

# Manifestations of a Sound Wave

Establishing Human-Data Relations from a Data-Centred Perspective

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Figure 1: A sound wave journeys and establishes human-data relations.

## ABSTRACT

In this provocation, we propose a view that data is relational and that data-human relations can be uncovered through a data-centred (as opposed to human-centred) perspective. The background for this is the increasing digitisation where many digital systems involve a number of different stakeholders who handle different versions

of data for different purposes under varying standards. Such systems can represent data in many ways, each emphasising certain aspects of the world and calling for specific actions. Furthermore, data accessibility and version control can vary between platforms and stakeholders. While human-centred approaches to designing these systems can shed light on aspects such as user experience or opportunities for supporting human-human collaboration, this ultimately excludes the perspective of the real-world “thing” represented as data. As such, it is critical to identify approaches to establish and design for data-human relations. We illustrate this point through a narrative in four fragments. The narrative is told from the perspective of a sound wave that discusses relations to stakeholders established throughout its existence. We conclude with reflections on the nature of these relations and how data as material for design is characterised through those.

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CHI'23, April 23–28, 2023, Hamburg, Germany

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ACM ISBN 978-1-4503-XXXX-X/18/06...\$15.00

<https://doi.org/XXXXXXXX.XXXXXXX>

## CCS CONCEPTS

• **Human-centered computing** → **HCI theory, concepts and models**; *Empirical studies in HCI*.

## KEYWORDS

Data, Data journey, Practice, Environmental assessment

### ACM Reference Format:

Stine S. Johansen, Rikke Hagensby Jensen, Eike Schneiders, and Nicolai Brodersen Hansen. 2023. Manifestations of a Sound Wave: Establishing Human-Data Relations from a Data-Centred Perspective. In *CHI '23: ACM Conference on Human Factors in Computing Systems, April 23–28, 2023*. ACM, New York, NY, USA, 4 pages. <https://doi.org/XXXXXXX.XXXXXXX>

## ≈ READER INSTRUCTIONS

This document allows the reader to travel along the journey of a sound wave in varying forms of data [6] as it is produced, mobilised, re-purposed, and processed for the purpose of writing an environmental assessment report. Rather than understanding this journey from the human-centred perspective of the consultants and developers typically collaborating and writing these reports, we take the perspective of the data. We suggest to either read this document in the order of the sections or assemble your own journey.

The data narrative materialised in this document is a provocation [1], constructed to critically bring the temporal, spatial, and dynamic aspects of material data elements embedded in practice into focus [5]. We argue that this exposes and embodies important human-data relations useful for conducting future collaborative design explorations [2]. With increasing digitisation for systems with multiple stakeholders, it is critical to investigate ways in which we can design *for* human-data relations *with* data. We build on the approach of “thing ethnography” [4] to suggest that when things become data, they retain a materiality that is different from physical things while also being dependent on social, physical, and material infrastructures that support it [3, 11]. Therefore, we take a data-centred approach. The point of taking this approach is to emphasise a perspective that is beyond a human-centred understanding [7] of the material central to environmental assessment practice, *i.e.*, the data-centred perspective.

The following sections are intended to reveal the relations that are established between data and people, recognizing how entanglements of the social and the material shape everyday life [8]. This is based on an empirical investigation (consisting of 10 interviews and two workshops) mapping the process of scoping and writing an environmental assessment report.

## ~ PRODUCING: BIRTH AND RE-INCARNATION

I have come into existence many times. A consultant captured me in 2011 with a recording device which allowed her to inspect some of my qualities. At that time, I came from a car that was passing by a potential construction site of a new apartment building. The moment I was captured, I transformed from analogue waves to digits of 0's and 1's stored on an SD card. The consultant focused mainly on capturing my amplitude and time period as opposed to my wavelength. I found that a bit reductive.

In many of my digital formats, I find myself stored in huge data warehouses. Back in Spring 2008, I was forgotten on an SD card for a while. When I was finally uploaded to one of these warehouses, other data bits were added to my format informing others about the geographical location at which I was captured. In some warehouses, I exist without this information. I do not fully understand why this particular information is only sometimes important to keep—nor why it is sometimes removed. In essence, I just make noise, so who really cares about where and when this took place.

In the warehouses, I am often surrounded by other similar looking sound wave data, although their 0's and 1's are slightly different than mine. I like having them close by, as we mostly hang around, waiting for the dull moments to change. Sometimes I am placed next to other data with completely different patterns of 0's and 1's solely based on similar location information. They tell stories of how they came to exist at different construction sites we have in common. For example, I surfed by a tree last month. A consultant captured, transformed, and stored that tree in the warehouse right next to me. The story goes that this particular tree does not exist at the construction site any more, for some reason beyond my knowledge. Now, it cannot use its digital patterns to transform into a new tree someplace else.

## ~ MOBILISING: STEPPING INTO MOTION

I am always ready and disposable to be put into action. I appreciate leaving the data warehouse and being useful. Consultants and governmental authorities call upon me for different purposes of which I do not know beforehand. Still, new adventures are exciting. To make myself useful to different people, they sometimes change or add interesting bits. At my core, I am the same, but it makes it possible for them to move me. My willingness to change means I exist in parallel to myself. To keep me constantly valuable, consultants and governmental authorities keep versions of me stored in different places. Even I get confused about which version I am. Sometimes I can only be accessed by certain groups of people who keep me in a proprietary place. I think it is a shame that I am inaccessible to other people beyond that place and that people can “own” complex versions of me. On the other hand, I think this illustrates my value, because they keep me secret from the wider world. In other, typically simpler, versions of me, I am publicly available but these open-access versions of me have typically been processed to a large degree. That makes it difficult to verify my provenance. Therefore, I often find that stakeholders look at me and then determine that they need to create yet another version. I am actually a bit annoyed that it can be that difficult for these stakeholders to retain my pedigree.

I have found that, sometimes, I do not meet the expectation of a consultant. When they scope the data they need to collect at the start of a project, I merely exist as a recollection based on prior projects. They do not always remember correctly, though, and that leads to some confusion. In the hands of these consultants, I sometimes find myself correlated with other data types. I think to myself: “Excuse me — but there were no bats around me before I was captured?” Furthermore, they relate me to these “SDG's”. I wonder how SDG3, Good Health and Well-Being, is related to me, a sound wave? Then again, if the project benefits from establishing relations between me and other data, I am happy to take that journey.

## ≅ RE-PURPOSING: DISCOVERY OF MY PURPOSE

I have found along my journey that I am not confined to one purpose in life. I do not fit into one box. I am versatile. This makes it possible for consultants to transform me into a higher level of abstraction to make me fit in their long printed reports. Presumably, this is to make me easier to conceptualise and share with readers compared to a set of 0's and 1's. I even heard that governmental authorities and motivated grass root citizens may use me to drive change, change tactics, and make decisions on my behalf. There is even learning between community members. I am very proud of that.

It is difficult to retrace the journey back to my birth sound waves in my digital form. I heard rumours that some uninformed people find it embarrassingly arduous to figure out by whom, from where, and when I came to be captured that day at the construction site. This one time, a developer wanted to start construction of an apartment building on an empty lot within the city. The consultant she contacted had engaged with me during a previous project, but now he reached out to me again, because the new project seemed very similar to the old one. But getting to my pedigree is almost impossible in this shape.

## ≠ PROCESSING: IDENTIFICATION OF MYSELF

My identity is constantly in flux. The qualities that make up my identity change depending on my environment. A tool referred to as Sound Plan is used to extend the amount of information that was present during times when I have been recorded.

Admittedly, I prefer my analogue form because I am heard by living entities with hearing capabilities. In my reduced format of 0's and 1's, I hardly ever get to be noisy (which is really the basis of my existence). Although I might never transform into analogue waves these days, it is delightful that I can use my new format to transform into a pallet of forms. Moving into Sound Plan means that I expand from 0's and 1's into a rainbow-coloured visual representation of myself.

Typically, there are naming conventions that allow stakeholders to find me in the mix of all my friends. A funny story is the time that a consultant mistook me for my friend. He knew from prior experience that the visualisations are supposed to look a certain way. In this case, they did not. He suddenly spent a lot of time in the office to find me. This included going into previous project management documentations that showed the data management plan.

Sometimes, I am also used as bits for computation purposes, where I am mixed up with all sorts of data types to help verify that I might not harm hearing creatures in my analogue existence. I have mixed feelings about being used as computational bits. On the one hand, I want to be useful. But I also ensure that I am not manipulated and turned into digestible information for the wrong reasons. For instance, I sometimes appear in simulations. The other day, I suddenly found myself being composed on the basis of another sound wave I had never met before. This took place in a shared office between three consultants. They composed me in fragments based on other sound waves and a simulation. This just goes to show that I am at once connected to the world and separate from it.

## ≈ DATA-HUMAN RELATIONS AS A FRAME FOR DESIGN

We propose three main reasons for taking a data-centred perspective as a frame for a design process. First and foremost, the design of complex systems with multiple stakeholders should take into account the various relations that each stakeholder has with the material of the system. While other approaches such as service design [10, 14] also encompass the interactions between several people and a system, we argue in this provocation that certain characteristics of the data materiality can be better uncovered through a non-human perspective. Second, taking a data-centred perspective enables designers to see that stakeholders' perspectives on entities in the world are in flux and depend on how they approach, process, and leave the entity. This extends the approach of "thing ethnographies" by considering digital "things" as material objects. These objects, as Dourish points out [3], are anchored in physical infrastructure but have unique properties such as the possibility of duplication, history traceability, and (re-)processability. Third, and finally, integrating a data-centred perspective into a design process can benefit from an investigation into the data-human relations that are formed. Relations from our narrative are identified as part of four different activities that stakeholders engage with while researching for and writing environmental assessment reports, including producing, mobilising, re-purposing, and processing. These activities show that the resulting human-data relations have a temporal, situated and material nature.

This highlights a couple of paths forward, both research-wise and practice-wise. With regard to research perspectives, we would like to further explore linkages between manifestations and materialities of data. Doing so brings our efforts into contact with, e.g., discussions of materiality within HCI [9]. One key aspect of this development concerns the idea of *computational composites*, i.e., blends of physical materials and computation [12]. This perspective speaks to our main point of data having a temporal form (see, e.g., [13] for further discussions of computational forms having temporal aspects), as well as the situated nature of data practices. This means that while capturing the full picture of data's role in practices is impossible, experimenting with novel forms of design approaches to capture and discuss data-centric design approaches is imperative.

## REFERENCES

- [1] Jeffrey Bardzell, Shaowen Bardzell, and Erik Stolterman. 2014. Reading Critical Designs: Supporting Reasoned Interpretations of Critical Design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Toronto, Ontario, Canada) (CHI '14). Association for Computing Machinery, New York, NY, USA, 1951–1960. <https://doi.org/10.1145/2556288.2557137>
- [2] Laurens Boer and Jared Donovan. 2012. Prototypes for Participatory Innovation. In *Proceedings of the Designing Interactive Systems Conference* (Newcastle Upon Tyne, United Kingdom) (DIS '12). Association for Computing Machinery, New York, NY, USA, 388–397. <https://doi.org/10.1145/2317956.2318014>
- [3] Paul Dourish. 2017. *The stuff of bits: An essay on the materialities of information*. MIT Press.
- [4] Elisa Giaccardi, Nazli Cila, Chris Speed, and Melissa Caldwell. 2016. Thing Ethnography: Doing Design Research with Non-Humans. In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (Brisbane, QLD, Australia) (DIS '16). Association for Computing Machinery, New York, NY, USA, 377–387. <https://doi.org/10.1145/2901790.2901905>
- [5] Rikke Hagensby Jensen, Enrique Encinas, and Dimitrios Raptis. 2022. Spicing It Up: From Ubiquitous Devices to Tangible Things Through Provocation. In *Sixteenth International Conference on Tangible, Embedded, and Embodied Interaction*

- (Daejeon, Republic of Korea) (*TEI '22*). Association for Computing Machinery, New York, NY, USA, Article 33, 15 pages. <https://doi.org/10.1145/3490149.3502257>
- [6] Sabina Leonelli. 2020. Learning from data journeys. In *Data journeys in the sciences*. Springer, Cham, 1–24.
- [7] Cecily Maller and Yolande Strengers. 2019. Social Practices and Dynamic Non-Humans. *Nature, Materials and Technologies*. London: Palgrave (2019).
- [8] Wanda J. Orlikowski. 2007. Sociomaterial Practices: Exploring Technology at Work. *Organization Studies* 28, 9 (2007), 1435–1448. <https://doi.org/10.1177/0170840607081138>
- [9] Erica Robles and Mikael Wiberg. 2010. Texturing the "Material Turn" in Interaction Design. In *Proceedings of the Fourth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '10*. ACM Press, Cambridge, Massachusetts, USA, 137. <https://doi.org/10.1145/1709886.1709911>
- [10] Joanna Saad-Sulonen, Amalia de Götzen, Nicola Morelli, and Luca Simeone. 2020. Service Design and Participatory Design: Time to Join Forces?. In *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 2 (PDC '20)*. Association for Computing Machinery, New York, NY, USA, 76–81. <https://doi.org/10.1145/3384772.3385133>
- [11] Pedro Sanches, Noura Howell, Vasiliki Tsaknaki, Tom Jenkins, and Karey Helms. 2022. Diffraction-in-Action: Designerly Explorations of Agential Realism Through Lived Data. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) (*CHI '22*). Association for Computing Machinery, New York, NY, USA, Article 540, 18 pages. <https://doi.org/10.1145/3491102.3502029>
- [12] Anna Vallgård. 2014. Giving Form to Computational Things: Developing a Practice of Interaction Design. *Personal and Ubiquitous Computing* 18, 3 (March 2014), 577–592. <https://doi.org/10.1007/s00779-013-0685-8>
- [13] Anna Vallgård, Morten Winther, Nina Mørch, and Edit E Vizer. 2015. Temporal Form in Interaction Design. *International Journal of Design* 9, 3 (2015).
- [14] Daisy Yoo, Anya Ernest, Sofia Serholt, Eva Eriksson, and Peter Dalsgaard. 2019. Service Design in HCI Research: The Extended Value Co-creation Model. In *Proceedings of the Halfway to the Future Symposium 2019*. ACM, Nottingham United Kingdom, 1–8. <https://doi.org/10.1145/3363384.3363401>