells of neoliberal globalism. Hiding the kernel from the shell is not a practice limited to programmers. Given the invisibility of software infrastructures in the everyday use of modern technologies, McPherson's argument demonstrates the need to unearth the inequalities built into the architecture of computer software.

Dourish and McPherson claim that studying the software upon which digital infrastructures operate will yield a greater understanding of the content that these platforms allow users to experience. Both McPherson and Dourish demonstrate the importance of investigating digital infrastructure. For Dourish, this means engaging with digital objects to see how they give rise to particular interpretations. Similarly, McPherson demonstrates how biases can be unknowingly encoded into and perpetuated by digital technologies. The work of both scholars establishes a precedent for the study of network infrastructures. In order to make network infrastructures more transparent it is important to make visible aspects such as the software upon which these systems operate.

Discursive Design refers to artifacts whose foremost objective is to create discussion and reflection.

03

Method

I begin this chapter by outlining various approaches and methodologies used by designers and researchers in order to describe my work in relation to a larger body of research in the fields of Design and HCI, these include *Discursive Design*, *Speculative Design*, *Design Fiction*, *Experiential Scenarios*, *Speculative Enactments* and *Material Speculations*. I then outline the methodology I used to conduct my research.

Discursive Design refers to the production of artifacts whose foremost objective is to create discussion and reflection. Discursive Design should be thought of as a genus under which many design practices should be considered species, including but not limited to *Adversarial Design*, *Anti-Design*, *Contestational Design*, *Critical Design*, *Critical Jugaad*, *Design Fiction*, *Dissident Design*, *Guerilla Futures*, *Interrogative Design*, *Radical Design*, *Reflective Design*, *Speculative Design*, *Speculative Re-Design*, *Tactical Media*, and *Undesign* (Tharp & Tharp, 2018). The Desktop Odometer is not inherently critical, as is the case with *Critical Design*, nor is it designated to exist within a specific context, as with *Material Speculation* (Wakkary et al., 2015). While the Desktop Odometer does share certain characteristics with these subgenres, it aligns most with *Discursive Design*.



Fig 3.1. This images shows speculative work by Dunne & Raby shown in a gallery space. Dunne & Raby (ca. 2019) *An Archive of Impossible Objects: Globes for a Plurivers*.

While design is often used to generate products addressing user needs, it may also be utilized as a tool for inquiry, to express ideas and theory, to explore alternatives, and to create discourse. *Speculative Design* is used to provoke future-oriented thinking for future planning, but is also commonly used as a critical approach, calling attention to current or potential issues; for instance, speculative inquiries are often focused on investigating the integration of emerging technologies in everyday life. Seminal figures in this design lineage, Fiona Raby and Anthony Dunne (Dunne & Raby, 2013), regularly use the gallery space to exhibit speculative artifacts to the public (figure 3.1). When displayed in a gallery context, however, the role of the viewer is usually passive – on the outside looking in. Raby and Dunne’s use of gallery space also raises ethical questions regarding who gets to engage with these visions of the future, both for the designers who develop

Fig 3.2. This image comes from an episode of the British science fiction anthology series *Black Mirror*. In this particular scene the character is using a futuristic virtual reality headset. *Black Mirror*: Season 3, Episode 2. (ca. 2018) Playtest.



the speculative visions and for the audience who experience them. Similar to *Speculative Design*, *Design Fiction* is often used to explore scenarios in the future (Bleecker, 2009). While these two methodologies can overlap, they are different practices. *Design Fiction* at times looks towards the future like *Speculative Design*. However, unlike *Speculative Design*, *Design fiction* often also looks back into the past and is even used to express alternate timelines. Fictional Design artifacts have an important role in *Design Fiction*. Like Science Fiction, *Design Fiction* uses narrative and context to suspend disbelief, often doing so by presenting fictional artifacts as though they were real. *Design Fiction* can be written as a story but is also often expressed cinematically (figure 3.2). *Design Fiction* enables designers to create entire worlds that help support concepts and ideas; however, as with *Speculative Design*, it is important to consider the authorship of design fiction as both a privilege and a position of power. In doing so, we can begin to think about the perspectives that are left out.

Since the introduction of practices such as *Design Fiction and Speculative Design*, designers and researchers have continued to develop methods that have improved the ways designers engage people in future thinking through greater participation and embodied ways of knowing.

Designers and researchers have developed and refined a variety of approaches to engaging people more viscerally in ‘futures’ conversations. Describing why this is important, Candy and Dunagan claim “we must bridge the ‘experiential gulf’ between inherently abstract notions of possible futures, and life as it is apprehended, felt, embedded and embodied in the present and on the ground” (Candy & Dunagan, 2017). One such approach, *Experiential Scenarios*, entails building out open-ended scenarios in fictional future time periods for audiences to experience.

Speculative Enactments are another approach that creates scenarios for people to actively take part in. For example, Eldsen et al. developed an event called Metadating (figure 3.3), which was essentially a speed dating event in which personal data was the focus of brief encounters between a group of singles. Describing the event, the authors wrote, “Rather than making a dating website, or constructing a *Design Fiction* on the basis of our speculation, we chose to run a speed dating event. Crucially, this put live social interaction with data at the heart of our study, along with consequential experience” (Elsden et al., 2017). The goal of the event was “to explore how quantified data relates to identity, and in particular, how people would rehearse and perform identities around their data with others” (Elsden et al., 2017). Elsden et al. advertised the



Fig 3.3. Elsden et al. (ca. 2017)
Metadating, data profile cards.

event, and people interested in attending the event were asked to fill out a blank data profile card. Data profile cards included standard dating-profile questions and prompts requesting users to collect data about themselves to be used at the dating event. At the event, the data profile cards were used to steer the conversation between guests. Reflecting on the event, the authors claimed “Something was really at stake in the context of the date to give a good impression of one’s self; these were, after all, real speed dates” (Elsden et al., 2017). Relative to the other approaches I have described above, *Speculative Enactments* offers a dramatic shift in how the viewer takes part in the work by becoming actively involved in the outcome of the scenarios presented. These scenarios are both speculative and consequential for the participant.

Another approach used to help ground speculation for participants is *Material Speculations*. The primary goal of *Material Speculation* is to put design artifacts, representing an alternative world, within a specific everyday experience in order to actually engage with it (Wakkary et al., 2015). By situating these artifacts in everyday life and provoking contrast, designers and researchers can offer unique opportunities for critical analysis. In order to generate a multitude of speculations, situated in real-world conditions, designers and

researchers have practiced *Co-speculation*. *Co-speculation* is “the recruiting and participation of study participants who are well-positioned to actively and knowingly speculate with us in our inquiry in ways that we cannot alone” (Wakkary et al., 2018). One example of Material Speculation is James Pierce’s *Camera Obscura 1C* (figure 3.4), a camera that allows users to take as many digital photos as they want, but to access and look at the photos, one has to break the camera to retrieve the SD card (figure 3.5). Pierce distributed the Camera Obscura 1C via Craigslist, local retail partnerships, community bulletin boards, as well as guerilla tactics such as “droplifting” (leaving a product in a retail store) (Pierce & Paulos, 2015).

Research Methodology

The approaches described above focus on the creation of discourse through experiential, collaborative, and consequential approaches. My research methodology consisted of three primary stages: Selling the Desktop Odometer on Amazon.com, Customer reviews, and Data synthesis / Analysis.

Selling the Desktop Odometer on Amazon.com

In this section, I discuss using Amazon.com as a platform for speculation. In the following chapter, I present my process for building the Desktop Odometer. I used Amazon.com to help generate feedback. The Desktop Odometer is available for purchase on Amazon.com (figure 3.8), and discourse about the device unfolds in the customer review section. On the product listing page, I include a description of the Desktop Odometer, of myself, and my research goals. When a customer purchases a Desktop Odometer, I package and ship the device. By being listed on one of the world’s most massive marketplaces, the Desktop Odometer is made available to a much greater

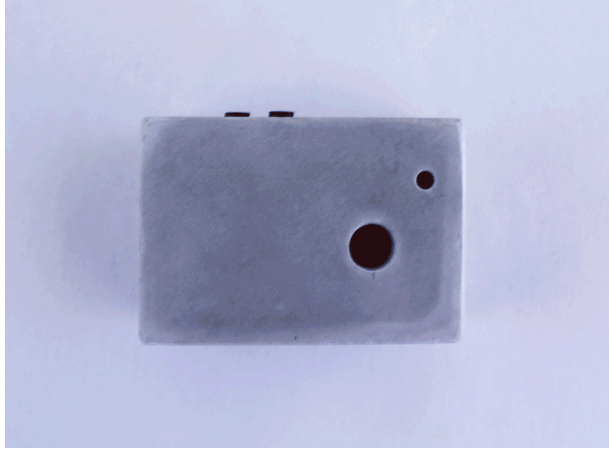


Fig 3.4. James Pierce (ca. 2015)
Obscura IC Digital Camera

audience. As opposed to seeking out participants, this approach invited people interested in the product and the research to reach out to me. In this way, the deployment of the Desktop Odometer as a design probe is driven by individual buyers and not researchers. Sales were generated both some organically, and through my own personal networks; many people learned about the Desktop Odometer through word of mouth and social media platforms such as Instagram and Facebook. Upon an inquiry, I would provide the Amazon link to purchase it.

Customer Reviews

In addition to developing a product to investigate the inner workings of the Internet, I also wanted to demonstrate how a design probe might exist within a commercial context and still be a research tool used to generate discourse. Customer reviews are a genre of communication that is social, meant to be seen by others, and is reactive (Reagle, 2016). It is common for customers who write reviews to utilize and rely on particular devices to communicate ideas, such as images



Fig 3.5. Removing the SD card from the Obscura IC Digital Camera. James Pierce (ca. 2015) Obscura IC Digital Camera

of the product in use, unboxing videos, product comparisons, and more. This form of product feedback is thus a useful way to generate discourse around a particular object. As a work of Discursive Design, the primary goal of the Desktop Odometer is to prompt discussion and reflection. Through the positioning of the Desktop Odometer on the Amazon Marketplace, Amazon becomes the vehicle and customer reviews become the means to create discourse. Initially, I hypothesized that using Amazon was a way to democratize speculative story-telling, allowing anyone with a computer and Internet access to take part. However, this assumption proved incorrect, as Amazon Customer Reviews are highly controlled and regulated. I discuss these events in more detail in the discussion section.

Participants

Desktop Odometers were sold to 47 participants over a period of 8 months, residing in 18 different states and two countries (US, UK,) (figure 3.7). The age of participants ranged from 19 to 68 years old. I reached out to 10 (21%)

of the 46 participants personally to see if they would be interested in buying the device; 14 (30%) of the participants contacted me after seeing information about the device which I had posted to either Facebook, Instagram or Reddit. 13 (28%) of participants purchased their Desktop Odometer after learning about the device from someone other than myself and subsequently contacting me for a link to purchase the device. The remaining 10 (21%) people who purchased the device found it while shopping on Amazon (figure 3.8).

Data / Analysis

I used open coding to categorize customer reviews into broad themes related to opaque infrastructures. One review could have different parts, that touched different themes. Once I had grouped parts of customer reviews into common themes, I expanded upon and revised themes. Early themes included codes such as: Awareness of opaque infrastructures, Thinking of the physicality of the web, and Proposing alternative forms, to name a few.

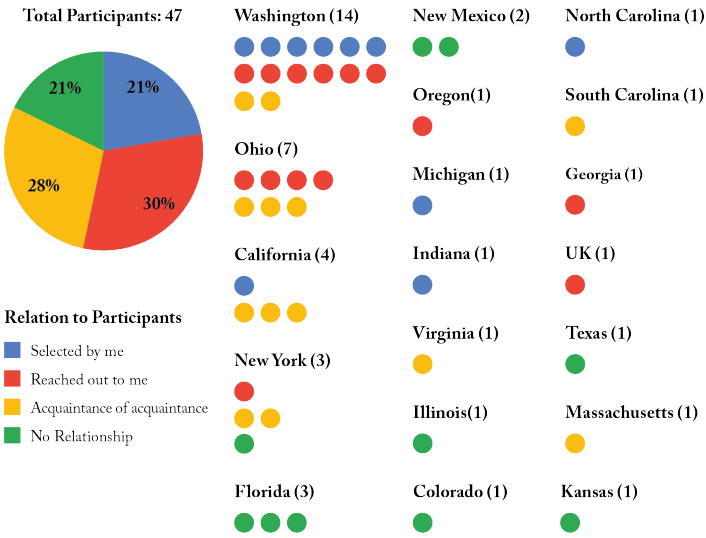


Fig 3.6. This chart illustrates my relationship with participants.

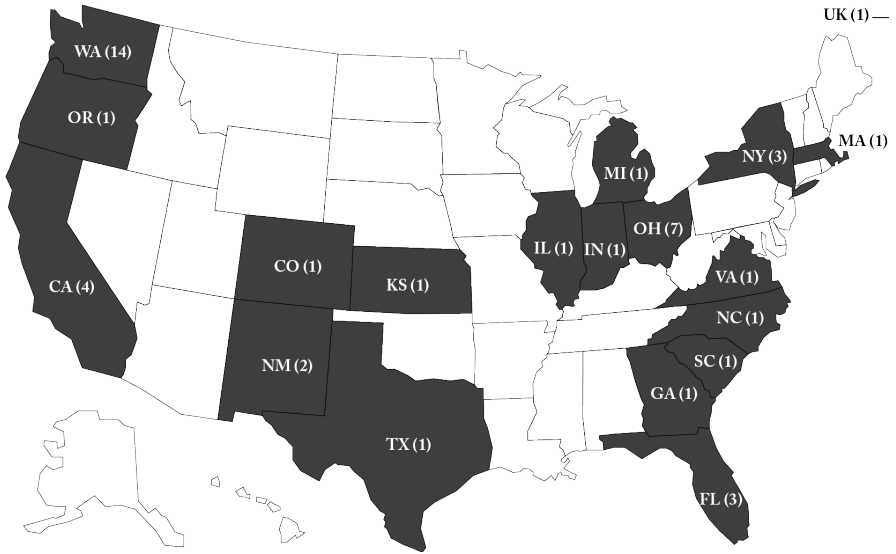


Fig 3.7. This map illustrates the state where participants live.

Fig 3.8. Desktop Odometer, product listing page on Amazon.com



Roll over image to zoom in

Desktop Odometer

by [HandMade_Futures](#)

★★★★★ ▼ 8 ratings

Price: **\$0.35** & **FREE Shipping**

Watch in awe as you travel immense distances in the blink of an eye. You have never truly understood just how far you can go until you encounter the Desktop Odometer. Information accessed on the internet appears so immediately but usually lives far away. For instance: a search for holiday decorations might take you from a server in Montana to India to Northeastern Canada. The Desktop Odometer tracks this distance allowing you to see just how far you go when surfing the web. The Desktop Odometer is part of an experimental design research project, that means to expand designers' conception of consumer products by inviting consumers to actively assert themselves in the definition of products. The Desktop Odometer is sold on Amazon.com Our primary way to engage with and learn from customers will be through Amazon customer reviews. Why Should I review it The Desktop Odometer is designed to be somewhat enigmatic to allow buyers to create their own meanings, narratives, use cases, and futures, which we hope to learn about through customer reviews. We want to know what you find interesting, exciting, silly, or stupid about

**To engage more people
in this exploration,
I sold the Desktop
Odometer on Amazon's
online marketplace.**

04

Producing Discursive Design

In this chapter I describe how I built the Desktop Odometer. I also recount the early conceptual work that led to its creation. In the final section of this chapter I describe the instructional materials such as the quick-start guide and the FAQ pamphlet. The entire production process took 12 weeks. I adopted a typical set of design constraints to ensure the device would be easy to use, relatively cheap to make, and easy to produce at a quantity of 45.

Product Overview

The Desktop Odometer tracks the distance you ‘travel’ on the Internet and displays this information on a small 24 x 2 character LCD display. The housing is constructed from cardboard. Embedded in the cardboard housing are three LEDs which indicate the device’s status. The green LED turns on when the device is powered on. When the device is looking for WiFi but is not yet connected, the red LED turns on. When the device connects to WiFi, the red LED turns off and the blue LED turns on (figure 4.1).

Building the Desktop Odometer

The Desktop Odometer was made in five phases. These phases include: Early Conceptual Work, Low-Fi Prototyping, Coding, High-Fi Prototyping, and Batch Production. In

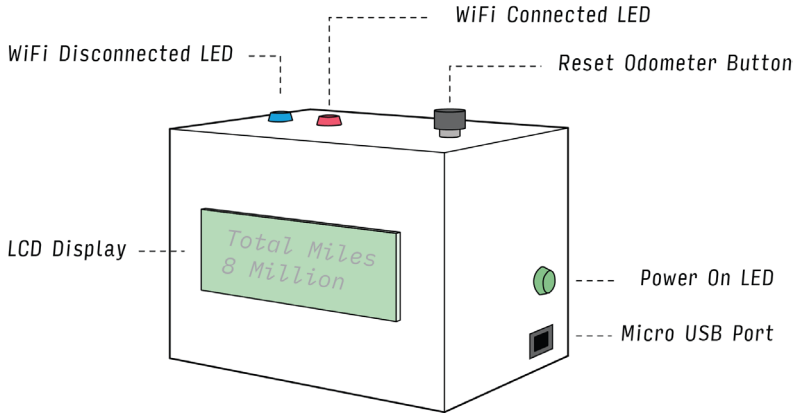


Fig. 4.1. Desktop Odometer diagram

reality, these phases were not so much clearly delineated stages, smoothly transitioning from one to the next, but instead they overlapped, ebbed and flowed, began, faltered, and restarted. However, these categories are helpful to clearly describe the different processes used in making the Desktop Odometer.

Early Conceptual Work

Prior to building the functional device, I used the Desktop Odometer concept as a tool for research, reflection, imagination, and provocation. The Desktop Odometer first appeared as a character in an animated short called *The Olympic Games in the Year of Youtube Red* (figure 4.2). In this video, the Desktop Odometer was essentially a prop, a necessary element of storyline. The animation takes place at a future Olympic Games in which web surfing is a competition included within the suite of track and field events. In *The Olympic Games in the Year Youtube Red*, the physicality of web browsing has been recognized to such an extent that it has become part of an Olympic event. While this approach was a useful way to express my own ideas about opaque infrastructures, it lacked engagement with others.

Fig. 4.2. Olympics: Year of Youtube Red, an animation which was part of my early conceptual work on opaque infrastructures.



To engage a greater audience in this exploration of opaque infrastructure, I positioned the Desktop Odometer on Amazon's online marketplace. To do this I produced a nonfunctional Desktop Odometer, i.e., a prop made to look real, but which was not actually counting miles (figure 4.3). In design fiction this type of prop is known as a diegetic prototype (Blecker, 2009). I then created an Amazon seller's account after which I listed the nonfunctional Desktop Odometer for sale on Amazon.com. Next, I sent a link to the product listing to various people in my personal network and asked them to pretend they had already purchased the device and to write a fictional review about their experience with it. By listing this fictitious device for sale online I was encouraging people to imagine what it would be like to own and operate it. Amazon's immense presence in consumer culture made it easy for participants to imagine the device was real. In addition to leveraging the credibility of the Amazon marketplace to suspend disbelief about the legitimacy of the product, listing the product on Amazon.com offered access to a broad, diverse user-base who use customer reviews to describe their experience with products. Whereas my initial



Fig. 4.3. Nonfunctional Desktop Odometer.

animation allowed me to imagine what it would be like to use the Desktop Odometer, listing the non-functional Desktop Odometer on Amazon.com presented both a greater audience and a new opportunity to engage in discourse about the device in the form of customer reviews. Therefore, customer reviews became the primary means for engaging others in my investigations into opaque infrastructures.

These initial explorations were valuable ways to speculate about the vast distances that information travels via the Internet, but without a “real” object, the depth of speculation was rather limited. It seemed that if users could live with and use the device, they would be able to engage in more thoughtful discourse. Therefore, following these explorations I decided to make the functional Desktop Odometer to be sold on Amazon.com.

Low Fidelity Prototyping

The making process began with Lo-Fi prototyping (figure 4.4); this included selecting, assembling, and testing hardware.

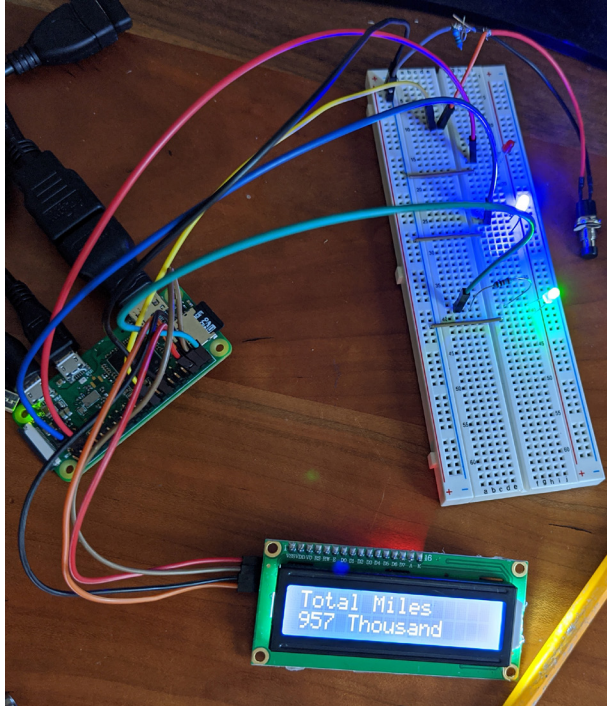


Fig. 4.4. Low-fidelity prototyping

When assembling the prototype, I used solderless components to save time and money. Once all components were connected, I began executing simple functions. This included sending data from the device's microcontroller in order to operate other components such as the Serial Display as well as LEDs.

Coding

I worked with a professional coder in order to develop the necessary software. I used traditional design techniques to communicate to the coder how the device was supposed to work. This included sketching scenarios, outlining critical user journeys and creation of storyboards to illustrate the onboarding experience. Software development began with creating a program to track the distance between a user and the servers they ping while surfing the web. To do this, we created

a downloadable web browser extension. The browser extension identifies an IP address associated with a given website, then runs the IP address through a website which identifies the zip code associated with the IP address. Now the program has both the user's zip code and the server zip code, the program calculates the distance between the two. This entire process is calculated by the browser extension. Once this operation is complete, the browser then sends this information to the Desktop Odometer.

One challenge in creating the Desktop Odometer was establishing device connectivity. For the Desktop Odometer to retrieve and ultimately display information from the browser extension, the Raspberry Pi inside the device needs to connect to the user's WiFi. Usually, this process requires a wireless keyboard and mouse, a monitor screen, and cords to connect the Raspberry Pi to the monitor as well as cords to connect the Pi directly to an Internet router. To make the process of connecting the Desktop Odometer to WiFi simple I developed a startup protocol, which allowed users to connect their Desktop Odometer to the Internet without any external devices (monitor, mouse, keyboard, etc). This startup protocol allowed users to connect their Desktop Odometer to the Internet using the same browser extension described above.

High Fidelity Prototyping

Once the initial prototype Desktop Odometer was working consistently, I soldered the components together (figure 4.5). Previously I had been using solderless breadboards and jumper wires to test out different approaches to wiring the device. Solderless components are good for prototyping but fall apart easily. Therefore, soldering these components was necessary

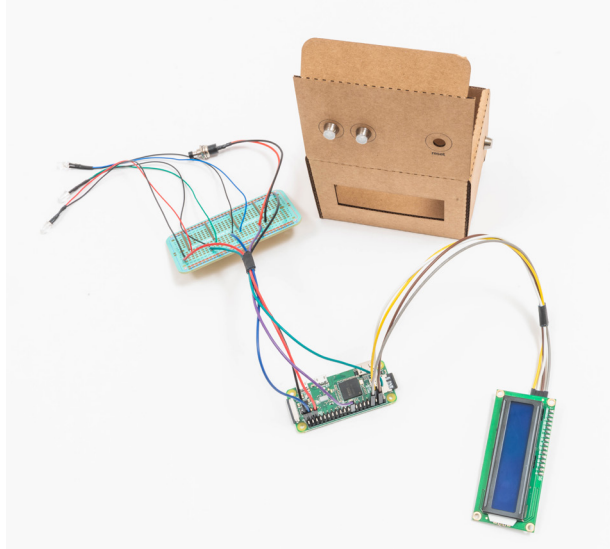


Fig. 4.5. Desktop Odometer during assembly

to ensure that the connections between components would remain intact even after extended use. After completing and testing my first soldered prototype, I began planning for batch production. Batch production was executed in individual stages. I started sourcing all the parts necessary to produce up to 48 Desktop Odometers. All parts were purchased from either Alibaba, Amazon, or Microcenter (figure 4.7). Once all the necessary components arrived I began copying the Desktop Odometer operating system to the SD cards. Adding the Desktop Odometer OS to the SD card took around four hours per SD card. I then inserted the SD cards into the Raspberry Pis (one per device). I then soldered four color-coded wires to each of the LCD 24x2 character displays. Next, I soldered three LEDs and one button to each circuit board (figure 4.6), which in turn was soldered to the Raspberry Pi. Next, I soldered the circuit board, LEDs, reset button and LCD 24x2 character display to the Raspberry Pi (figure 4.8). Once all the connections had been soldered, I began the next stage of

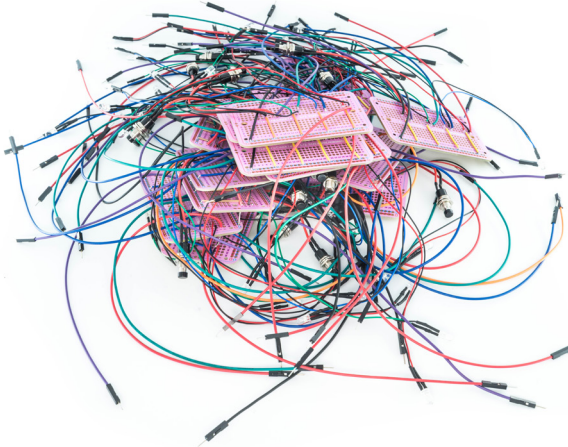


Fig. 4.7. LEDs and buttons soldered to breadboards.

batch production, quality control. This entailed testing each unit to make sure they worked. This involved powering on each device and going through the startup protocol.

With the electronic components working, I then began finalizing the outer shell. I used E-Flute cardboard to construct the Desktop Odometer's housing. I cut the form out of sheet cardboard using a laser cutter, then folded the boxes, leaving the lid open so that I could add the components (figure 4.11). After the cardboard housings had been folded I began the next stage of batch production, assembly.

To assemble each device, I first put the LCD 24x2 character screen in place using hot glue to hold the component in place. I then placed the Raspberry Pi into the box, followed by the circuit board. Once again using hot glue, I secured the LEDs into their positions. I then put the reset button in place using a hex bolt to secure it. Finally, I closed the lid on the cardboard enclosure.



Fig. 4.7. Preparing components for batch production

Instructional Materials

I designed two instructional guides to inform the users both about how the Desktop Odometer works and about my goals as a researcher: a quick-start guide and a FAQ pamphlet (figure 4.9). Given that the Desktop Odometer is an open-source product made entirely from off-the-shelf parts, the setup process is more involved than with a product made by massive companies with a vast number of users. The quick-start guide walks the user through the setup process. IoT devices made by companies such as Google or Amazon can leverage highly developed network infrastructures, which make the setup process relatively quick and straightforward. In contrast, the Desktop Odometer quick-start guide requires a bit more patience. There are 14 steps, and for first-time users, it usually takes around 15 minutes to complete. The quick-

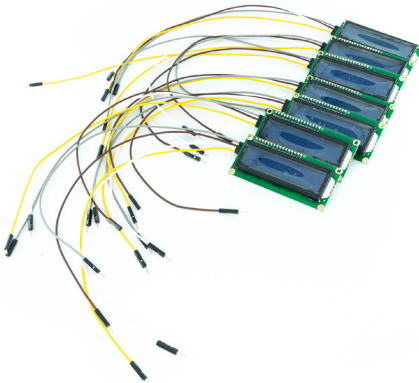


Fig. 4.8. 24 x 2 character LCD displays.

start guide exists in booklet and video format. The two formats allow users to choose the one that works best for them.

The FAQ was developed to serve two purposes: to explain that the Desktop Odometer is a product as well as a tool for research, and to explain to the user how I plan to use customer reviews within my research. Given that customer reviews are posted online and that their responses would be used for research, it was essential that buyers were aware that if they left a product review it would be used as part of the research.

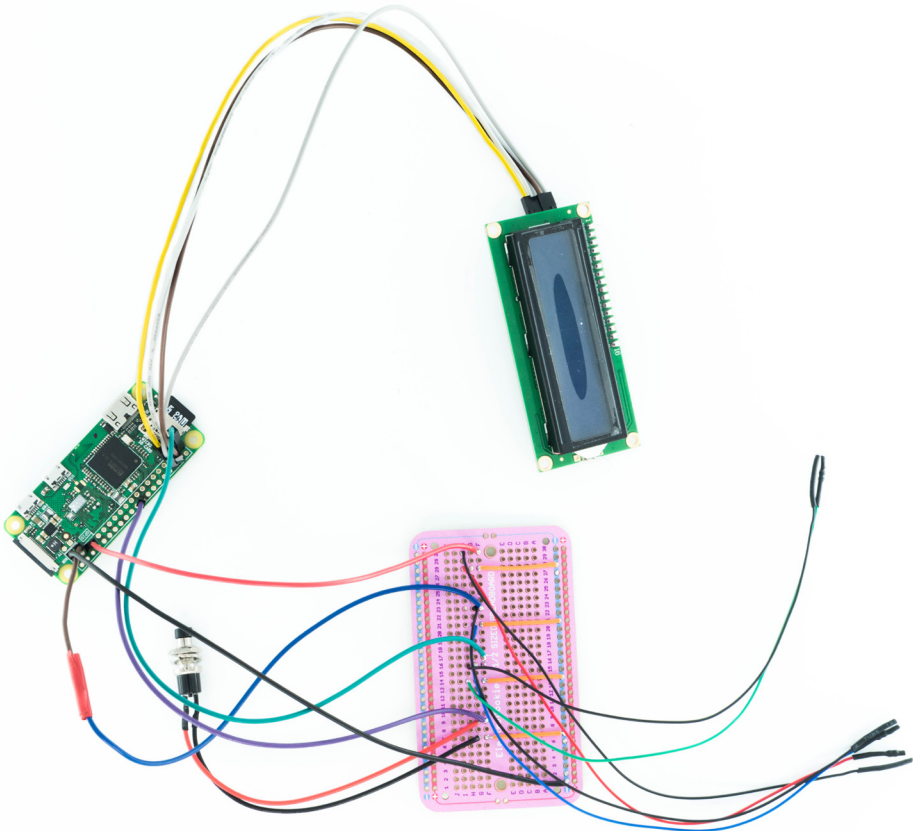


Fig 4.9. Inner components of Desktop Odometer

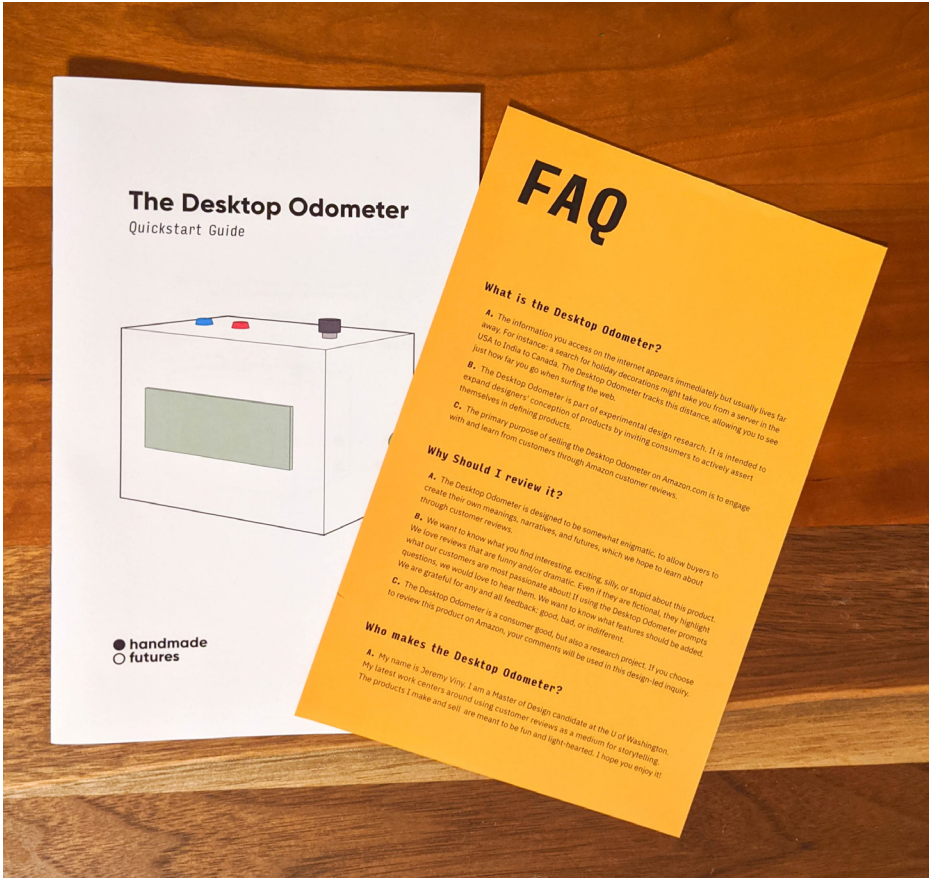
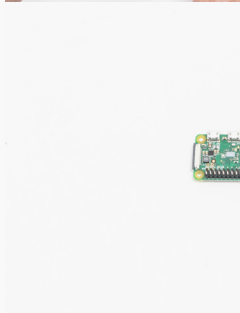
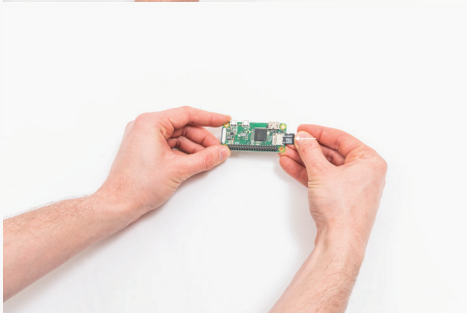
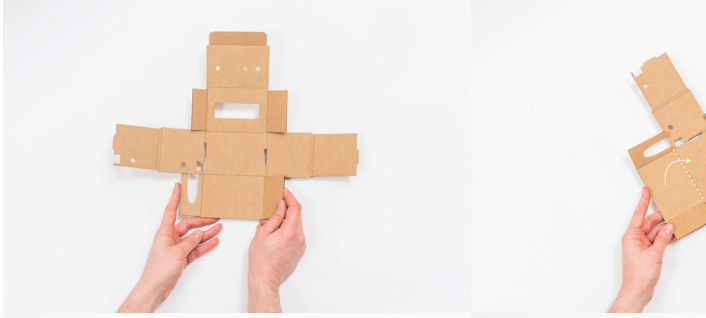
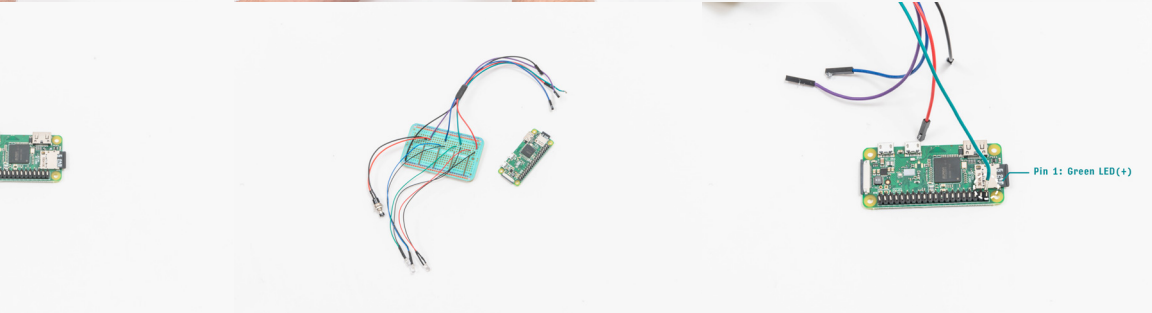


Fig 4.10. Quick-start Guide and FAQ pamphlet

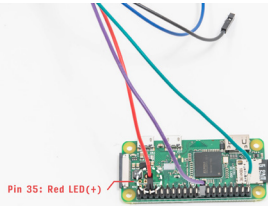
Fig 4.II. Desktop Odometer assembly







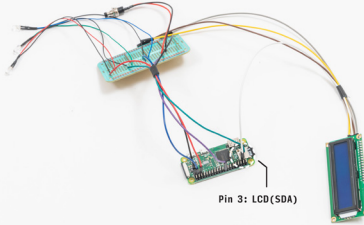
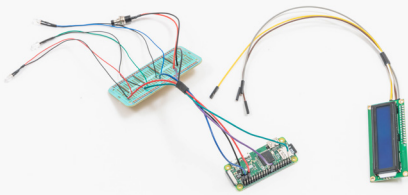
Pin 18: Reset Button(+)



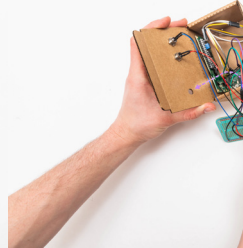
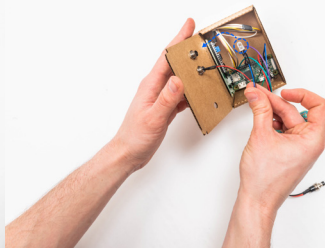
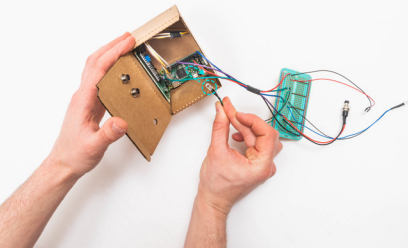
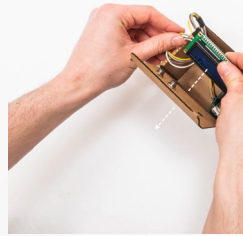
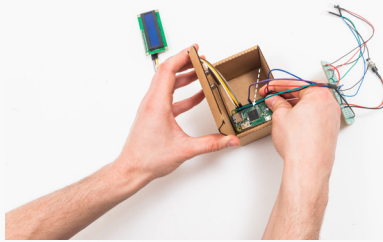
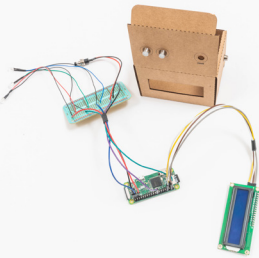
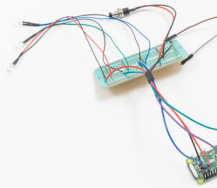
Pin 35: Red LED(+)

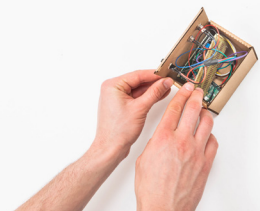
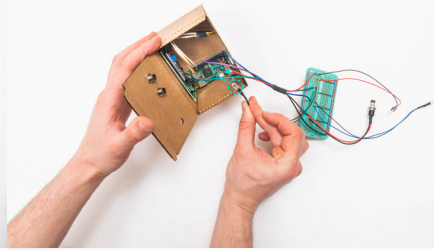
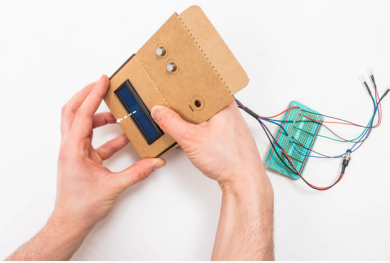
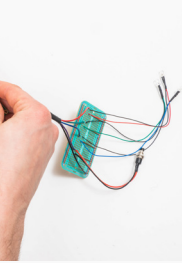
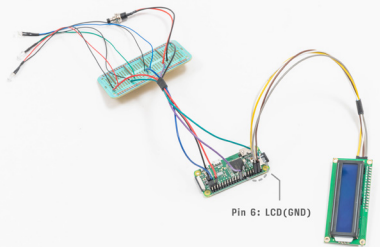
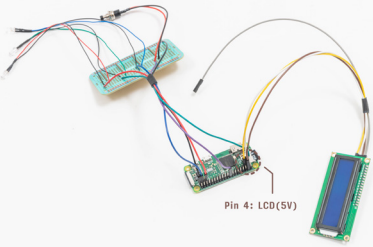
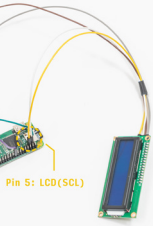
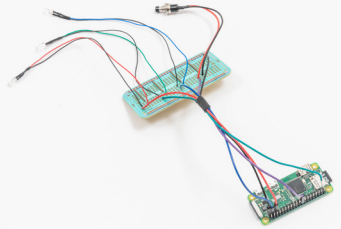
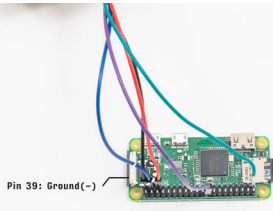


Pin 37: Blue LED(+)



Pin 3: LCD(SDA)





“By looking through your emails, we saw that you have relationships with buyers that violate our Customer Review Policy.”

- Amazon Customer Service

05

Findings

The findings described in this chapter come from two approaches in my research. The first group of findings covers the research through design required to build and disseminate the Desktop Odometer. The second group of findings comes from themes generated from Desktop Odometer customer reviews.

Barriers to entry for atypical IoT

During the process of creating the Desktop Odometer, I encountered a variety of logistical difficulties which in themselves became integral to my research. One such difficulty lay in the attempt to publish the browser extension which is necessary to use the Desktop Odometer. In the initial design for the Desktop Odometer, I planned to make the browser extension available for free on the Google Play store. However, the extension was repeatedly rejected by

Google App, which cited a variety of issues, each of which I addressed in turn. These issues included concerns about my use of non-proprietary software (a Raspberry Pi), a lack of a privacy policy, and the non-patented status of the device. I responded to each of the problems Google cited when rejecting the Desktop Odometer browser extension from the Google Play Store. This included drafting a privacy policy and rewriting browser extension code to protect users' private information using modern data encryption techniques. Despite these edits and 12 attempts to seek help from a Google admin (figure 5.1), the extension was never published. In each attempt to reach a solution, I was sent a boiler-plate email listing the same issues, which I had already addressed.

My eventual workaround solution was to make the browser extension available for customers on my website. This required extra communication with my customers and made it more difficult for novice users to understand and even find my product. The Desktop Odometer was made virtually invisible due to its absence from a prominent software marketplace, even if it was available on Amazon.com for retail.

This process illuminates the prohibitive barriers to entry into the smart device market. The opacity of the approval process ensured that small makers, such as myself, are blocked from taking part in this community. Had my product looked more like the typical smart device, made by a large company or Venture Capital funded start-up for the purposes of gathering and monetizing user data, perhaps I would have found more success in this market. There is no room for a bespoke, small batch production of discursive artifacts on Google. Given the problems I encountered as well as importance of prominent marketplaces in determining the success of products, I fear

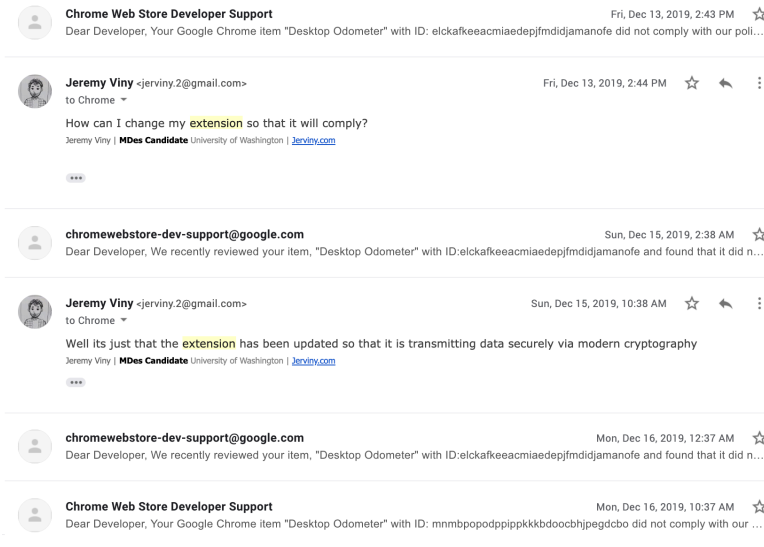


Fig. 5.1. Correspondence with Google admin

that prominent marketplaces such as the Google Play Store perpetuate a homogeneous vision of connected products. These barriers to entry disincentivize any IoT which falls outside the data-gathering/convenience hegemony. In a quote in *Living a Feminist Life*, Sarah Ahmed uses the metaphor of a path to explain how such models create barriers to non-normative ideas, while simultaneously strengthening the hold of the status quo. She writes, “The path exists in part because people have used it. A path can be kept clear, maintained; you can be supported by how a route is cleared,” but also, “When it is harder to proceed, when a path is harder to follow, you might be discouraged; you might try and find another route. A consciousness of the need to make more of an effort can be a disincentive. Just think of how we can be dissuaded by perpetual reminders of how hard something would be” (Ahmed, 2017). Here Ahmed demonstrates the

hidden ‘maintenance’ of certain ideas and practices in their continued use over others. This is most applicable to my product: just knowing the difficulties ahead is discouraging. Through abysmal seller support and control of a dominant marketplace, Google passively and quietly maintains a particular path which favors the status quo.

Observing Ethics in Practice

The Desktop Odometer became a way not only to observe hidden aspects of the Internet’s opaque infrastructure, but also a way to use Research through Design to investigate corporate ethics in practice. In particular, by selling the Desktop Odometer, I was able to compare Amazon’s public-facing privacy policy regarding seller/user data with my own experience in the handling of my data and the data of my customers. For my research, I needed to utilize a democratic platform where consumers could freely express their ideas about products via customer reviews. Because of its ubiquity and massive customer base, I chose to sell my product on Amazon. Amazon also has a simple process to leave customer reviews from a user’s account. At first there was no problem – customers were buying the Desktop Odometer, using it, and writing reviews. Then one afternoon I checked the Desktop Odometer Product page and much to my dismay, I saw that eight customer reviews had been taken down. Unsure about why customer reviews were being erased, I contacted Amazon seller support. Initially, I was told that Amazon seller support could not help me with this problem and that I should look to other sellers for answers in Amazon Seller Central, a forum for sellers to communicate with one and other. Seller Central is an unmoderated forum. As such questions are rarely ever met with a definitive answer, instead questions

are more commonly met with various, at-times contradictory anecdotes. Unable to find answers to my questions I continued to call and email Amazon Seller Support. I sent 12 emails which were never answered and called eight times. Eventually, I was able to speak with an Amazon Seller Support Representative who was willing to look into the matter. At one point during the call, this representative told me, “By looking through your emails, we were able to see that you have relationships with buyers that violate our Customer Review Policy.” Troubled by this statement, I asked, “How were you able to look through my personal emails on my Gmail account?”, to which the seller support representative said, “I cannot tell you that, but we can, and we did.” This conversation provides a troubling demonstration of Amazon’s privacy practices in regards to seller data. After looking more deeply I found that Amazon’s privacy policy states, “We know that you care how information about you is used and shared, and we appreciate your trust that we will do so carefully and sensibly.” This ambiguous statement explains very little about what felt like a significant breach of privacy. After reviewing the privacy policy in more detail, I learned that by using Amazon services I unknowingly agreed to supply Amazon with information such as, “e-mail addresses of friends and other people.”

In her book, *The Age of Surveillance Capitalism*, which details the growth of enormous Internet platforms, Shoshana Zuboff writes, “a reasonable reading of all the privacy policies that one encounters in a year would require 76 full workdays at a national opportunity cost of \$781 billion.” (Zuboff, 2020). Her calculations support the common claim that “nobody reads the manual.” She argues that the authors of such privacy policies know this fact and count on it, because the

interminable length of these agreements ensures that almost nobody will parse through all the instances of possible privacy invasion before clicking “I agree”. My experience with Amazon customer service was alarming because the agents to whom I spoke revealed permissions I had been unaware I had granted. Amazon’s AI can access not only information found in my email inbox but the email addresses of my contacts. With this information, their AI was able to take down reviews of my product by customers with whom I had communicated with in the past – flagging them as ‘friends or family’. The AI created a network of my personal relationships – true or not – and disqualified customers based on its assumption. When I disputed these charges, arguing that prior communication with customers had often been necessary to explain the nature of my product and research project, the service team told me they believed me, but that there was nothing they could do to override the algorithm’s decision. In my case, as a one-person business that makes and sells a very specific product in small batches, connecting personally to customers/participants is essential, not only to remain in existence but also for me to be transparent with my customers.

Looking beyond the fact that it is nearly impossible for users to read all the privacy policies to which they agree, these policies fail to explain all the ways in which this information is woven together to create meaning. For example, Amazon’s privacy policy notes that they can collect your IP address and the email addresses of your contacts. Individually, these permissions are relatively straightforward; I can imagine how Amazon could use one particular form of data, such as an IP address. When all these permissions are aggregated in one privacy policy, however, it becomes much more

difficult to understand what information Amazon can learn about you through various combinations of individual data points. In combination, this data is generative for Amazon's development of behavioral models, but it leaves the user unaware of the meaning of their own data. Amazon in effect claims to have a right to know what traces of ourselves 'might' be collected, but we do not have the right to know how that data is used. The question we need to ask is what kind of ownership should we have over this data, and at what point do we no longer have a right to it?

Customer Reviews

Despite the obstacles I faced in publishing and selling the Desktop Odometer, I was able to fulfill the main goals of my study and collect meaningful user-generated content in the form of customer reviews. Below I include a qualitative analysis in which I explore themes expressed through customer reviews.

Thinking of the physicality of the web

In *The Undersea Network*, Nicole Starosielski writes, "A focus on infrastructure brings to relief the unique materialities of media distribution – the resources, technologies, labor." (Starosielski, 2015). Similarly, the American designer and artist Maya Lin claims "What we don't see, we pollute." (Farr, 2006). In these quotations, both Starosielski and Lin acknowledge the importance of transparency to empower citizens to better understand the resources on which they depend. The desire to more deeply engage with these systems was expressed by Sharron, a customer who was amazed at how far information online must travel. In her review participant Tyler (all names are pseudonyms to protect anonymity)

described her experience using the device, writing, “whaaat this is amazing! It’s a very new idea and helpful in an age where we often take information and the Internet for granted. It was eye-opening for me to see which links or pages would cause a huge distance to be added to my total miles.” Tyler’s reviews demonstrate how the Desktop Odometer was a catalyst for deeper inquiries into opaque infrastructure.

Drawing the users’ attention to the immense distances information travels, the Desktop Odometer motivated some users to consider the Internet’s effect on the climate. For example, one customer, Taylor, wrote “I’m merely sitting, or standing at my desk, yet my actions are reaching great distances. Action at a distance; I feel so powerful. My desktop odometer made me feel quite accomplished at first, until I read an article in the New Republic, I learned that the Internet “is the largest coal-fired machine on the entire planet, accounting for 10 percent of global electricity demand.” The transmission of information over immense distances becomes a gateway to grappling with the physicality of the web. As seen by Taylor’s review, once a consumer starts to engage with the hidden infrastructure behind their computer screen, other realizations may follow.

Reflecting on the mandatory shutdown of all non-essential businesses in response to COVID-19 another reviewer, Alex (figure 5.2), described how using the device led to experiencing the web as a more dynamic activity. In her review she wrote, “The Desktop Odometer makes the immateriality of the Internet real and brings a small but meaningful feeling of movement back into my life. While I am not walking past the park to my now indefinitely closed office building, I am logging onto my email, thousands



Fig. 5.2. Image posted by customer, Alex

of miles away. I move from website to website, traveling at breakneck speeds. This new world is frightening, but Desktop Odometer brings some sense of normalcy and meaning to my routine.” Alex’s review demonstrates the value of making and disseminating the functional desktop Odometer. Thinking about the device in the context of her own life led Alex to formulate a more dynamic understanding of the web. As illustrated by the examples above, many customers described how using the device led them to think about the physicality of the web. Therefore, customer reviews help illustrate how the Desktop Odometer was a useful way to engage with the physical yet often hidden facets of the web.

Awareness of Opaque Infrastructures

Nicole Starosielski describes the importance of revealing opaque infrastructures, writing, “Capitalist societies generally educate people to appreciate the “conveniences” and “choices” of modern consumer technologies, but to remain blind to the infrastructures that support them. As a result, infrastructural changes often occur quickly and without notice, short-circuiting

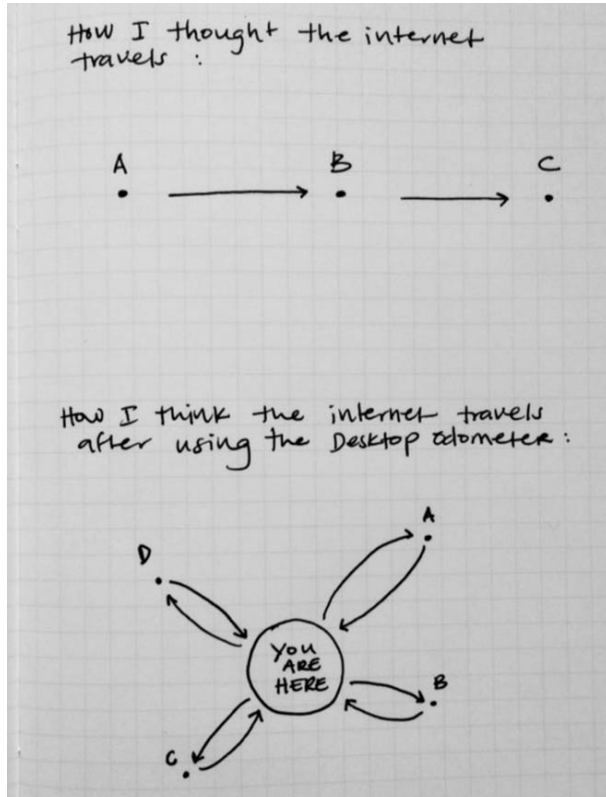


Fig. 5.3. Image posted by customer, Jen

citizens-users' ability to participate in systems development." (Starosielski, 2015). In their reviews, many customers described ways in which using the device led to a greater awareness of Internet infrastructure. In order for the Desktop Odometer to do this, it had to focus the user's attention on what is normally overlooked and in the background. This was reflected in Sam's review, in they which described the concepts of conceptual underpinnings, writing, "The Odometer is an interesting thought experiment, one that re-centers your focus from the content that you consume every day to the backend mechanisms that make your browsing experiences possible." Sam's review highlights how the Desktop Odometer was a useful product for thinking about the Internet's inner workings.

Using the device left some customers with a more accurate conception of how information travels. For example, participant Jen wrote, “Often I tend to think of the “Internet world” as existing on almost a different plane than the “real world”. This product showed me, in a way, the physicality of the Internet, and that things don’t actually just magically appear on my screen.” In her review, Jen provided a sketch of a map depicting her understanding of how information moves throughout the web, before and after using the device (figure 5.3). Jen’s drawing before and after using the device illustrates, literally, how using the device led to a more accurate conception of information travels. For Jen, understanding the physicality of the Internet led to a more accurate understanding of how it works.

In addition to enabling new understandings of opaque infrastructures, the Desktop Odometer prompted users to ask a variety of interesting questions. One user, Frankie wrote, “I am curious if bigger tubes translate to faster Internet? When the Internet is slow or tubes are overworked what does that look like? How does the system decide which request has priority when there is a lot of traffic?” Frankie’s question demonstrates how for him, the device was an experiential gateway to developing questions surrounding fairness and equity regarding access to information. Reviews like Frankie’s help demonstrate the value of the Desktop Odometer as a discursive product.



Fig. 5.4. Image posted by customer, Max used to illustrate how different objects could be used to house the device.

The Desktop Odometer helped some users make sense of abstract concepts such as data within the context of their own life. For example, Jordan wrote, “this little object from the future makes tangible, what was previously invisible and unknown to me. The odometer is a daily, delightful reminder to me that data really might be the most valuable resource of our time, and it need not feel like an episode of *Black Mirror*.” Jordan’s review describes how using the device led her to think about the value of user data – not in the context of a dystopian future – but situated within the world she currently lives in. By experiencing concepts which at times may seem sci-fi or futuristic, users can recontextualize these concepts as already embedded within everyday life, which is important in creating more accurate depictions of opaque infrastructures.

Form development

Compared to the vast majority of connected objects, the Desktop Odometer is unique in that its exterior shell is made of cardboard, foregoing the more typical materials (hard plastics and aluminum) used to outfit connected devices. A traditional prototyping material, cardboard was consciously selected to evidence an incomplete aesthetic that invited participants to criticize the design and communicate alternatives. (figure 5.4). Ultimately, many participants commented and questioned the material considerations. For example, one reviewer, Max wrote, “i opened it up to see if there was some unseen reason for the drab exterior. and what did i find? wires and circuit boards! like hello i could be putting these little pieces in any container i wanted.” Max’s review calls into question the reasoning behind housing most connected devices in inconspicuous or bland containers. While the enclosures for most devices are the result of a variety of design decisions, it is important to also acknowledge some of the unintended consequences of sealing connected technologies. For Max, removing the electronics from its given enclosure allowed her to observe the technical and material infrastructure of this particular device.

**Through these investigations
we can begin to examine how
infrastructures align with
the values and aspirations of
the people who use them.**

06

Discussion

In this thesis, I have presented the Desktop Odometer, a product created to investigate opaque infrastructures. I have conducted this work using two primary approaches. The first approach was selling the Desktop Odometer on Amazon to elicit user-generated feedback about the inner workings of the Internet, and the second was using research through design as a way to investigate the infrastructure necessary to support making, using and selling the Desktop Odometer. While the Desktop Odometer has helped to unearth information about network infrastructures, more research is necessary in order to make these infrastructures transparent. In this chapter, I introduce a variety of questions about opaque infrastructure that require further attention. After introducing these questions, I discuss potential avenues to address them, building on the approaches I have already described in this research.

Continuing investigation towards revealing Opaque Infrastructure

Throughout this work, I have described how the Desktop Odometer has been used to explore opaque infrastructures. Still, more work is necessary to make network infrastructure more visible. Author Nicole Staroskielski describes the complexity of engaging with infrastructures, writing, “infrastructure is a fundamentally relational concept rather than a concrete object; it is something that emerges from people in practice, [and is] connected to activities and structures” (Parks & Staroskielski, 2015). Staroskielski’s quote highlights how infrastructures can be made visible by actively engaging with it. An individual’s understanding of infrastructure is typically related to their interactions with them. Using the Desktop Odometer offers a new way to engage with Internet infrastructure and thus affords new understandings through engagement.

The continued production and deployment of novel discursive artifacts offers opportunities for future inquiries. In this section, I highlight various needs for continued infrastructure investigation, which extend beyond the scope of this project. After describing why more research into the question is necessary, I use the themes outlined in the findings section (observing opaque infrastructures, thinking of the physicality of the web, and alternative forms of IoT) as a starting point to begin developing additional bespoke products. Like the Desktop Odometer, such products are intended to help improve the transparency of opaque infrastructure.

Web Route Possibilities Map

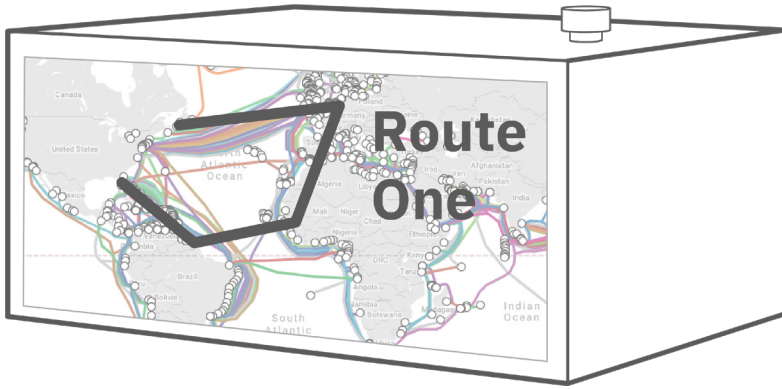


Fig. 6.1. Concept illustration I: Web Route Possibilities Map

Building Awareness of the Internet's Material Infrastructure

The web is commonly portrayed as immaterial, wireless, non-local and part of the public domain. Contrary to this popular depiction, Internet infrastructure is heavily wired, mostly centralized, and predominantly owned and operated by private corporations. These qualities meaningfully impact its use in ways that may have unintended and possibly undesired policy implications. For example, during the 2008 rollout of New York's fiber-optic network, Verizon Wireless refused to lay cables in low-income areas (Burrington, 2016). Verizon's decision to exclude particular areas from New York's publicly funded fiber-optic network illustrates what can happen when the creation of infrastructure is both guided by short-term profit incentives and hidden from the public it is meant

to serve. Bringing to light the material aspects of Internet infrastructure is essential to building greater public awareness of the systems upon which we rely.

How do we build greater awareness of the Internet's material infrastructure? In several product reviews about the Desktop Odometer customers expressed their desire to learn more about how information moves through the world. Their questions prompted me to conceptualize the *Web Route Possibilities Map* (figure 6.1). This concept is just one example – there are of course many other ways to depict the material infrastructure of the Internet. Just as Google Maps presents a variety of routes to a particular location, the *Web Route Possibilities Map* shows users a variety of possible routes information must travel to return a particular search request. By showing the multiple routes data can travel to return a user's search request, the *Web Route Possibilities Map* allows users to glimpse the physical paths of this information as it travels through complex fiber-optic networks, hidden from plain sight. As discussed in Chapter 2 – Related Works, many facets of the Internet are not well understood or largely ignored, such as the signals used to distribute information and the various physical infrastructural elements that transport data. As a product, The *Web Route Possibilities Map* creates an alternative to the dominant narratives of immaterial networks by focusing specifically on these materialities. Recognizing the materiality of Internet infrastructure fosters greater public awareness of the system that both enable and control the operation of society.

Drawing Attention to Form

The inconspicuous exterior housing covering most connected devices is the result of a variety of design decisions. However,

as a result, users are usually unable to observe the electrical components within the housing. By hiding these components, users remain unaware of their existence and as a result the housing helps reinforce narratives of connectivity as immaterial. Companies such as Apple have attempted to discourage customers from opening their Apple products by voiding warranties when any repair has been attempted on Apple products by anyone other than an authorized Apple repair representative. This issue has become known as the right to repair. Proponents of the right to repair argue that if you cannot repair it you don't own it (Wiens, n.d.). Repair proponents argue that by preventing buyers from fixing their products the makers of those products create dependencies, ultimately forcing customers into an unequal power dynamic. Max's photoshopped image of the Desktop Odometer placed within a Furby doll provokes questions not just about repair but also about ownership and customization.

Building on this idea, I propose the following question: Can connected devices be designed in a way that promotes greater awareness of both the exterior and interior components of connected devices? In response to this question, I conceived a concept called *Connected Negative Space* (figure 6.2), a connected device that is defined by the absence of any proprietary enclosure. The concept of *Connected Negative Space* includes the bare electronics necessary to operate a Google Home Mini, a smart assistant with voice UI. *Connected Negative Space* comes with a hole-saw, a drill bit. Users are directed to use the drill bit to cut a hole out of any object they want to house the electrical components. Once the hole has been cut users are able to embed the electrical components within the housing of their choice. After this, they can start using the device. *Connected Negative Space*

Connected Negative Space

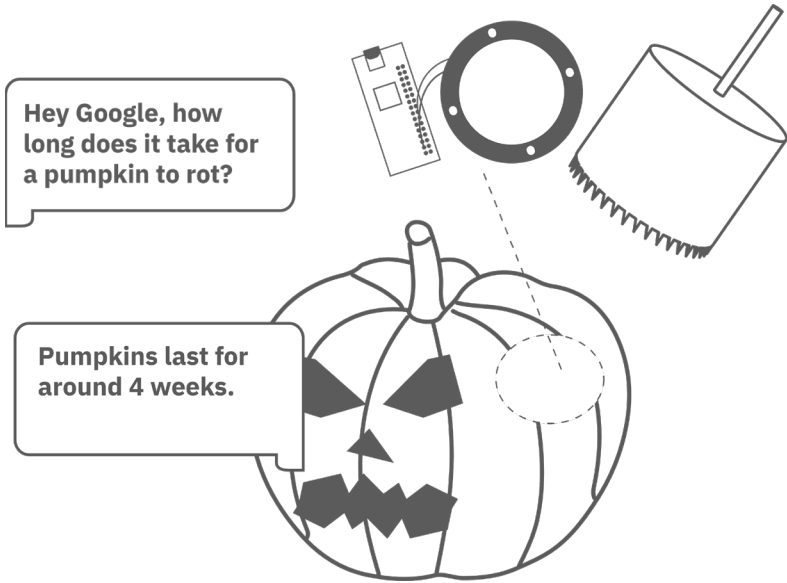


Fig. 6.2. Concept illustration2:
Connected Negative Space

is intended to provoke investigation into the material components of connected devices. In addition, this concept is intended to encourage exploration into the relationship between a device's capabilities and the housing it resides in.

Reflection on Methodology

In this work, I have used the Amazon marketplace as a site for user-generated, participatory, and experiential design research. In this final section, I describe potential opportunities for future work based on features and unique characteristics of online marketplaces.

Histories of Customer Reviews

Customer Reviews are not new. In fact, star-based rating guides became widely distributed for consumers as early

as the 1900s. Joseph Reagle, the author of *Reading the Comments*, claims, “In 1900, Michelin printed its first guide, and stars were used only to indicate the class or cost of hotel accommodation, a convention that was used by existing train guides” (Reagle, 2016). Later, in 1927, two engineers, F.J. Schlink and Stuart Chase, set out to develop a scientific approach to review products. In their book, *Your Money’s Worth: A Study in the Waste of the Consumer’s Dollar*, they argue, “We are all Alices in a Wonderland of conflicting claims, bright promises, fancy packages, soaring words, and almost impenetrable ignorance.” (Chase & Schlink, 1927). Their work served as the inspiration for the creation of the Consumer Report in 1936. Customer reviews are deeply ingrained in consumer culture, so much so that there are well-established sub-genres of reviews. One such sub-genre is the review parody, a popular form of a comment often directed at seemingly absurd products. In addition, there are popular forms of reviews such as unboxing videos, product comparisons, troubleshooting, and many more. Most consumers are comfortable using customer reviews as a medium to express their experience of a given object and also, from the reader’s side, to understand products based on what other people have said in their reviews. Because they rely on well-established methods of communication, reviews offer an effective way to engage with users. Given how ingrained reviews are in our consumer culture, they are uniquely well suited as a research tool.

Asynchronous Feedback in Co-speculation

Before Amazon removed customer reviews from the product listing page, I was able to observe instances of user-generated content unfolding in an asynchronous format. *Co-speculation* refers to “the recruiting and participation of study participants who are well-positioned to actively and knowingly speculate with us in our inquiry in ways that we cannot alone” (Wakkary et al., 2018). Typically co-speculation is a dialogue which takes place between designers and research participants. However, on an online forum such as Amazon.com *Co-speculation* can be an asynchronous dialogue that evolves and grows over time. It can be a conversation held by many, not simply the designer and user. For example, in customer Eliot’s review he wrote, “Now that I have the Desktop Odometer I don’t feel the need to travel via airplanes as much. It feels great to know I am going so far without burning fossil fuels and destroying the environment. #GoGreen.” This prompted another customer, Connie, to respond, writing, “you still are burning fossil fuels etc. because all that Internet cloud stuff is actually happening here on earth in city sized servers all over the planet that are using tons of energy (fossil fuels etc.) and helping with global warming and destroying the environment...” (Customer Connie). This exchange between customers helps highlight the social as well as the discursive possibilities of using online forums such as customer reviews as a site to conduct participatory research.

While customer reviews can be a form of critique, they also can be a generative starting point to develop new concepts. In the discussion chapter, I present sketches that build on the themes presented in the findings chapter. If

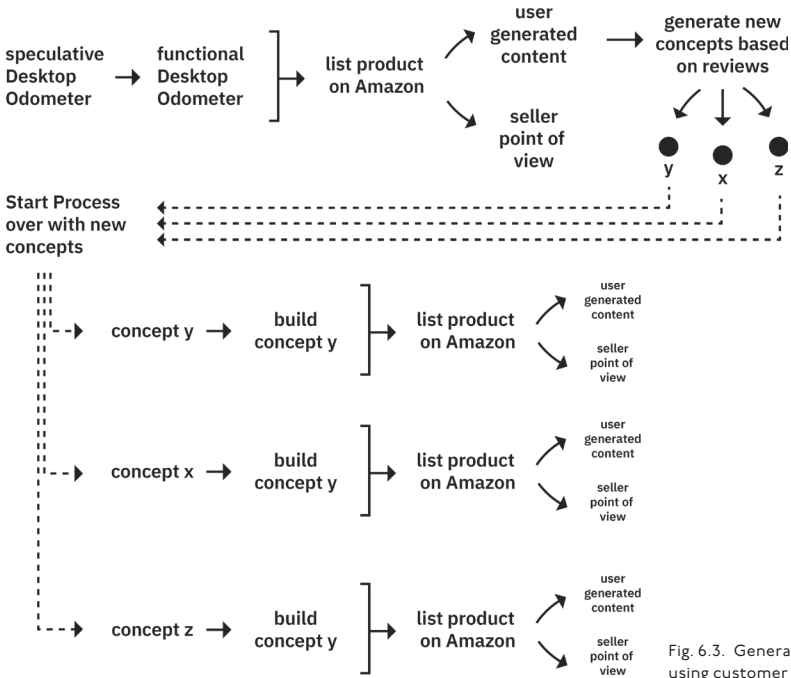


Fig. 6.3. Generative approach to using customer reviews

these concepts are developed into functional products, this approach utilizes participant feedback not only in the review of products but also much earlier in their development. Figure 6.3 illustrates how this approach can be repeated based on customer reviews. Continuing the production and deployment of novel discursive artifacts offers the possibility to continue the investigation of opaque infrastructures in a way that builds upon previous research.

In this chapter, I have proposed various questions relating to network infrastructure. It is my hope that these questions indicate the value of the methodology from which they came and also help to guide structuring and restructuring

of future networked information technologies. In the future, I hope both HCI and Design researchers build on the work I have proposed by incorporating their research on online marketplaces to create discourse.

Conclusion

There is no 'best' approach to investigating infrastructure. Infrastructure is the topic of study in a variety of disciplines. I have focused on using products, a common medium for designers, as an experiential tool to investigate opaque infrastructure. I used three approaches to investigate opaque infrastructures: the first was making the Desktop Odometer itself, the second was selling the Desktop Odometer on Amazon.com as a way to elicit user-generated feedback about the inner workings of the Internet, and the third was gaining firsthand experience of the seller's side on Amazon.com.

The researcher and Sociologist Susan Leigh Star describes infrastructure as “both relational and ecological—it means different things to different groups and it is part of the balance of action, tools, and the built environment, inseparable from them” (Star, 1999). The infrastructures I have discussed in this work are so totally embedded in everyday life that any notion of choice – choosing whether or not to engage with these systems – is simply an illusion. The fact that there is little or no choice only highlights the need to investigate opaque infrastructures. Through these investigations we can begin to examine how opaque infrastructures align with the values and aspirations of the people who use them, how opaque infrastructures shape the futures of the people who will be affected by them, and whose voices are and are not being considered in the shaping of them.

Appendix

7.1 Customer Reviews

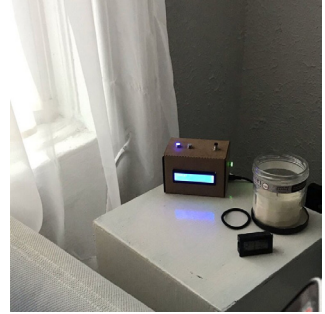
Alex



Great reminder of the outside world for those in lockdown

on Mar 23, 2020

I'm on Day 12 of my mandated 14-day self-isolation period as recommended by the CDC, after a close encounter with someone who fell ill. My apartment is very small, and I have been maxing out at around 750 steps a day. Self-isolation has made it clear to me that I really only understand time through place. My routine was defined by movement--from the bed, to the bathroom, to the office, to the gym. I spent the first few days senseless, trapped in a pocket dimension where nothing and everything was happening at the same time. Then I set up my Desktop Odometer. The Desktop Odometer makes the immateriality of the internet real, and brings a small but meaningful feeling of movement back into my life. While I am not walking past the park to my now indefinitely closed office building, I am logging onto my email, thousands of miles away. I move from website to website, traveling at breakneck speeds. This new world is frightening, but Desktop Odometer brings some sense of normalcy and meaning to my routine. It is really beautifully designed, I love the care put into the lights at the top. The instructions were clear and easy to understand. I worried that my habit of using Firefox was messing up the data collection aspect, but I appreciate that it appears to be sniffing the entire Wi-Fi network.



Greg



Very happy with my Desktop Odometer

on Dec 30, 2019

Wow! I am so happy with my new desktop odometer. This product was hand-delivered to me by its creator—showing the care and intention it carries with it. My desktop odometer currently reads somewhere in the high tens of millions. At first, I was pretty blown away by the huge numbers it displayed, and later I realized that I didn't have much context or awareness of what that number really means. As it continues to increase I forget that it is racking up the miles. The bright blue screen is ominous and authoritative in all the right ways. I could not recommend this product high enough!

Max

Works great, but needs special edition skins or at least some color

on Dec 19, 2019



conceptually, this is a great product - it tracks where i go on the internet and gives me a meaningless number that updates as i browse! incredible. i use it everyday; it sits on my desk next to my PC and tallies inscrutable sums. i've had it going for 2 weeks and i've had no problems with its function at all.

but visually? this thing is BOOOORRING: a cardboard box is all i get for spending 35 hard-earned dollars???? and, reader, i opened the thing up to see if there was some unseen reason for the drab exterior. and what did i find? wires and circuit boards! like hello i could be putting these little pieces in any container i wanted. for eg., like how you can buy covers for your unsightly tissue boxes! at the very least, could we get a color option??

so thats all i ask, handmade futures: pls come out with some colors and maybe, new textures? i hear "marble" is very hot right now or perhaps an iridescent vinyl? i think this would rly make a splash with youth especially. and maybe an occasional limited release with something like faux fur or a different shape or perhaps a colab with popular brands such as nike and disney. dang im giving u these ideas for FREE. AND you could also reach out to the luxury customers who wouldn't b caught dead with such an eyesore in their home by offering an edition encrusted w diamonds or at very least a solid platinum.... i'm attaching a few photos as examples..

anyway, the customer needs OPTIONS bc i've resorted to carving out a hole in a furby doll i found in my basement and though it still works great, now it looks like ive got a satanic teletubby on my desk enumerating the sins of man. (see last photo)

Flynn

Makes me feel Like Will Robinson

on Jan 11, 2019

I was surprised to see it was smaller than I thought it would be (in a good way). The cardboard and recyclable packing materials give it a feeling of impermanence, which I like, despite it being a super teleportation logging machine. Seeing how much distance I can cover so quickly, I wish I knew what places in the world I visited without knowing. Behind the mysterious glowing blue screen, I think it knows more than it tells me. Like it's full of more secrets and just doesn't have the same senses to tell me, kind of like the robot in *Lost in Space* (the Netflix Original), but I haven't finished season 2 yet. Looking forward to more adventures with my new expressionless robot friend!

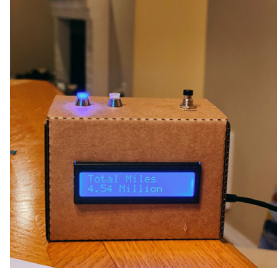
Tyler



Makes you browse in a new way

on Mar 22, 2020

Desktop odometer was beautifully packaged (had a perfect thoughtfully crafted feel) and the Quickstart guide that came with it was helpful and well-explained. The “whaaat this is amazing!”: It’s a very new idea and helpful in an age where we often take information and the Internet for granted. It was eye-opening for me to see which links or pages would cause a huge distance to be added to my total miles. The product itself is a good mix of “gadget” but also minimalistic; I’d be happy to put this alongside my desk :) The “I’d love to see more!”: I’m curious to understand better why certain searches led to the distance that got recorded. In other words, I feel like I got the “answer” but no idea how we got there. How is distance calculated? Does the information size come into play? (i.e. a streaming video vs. a link?) In the package, it says a search could take you “from a server in USA to India to Canada” -- I’d love to see that bounce of information relayed so I have a better understanding of how the internet and data being surfaced works.



Kai



My Travel buddy

on Mar 22, 2020

During this time of quarantine, the desktop odometer is a wonderful way to explore what is beyond my 4 walls (I literally have 4 walls in my apartment)... While looking at photos of Zion National Park (where I was supposed to go for spring break), I was able to see the millions of miles my computer traveled in order to display the pictures for my enjoyment. At least my computer can travel these days.

Frankie



Tell me more about dem tubes

on Feb 12, 2020

I am curious if bigger tubes translate to faster internet? When the internet is slow or tubes are overworked what does that look like? How does the system decide which request has priority when there is a lot of traffic?

Joelle

For me, not so much, might gift to a friend

on Mar 20, 2019

After receiving the odometer in the mail I let it basically rot on my desk for multiple months. I remember receiving joy when I unboxed it and wanting to know more about how it was actually made, and wishing the setup of the product was more hands-on instead of online. People came into my room over the coming weeks and thought it was very cute, albeit not operating, because it was like my little robot friend who was with me on my online adventures. I struggled motivating myself to set it up, because the information I would be receiving from the product felt kind of useless to me, except for passing fascination. After plugging in, I feel more paranoid about which sites I am visiting because it feels like this little box is following my every move. I don't picture myself using this object in my daily life, because the information I am receiving from the odometer doesn't feel important to my success online or earth-shattering in the way I observe my own positionality online. I can imagine for a kid this product would be super engaging and a way to limit what kids observe online, and stress the importance of making more embodied connections to what we think of as the internet of technology. Though for someone who doesn't really like going online, like myself, or doesn't really care where my connection is reaching, I am kind of left uninterested. THIS DOESN'T FEEL GOOD TO SAY. Part of me wishes the machine (as I do believe it holds more information than it is sharing) could be acting with more personified emotions, I wish I felt a concrete message of love for fear from this object, so I felt more thoughts being provoked while using it. (If this makes sense). For example I wish it showed me a picture of a random person also on this site all the way across the world, and their height or something meaningless but intensely personal, provoking fear, curiosity, and intentionality when I go online. I have faith my friend who does corporate security for Amazon will love and adore this invention, but for now maybe its for him and not for me, maybe I am not the correct user.

Derrick

Update: Material Color Fades :(

on Jan 3, 200

I found this product while looking for high tech accessories to match my desk at work. I wanted something functional but beautiful and this product looked perfect. The packaging was pretty promising too. Sadly it seems the materials fade over time and now it is only functional...changed to four stars. I didn't realize how much I'd enjoy the functionality of this product. When I'm online these days, it seems data is only a click away, but my odometer keeps me in check. I've watched thousands of miles fly by in a few seconds of a YouTube video! One time my friends and I even had a race to see who could hit 10,000 miles first surfing on Wikipedia. If only I could play online instead of LAN...

Taylor



I went 43.68 million miles in a day

on Jan 30, 2020

It was a productive day of grading my student assignments online, and researching a new artwork I want to make, which racked up the miles. I'm merely sitting, or standing at my desk, yet my actions are reaching great distances. Action at a distance; I feel so powerful. My desktop odometer made me feel quite accomplished at first, until I recalled the recent article in the New Republic, "Can the Internet Survive Climate Change?" In it, I learned that the internet "is the largest coal-fired machine on the entire planet, accounting for 10 percent of global electricity demand." Whoa. Okay, time to unplug my devices and read a book. Or at least turn them all off while I sleep. Oh, desktop odometer, I love your little off switch, very satisfying. But I do not love how forgetful you are. Why can't you remember your wifi connection each time I turn you on again? You really want me to fiddle with the 3-part reconnection process each time? Naughty odometer. You are a complex thing, hidden in your unassuming cardboard exterior.

Jordan



The nightlight I never knew I needed

on Mar 20, 2020

The Desktop Odometer is no doubt a unique object—it makes data (the miles we "travel" online) visible in an understated format. This small cardboard paradox feels like it's always been there, blending in with its no-nonsense aesthetic & simple user guide, which I leave open on my desk for days. Yet, this little object from the future makes tangible, what was previously invisible and unknown to me. The odometer is a daily, delightful reminder to me that data really might be the most valuable resource of our time, and it need not feel like an episode of Black Mirror. What else can it do? The odometer stops working about two weeks into using it, but I've already discovered that its small green LED light emits a warm glow in my studio apartment. I grow to enjoy it, and leave the box plugged in for months to follow, despite its broken counter. The odometer becomes a pleasing artifact atop my desk, nestled in with my plants and notebooks. Guests visit and ask me whether it's a speaker or an alarm clock. It becomes a conversation piece. I eventually return it for repair, but I miss its presence—the warm little nightlight I never knew I needed.



Sam



A Paperweight that makes you self-reflect

on Jan 3, 2020

Upon receiving the desktop odometer, I as skeptical about an extra device on my desk just for telling me where my internet usage went. Questions such as “why a box? Will it be beneficial towards my life? If it takes up space, then will it get in the way of my ordinary life?” came up as I opened the box. But as I set up the device and spent time with it, the more integrated and invisible it became in my life.

UNBOXING: Materials are largely renewable, such as paper and cardboard. In the box, there was an instruction manual and a piece of paper describing the usage of the odometer. **THE DEVICE:** Cardboard wasn't the best quality, but the odometer felt sturdy and solid. No parts were rattling around inside, and the design of the device was simple and clean, with a clearly outlined port for power and the reset button was satisfying to press.

THE SETUP: Setting up was probably the hardest part of the device. The instruction manual's labels of the lights were reversed, but it was still intuitive by coloring whether it was connected to wifi or not. It took a couple of tries to make sure that my computer could connect to the box, and I discovered that the extension in chrome doesn't support the 5g channel of the router. After it connected after a couple of tries, the extension worked perfectly, and after a couple of seconds, the box was connected to the internet. **USAGE:** I was immediately struck with a feeling of fascination as soon as I opened chrome and started my journey. I was surprised just how many millions of miles that the odometer tracked of information being sent to my computer. Often times, I would try and go to the most obscure websites I could try and see just how far I could get the odometer to jump by using it.

EXTRAS: I was skeptical at first of the lack of functionality the box had to offer, but the more I used it, the more it became integrated into my daily life. While working, I would often glance at the box to see where my search went, and depending on the number of miles I went, I found it correlated with how fast the page loaded and how fast I was able to download resources from the page. In addition, the box acted as a handy marker as to whether our apartment wifi went down, so I could see at-a-glance when our router needed resetting.

FINAL WORDS: The desktop odometer is a box that broadened my perspectives about not only where our information comes from, but just how much we consume in one day. In one 30-minute session, I was surprised to see over 50 million miles racked up on my odometer by just looking at news and looking through various articles for my classes. The physicality of the box can be just as easily replicated in an extension that lived on your computer, but the feeling of a counter sitting on your desk that is always there makes you realize even more about just how much you are online every day. The Odometer is an interesting thought experiment, one that re-centers your focus from the content that you consume every day to the backend mechanisms that make your browsing experiences possible.



John

marriage=save

on Jan 4, 2020

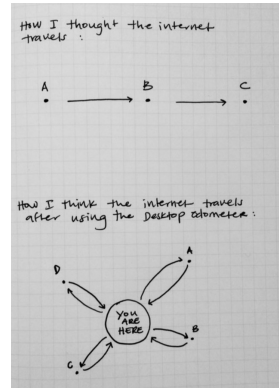
My wife and I haven't been getting along ever since our daughter left for college.. I almost thought our marriage was in shambles until I happened to end up with this during my jobs white elephant gift exchange. As I started setting up the device my wife began asking me questions about it left and right!!! It's the most action I've gotten in YEARS!!!!!! We browse the internet together every night and when I'm out of town for work she'll call me telling me about her online travels. Ever since the desktop odometer, my wife talks to me, goes on walks with me, and even calls me sweet cheeks again like we're back in our 20's when we first met!! THANK YOU DESKTOP ODOMETER!!!!

Jen

Cute addition to my pile of things I like, but don't really know what to do with.

on Jan 4, 2020

First off, the desktop odometer is super cute! I really like the form factor of it, and how it looks in my room. Definitely a conversation starter kinda piece to have, it makes me look like I'm into cool, smart lil gadgets. Super easy to set up, and it was fascinating to see how many miles I was traveling with just a couple internet searches. My parents are kinda strict so I don't get to travel much, so this will do for now I suppose. In a time of isolation such as now, it was kind of funny to think that I was actually traveling all those miles. Often I tend to think of the "internet world" as existing on almost a different plane than the "real world". This product showed me, in a way, the physicality of the internet, and that things don't actually just magically appear on my screen. It made me a little more empathic to when the internet is slow, or takes longer to load. Poor thing is traveling so far just so I can search up something that I will inevitably end up forgetting. Although I wished there was a way to find out where it was traveling! But alas, all is well and I still like this product.

**Alan**

Amazing!!!!

on Oct 31, 2018

It's incredible to experience the vast distances you travel at a speed of 3mbps. When surfing the web, all I have to do is glance at the Desktop Odometer, and instantly I can almost feel the wind in my hair. I feel alive again!!!

FIVE STARS.

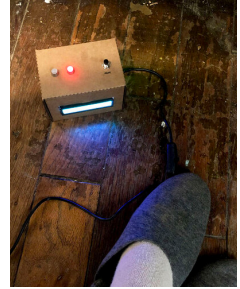
Thanks, Desktop Odometer

Jean

Amazing!!!!

on Mar 10, 2020

My desktop odometer lived a very short and adventurous life. During setup, my desktop odometer lived on the edge. Precariously it perched on the precipice of my desk, hanging on by a short chord stretched to its limits. As the light turned green and life filled the unassuming box, gravity called and the odometer fell down to the depths below. Upon inspection, the desktop odometer's light of life still flickered, but it became clear that destiny deemed the desktop out of reach. And it was then that the desktop odometer died, and the floortop odometer was born. The floortop odometer still achieved all the tasks one would expect. As I worked on my computer, and looked below towards the ground, the tapping of my feet seemed to fall in a steady rhythm with the odometer's unwavering rise in miles traveled. While my desktop misses the friend it was promised, I have gained a friendly foot companion, a subtle comfort like that of a cat sleeping by the warmth of a fire.

**Liz**

I love my internet odometer.

on Feb 2, 2020

It is strange, impractical and I have absolutely no use for it. Yet there is something about it that adds value to my experience. I especially like the way the screen lights up and the way the buttons pop up. The cardboard however, feels almost too light in my hands, I wish it had more weight. I think it could be cool to make the odometer box out of clear colored acrylic, so you could see the wires inside. It makes me feel like I am in the cockpit of a plane or rocketship, I wish I could add more dials to my desk ...what else could I measure? And why am I calculating these numbers? What will they tell me at the end of this? I like that the odometer poses questions, rather than giving answers. It is a tool for thinking. It offers a less tangible contribution to my existence, yet by its arbitrariness and irrelevance it opens new doors of possibility and ways of thinking. Why am I using this? What are some things that are similar to this? What are some things that are different? What other arbitrary things in my life? The desktop odometer could be a fancy night light? Perhaps a nightlight is arbitrary. This also poses the question what gives something value? How do we quantify that? How does spending money on something play a role in that? Anyways. I enjoy this. What is life if not for joy. I think there is more to the desktop odometer than what first meets the eye. Or maybe there isn't I don't know.

Chuck

Awesome!

on Oct 29, 2018

There are a few things one looks forward to in life. Unboxing my first, Desktop Odometer was one of them. This a refurbished unit from Handmade Futures but it looks brand new. I had just purchased a new mac book pro but I love when things have a vintage feel so when I saw that the refurbished Desktop Odometer already had 2,000,000 miles on it I had to pull the trigger. You should see my friends faces when they see how many miles I have logged

Alfred

Go Green!

on Oct 29, 2018

Now that I have the Desktop Odometer I don't feel the need to travel via airplanes as much. It feels great to know I am going so far without burning fossil fuels and destroying the environment. #GoGreen

Reply: @JusJack, uhhmm...but you still are burning fossil fuels etc. because all that internet cloud stuff is actually happening here on earth in city sized servers all over the planet that are using tons of energy (fossil fuels etc.)and helping with global warming and destroying the environment...sorry for the #debbiedowner moment--It was something I didn't really understand until recently myself...the internet is Not Carbon Neutral...#passiton

Hunter

What a cool Gizmo

on Jan 27, 2020

Just got my Desktop Odometer hooked up and I love this thing! It's fascinating to realize how my internet travels relate to real points and places in the non-virtual world. This device makes me understand that the internet really does transport and redefines how I can interact with the world. Love logging the miles! What a cool Gizmo!!!!

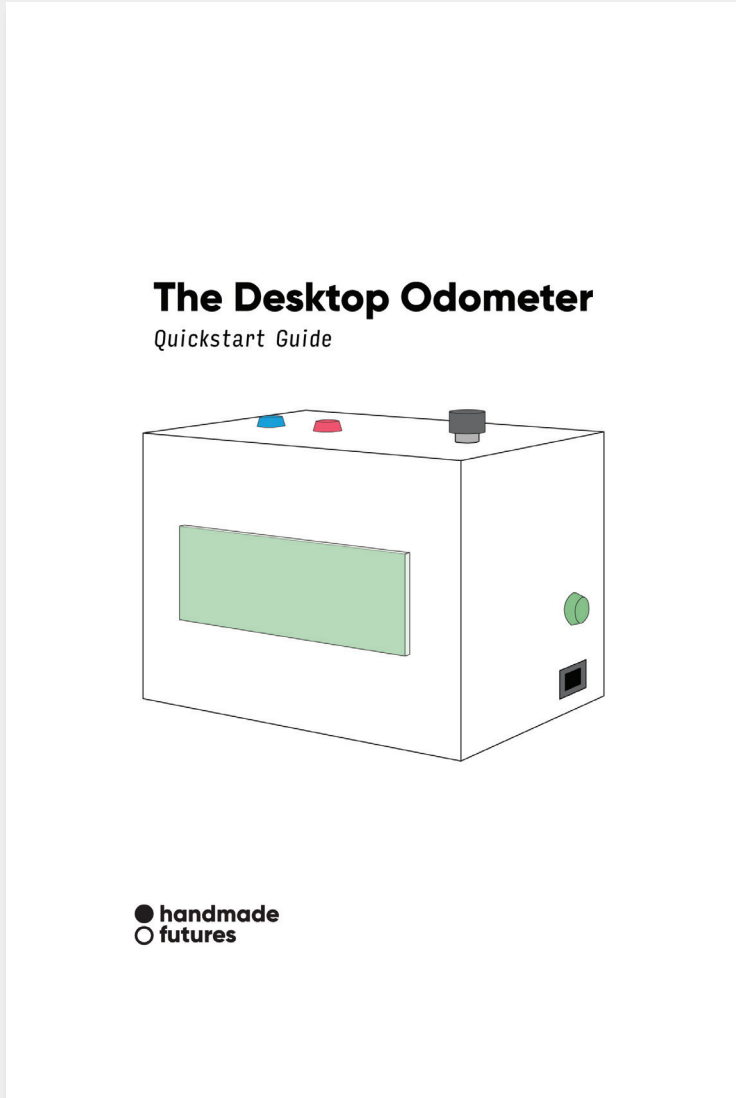
Reply: @Amy, Thanks Mom

Appendix

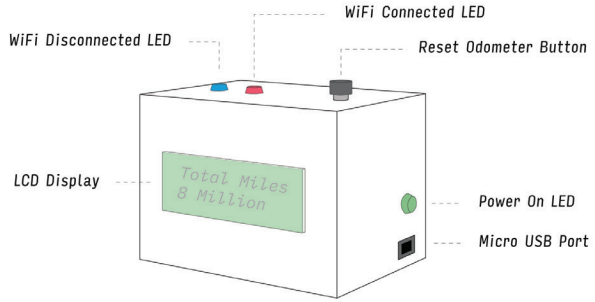
7.2 Instructional Materials

Quickstart Guide

The quick-start guide walks the user through the setup process. There are 14 steps, and for first-time users, it usually takes around 15 minutes to complete. The Quickstart guide exists in booklet and video format. The two formats allow users to choose the one that works best for them.



The following guide outlines how to set up
the Desktop Odometer by Handmade Futures



1.

Go to the Google Chrome Extension Web Store



chrome.google.com/extensions

Chrome Web Store

Search the store

3.

2.

Search for the Desktop Odometer Browser Extension



chrome.google.com/extensions

Chrome Web Store

Desktop Odometer



3.

Click "Add to Chrome"



chrome.google.com/extensions

Chrome Web Store

Home > Extensions > Desktop Odometer

Desktop Odometer

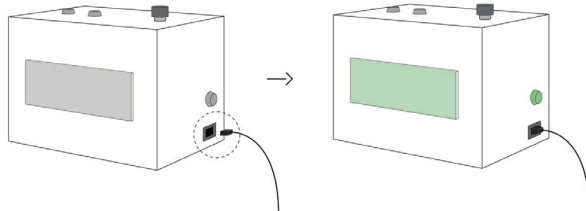


Add to Chrome

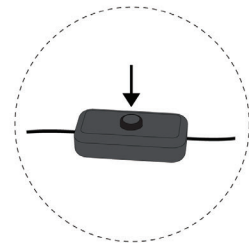
5.

4.

Remove Desktop Odometer from packaging and connect power supply

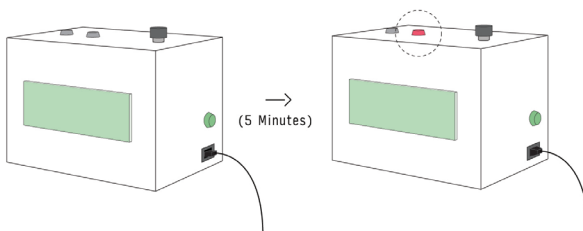


Please make sure switch connected to the power cord is pushed down



5.

Wait five minutes for red LED to turn on

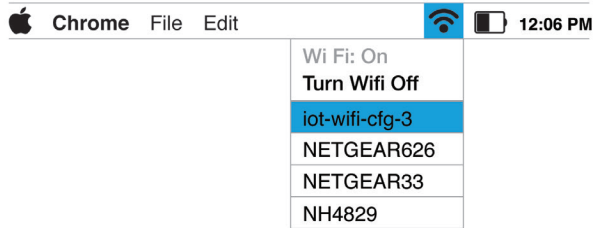


(Please note, even once the red light is on you are still not yet connected)

7.

6.

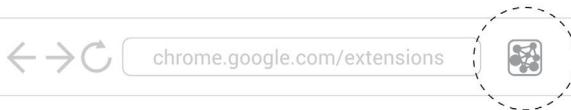
Go to Wi Fi settings and connect to 'iot-wifi-cfg-3' network



8.

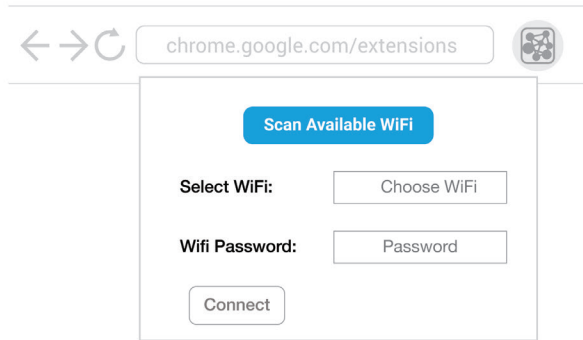
7.

Open Google Chrome Web Browser, then find and select the Desktop Odometer Extension



8.

Select 'Scan Available Wifi'



9.

Select your home WiFi network from the drop-down menu

→ chrome.google.com/extensions

Scan Available WiFi

Select WiFi: Choose WiFi

Wifi Password: NETGEAR626

NETGEAR626

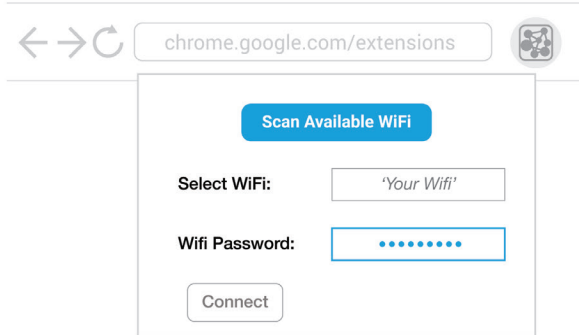
NETGEAR33

Connect

11.

10.

Enter your WiFi password

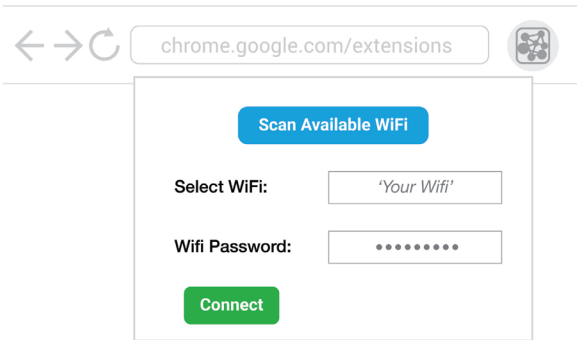


The image shows a browser window with a navigation bar containing back, forward, and refresh icons, and a search bar with the URL "chrome.google.com/extensions". To the right of the search bar is a small icon of a network or extension. Below the search bar is a white box containing a blue button labeled "Scan Available WiFi". Underneath this button are two input fields: "Select WiFi:" with a text box containing the placeholder text "'Your Wifi'", and "Wifi Password:" with a text box containing seven dots. At the bottom of the white box is a "Connect" button.

12.

11.

Press the connect button

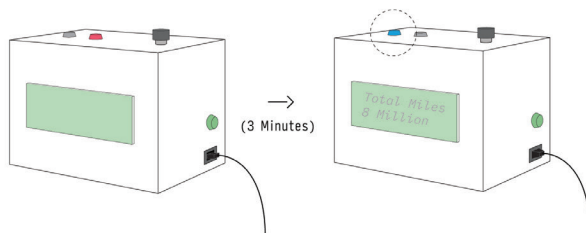


The image shows a browser window with the address bar containing "chrome.google.com/extensions" and a WiFi icon on the right. Below the address bar is a white box containing a blue button labeled "Scan Available WiFi". Underneath this button are two input fields: "Select WiFi:" with a text box containing the placeholder text "'Your Wifi'", and "Wifi Password:" with a text box containing seven dots. At the bottom of the white box is a green button labeled "Connect".

13.

12.

After a few minutes, the red LED will turn off, and the blue LED will turn on. Once the blue LED is turned on, your Desktop Odometer and begin tracking your journeys!



If you have any further questions
please contact Jerviny2@gmail.com

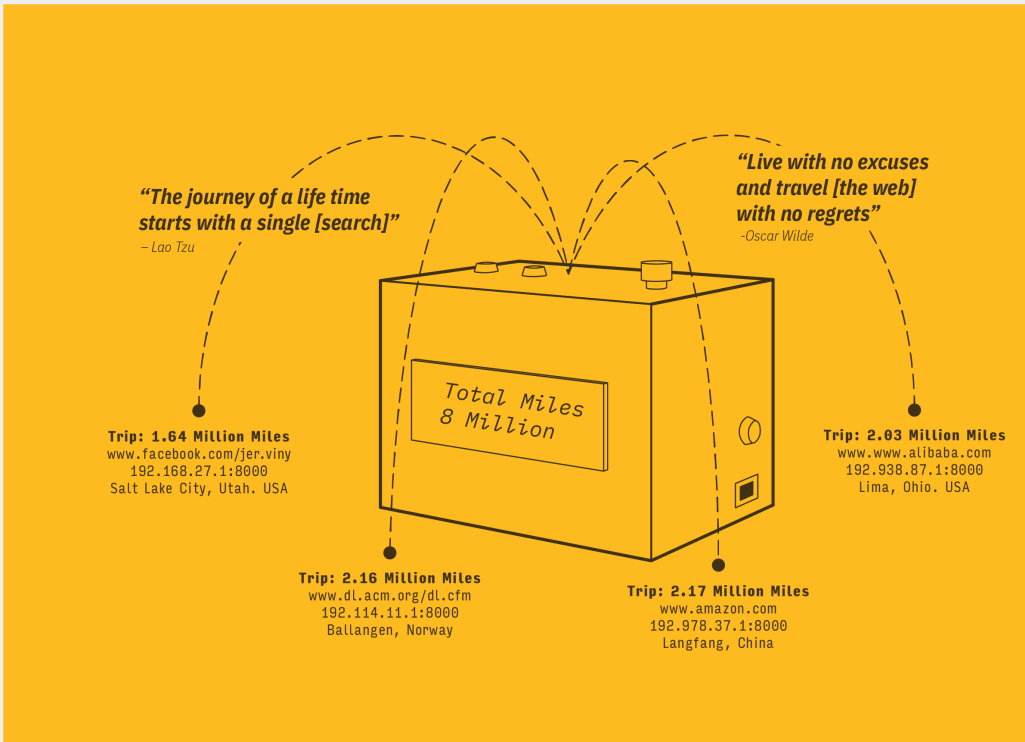
● handmade
○ futures

Appendix

7.2 Instructional Materials

FAQ Pamphlet

The FAQ was developed to serve two purposes: to explain that the Desktop Odometer is a product as well as a tool for research, and to explain to the user how I plan to use customer reviews within my research. Given that customer reviews are posted online and that their responses would be used for research, it was essential that buyers were aware that if they left a product review it would be used as part of the research.



FAQ

What is the Desktop Odometer?

- A.** The information you access on the internet appears immediately but usually lives far away. For instance: a search for holiday decorations might take you from a server in the USA to India to Canada. The Desktop Odometer tracks this distance, allowing you to see just how far you go when surfing the web.
- B.** The Desktop Odometer is part of experimental design research. It is intended to expand designers' conception of products by inviting consumers to actively assert themselves in defining products.
- C.** The primary purpose of selling the Desktop Odometer on Amazon.com is to engage with and learn from customers through Amazon customer reviews.

Why Should I review it?

- A.** The Desktop Odometer is designed to be somewhat enigmatic, to allow buyers to create their own meanings, narratives, and futures, which we hope to learn about through customer reviews.
- B.** We want to know what you find interesting, exciting, silly, or stupid about this product. We love reviews that are funny and/or dramatic. Even if they are fictional, they highlight what our customers are most passionate about! If using the Desktop Odometer prompts questions, we would love to hear them. We want to know what features should be added. We are grateful for any and all feedback: good, bad, or indifferent.
- C.** The Desktop Odometer is a consumer good, but also a research project. If you choose to review this product on Amazon, your comments will be used in this design-led inquiry.

Who makes the Desktop Odometer?

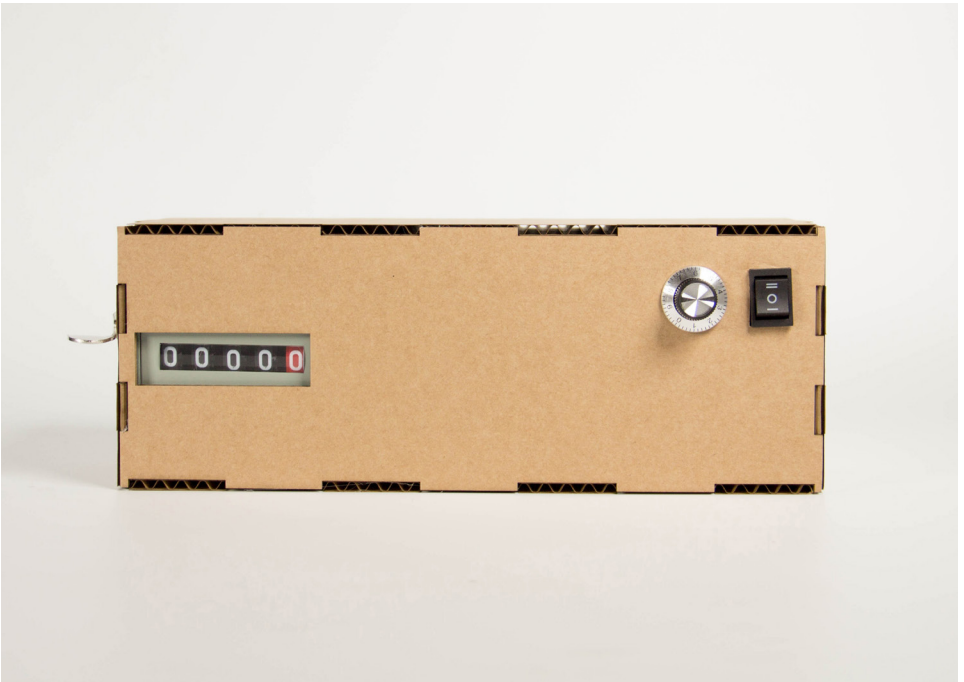
- A.** My name is Jeremy Viny. I am a Master of Design candidate at the U of Washington. My latest work centers around using customer reviews as a medium for storytelling. The products I make and sell are meant to be fun and light-hearted. I hope you enjoy it!

Appendix

7.3 Early Conceptual Work

Design Fiction Prop

To engage a greater audience in this exploration of opaque infrastructure, I positioned the Desktop Odometer on Amazon's online marketplace. To do this I produced a nonfunctional Desktop Odometer, i.e., a prop made to look real, but which was not actually counting miles.











amazon prime

Handmade

Deliver to Jeremy Seattle 98102

Buy Again Browsing History

EN Hello, Jeremy Account & Lists Orders Prime

handmade

Gifts Jewelry Home & Kitchen Clothing, Shoes & Accessories Wedding

Handmade Products > Electronic Accessories

HandMade_Futures

Desktop Odometer

★★★★☆ 4 customer reviews



Watch in awe as you travel immense distances in the blink of an eye. You have never truly understood just how far you can go until you experience the Desktop Odometer. The Desktop Odometer tracks the distance the user travels online via the computers internet browser. The device connects wirelessly to your computer for easy use. The Desktop Odometer is handcrafted at the Electronics and Crafts Studio for the Dark Arts (ECSDA) in Seattle Washington. Utilizing a grumpy old laser cutter, Fresh raspberry PI's and a whole lot of magic you can now see as you travel through the web and into the unknown.

Deliver to Jeremy - Seattle 98102

\$50.00

~~\$70.00~~ You Save: 29%

& **FREE Shipping**

In Stock.

Usually takes between 6 and 10 days to create

Ships from and sold by [Hand Made Futures](#).

Gift-wrap available.

Add to Cart

[Turn on 1-Click ordering for this browser](#)

Add to List



HandMade_Futures

Woodworking, Magic, Electronics and Dark Arts in Washington

[Contact me with general inquiries](#)

Share

Appendix

7.3 Early Conceptual Work

Design Fiction: Olympics: Year of Youtube Red

The Desktop Odometer first appeared as a character in an animated short called The Olympic Games in the Year of Youtube Red (figure 4.2). In this video, the Desktop Odometer was essentially a prop, a necessary element of storyline. The animation takes place at a future Olympic Games in which web surfing is a competition included within the suite of track and field events. In The Olympic Games in the Year Youtube Red, the physicality of web browsing has been recognized to such an extent that it has become part of an Olympic event. While this approach was a useful way to express my own ideas about opaque infrastructures, it lacked engagement with others.



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Image Credits

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