Sketching Across the Senses: Exploring Sensory Translation as a Generative Practice for Designing Data Representations

Jordan Wirfs-Brock
wirfsbro@colorado.edu
University of Colorado Boulder
Boulder, Colorado, USA
wirfsbro@colorado.edu

Maxene Graze
maxene.graze@gmail.com
MURAL, Independent Researcher
Portland, OR, USA

Laura Devendorf
University of Colorado Boulder
Boulder, Colorado, USA
laura.devendorf@colorado.edu

Audrey Desjardins
adesjard@uw.edu
University of Washington
Seattle, Washington, USA

Visda Goudarzi
vgoudarzi@colum.edu
Columbia College
Chicago, Illinois, USA

Mikhaila Friske
Mikhaila.Friske@colorado.edu
University of Colorado Boulder
Boulder, Colorado, USA

Brian Keegan
University of Colorado Boulder
Boulder, Colorado, USA
brian.keegan@colorado.edu

ABSTRACT

This workshop engages the phenomenon of synesthesia to explore how translating between sensory modalities might uncover new ways to experience and represent data: What does it mean to taste a timeline, hear a network, or touch a categorical scale? We employ the method of sketching, which traditionally favors visual representations, and consider what it means to 'sketch' in other modalities like sound, taste, and touch. Through a series of rapid, playful activities ideating data representations across sensory modalities, we will explore how the affordances of sketching—like intentional ambiguity—might help designers creatively map data to experience. We will also discuss challenges for sensory sketching in remote, collaborative environments and brainstorm suggestions for digital tools. The outcome of this workshop will be a series of exercises and examples that serve as a toolkit for designers, researchers, and data practitioners to incorporate sketching across the senses into their work.

CCS CONCEPTS

• **Human-centered computing** → **Interaction design process and methods**.

KEYWORDS

sketching, perceptualization, visualization, sonification, physicalization, multisensory interfaces

1 BACKGROUND

> "*...translating is simply the sheer joy of trying to do something deeply paradoxical: namely, to carry off in medium 2, radically different than medium 1, some virtuoso stunt that someone else once carried off from medium 1....a game, an exercise in creativity, a challenge that, if met with sufficient flair, provides a wonderful esthetic reward*" — Douglas Hofstadter, *Le Ton Beau De Marot*, p. 366 [19].

Design is fundamentally an act of translation: translating observations into design insights, and translating those insights into artifacts. In this workshop, we explore how a specific kind of translation—translating between sensory modalities—might benefit human-computer interaction designers as an ideation practice. We focus our inquiry into sensory translation on the domain of *data representation* and the method of *sketching*. While the HCI community has a strong foundation in sketching as a way to explore design possibilities, sketching tends to privilege visual outcomes. Thus, to develop techniques for designing multisensory data representations, we ask: **How can we sketch across the senses in order to creatively map data to experience?**

In the workshop, we will facilitate rapid, playful activities that encourage participants to creatively transgress sensory boundaries by invoking *synesthesia*, a phenomenon where stimulus in one sense provokes an experience in another [18]. What does it mean to taste a visual timeline, or hear a texture scale? By juxtaposing unexpected sensory representations, we seek to disrupt our standard practices of communicating data. We will explore how sensory translation can expand the way we experience and encode data by unearthing relationships between the senses that are not initially apparent. It
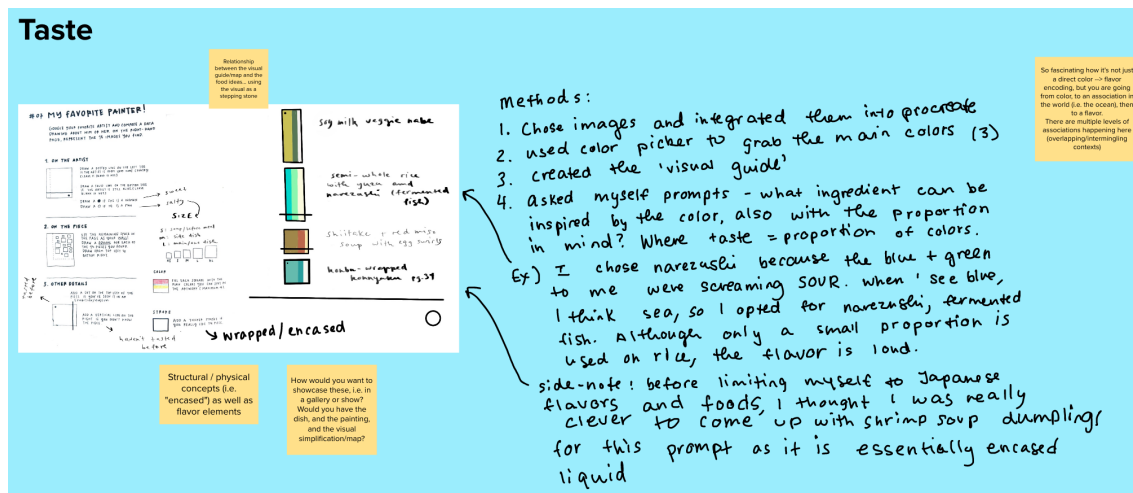
Figure 1: Graze translated the "My Favorite Painter" exercise from *Observe, Collect, Draw!* [22] into a food experience sketch. A bold visual outline, which represented really liking a painting in the visual sketch, became food that was "wrapped/encased" in the food sketch. She documented the sketch through text notes in the digital whiteboard tool MURAL.

is impossible to translate one hundred percent of the meaning from one sensory experience to another; instead, we seek to call attention to differences between sensory experiences by attending to what is lost and what is gained through acts of sensory translation. Similar to how traditions such as seamful design [8] and diffractive tactics [12, 25] invite us to re-examine our relationship to technology, we are curious how sensory translation might invite us to re-examine our relationship to data: We hope to reflect on what meanings in the data we are able hold constant as we shift between sensory modalities, as well as what new meanings emerge as the data is diffracted through new modalities. Our goal is not to seek out a single best sensory representation of a data set, but rather to learn from the multiplicity of sensory translations, embracing the "cascading" nature of translation [19].

Sketching supports this goal by showcasing the value of the ambiguity inherent in the rough, unfinished quality of a sketch. As Buxton writes in *Sketching User Experiences*, "much of [sketches'] value derives from their being able to be interpreted in different ways, and new relationships seen within them, even by the person who drew them" [7]. A sketch is distinct from a final artifact in crucial ways: sketches are quick, plentiful, "suggest and explore rather than confirm," and are inherently social [7]. Yet it is often difficult to sketch with data sets, which are by nature specific, precise, and unambiguous. We seek to explore how sensory translation may free us from the rigid materiality of data, opening up new avenues for engaging sketching as a tool for thinking and designing with data sets. A primary outcome of this workshop will be a participant-fueled website that provides guidance to future practitioners by offering exercises and examples of sensory translation in service of representing data.

1.1 Extending HCI traditions of multi-modality, sketching, and making the familiar strange

Experiences and technologies that embrace the role of taste, smell, and touch have been topics of interest at recent HCI workshops [3–6, 9, 24]; further, sketching is of perennial interest to the HCI community as a method for ideation, communication, and understanding people [7, 15–17, 26]. We combine and extend multisensory experiences and sketching by centering the act of sensory translation: What happens when, in a quick and playful manner, we take an experience in one sensory modality and reconstitute it in another? We focus on translation, not with the goal of completely transferring meaning, but of highlighting the new knowledge that can be gained through translation. Our workshop is also inspired by past work on making the familiar strange through techniques for noticing [2] and synesthetic aides [21]. We apply these techniques to data representation: Perhaps sensory translation can help designers become more deeply acquainted with data, be more open and curious as they explore how to represent data, and be more intentional and reflexive about data mapping and encoding.

1.2 Experiments in Sketching Across the Senses

This workshop grew out of a series of open-ended design explorations that two of the workshop organizers, Wirfs-Brock and Graze, undertook: We adapted visual data sketching exercises from *Observe, Collect, Draw!* [22]—a hands-on data diary—for sound, taste, gesture, and texture. For example, in Figure 1, Graze has translated a data-driven visual sketch about her favorite painter as a food experience, which she described in written notes. Additionally, we selected a data set of interest to us, the air quality index [1], and created sensory sketches using this data set as inspiration (Figures 2, 3). We found these activities to be challenging at times (*What does*
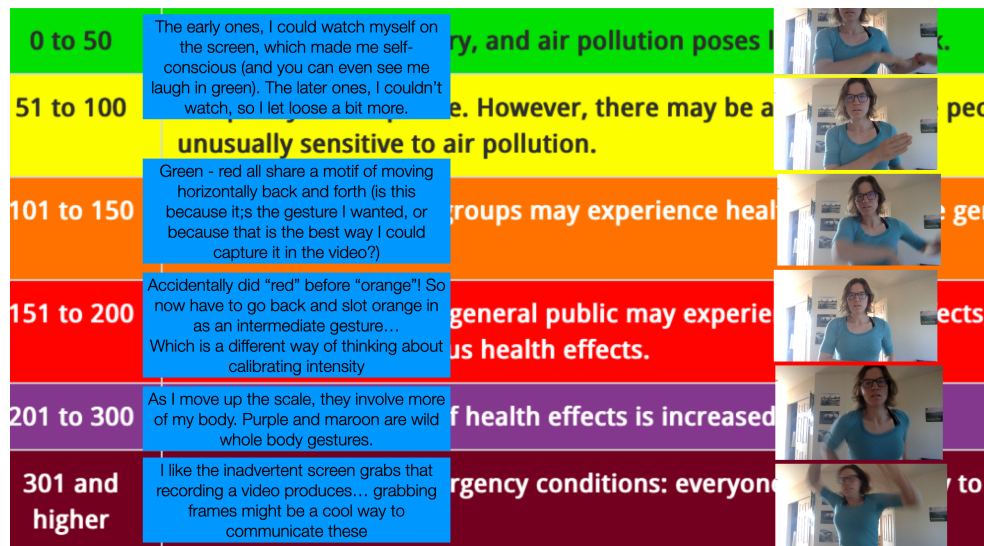
Figure 2: Wirfs-Brock translated the air quality index (AQI) color-scale [1] into gestures, which she documented by both writing text notes (left) and embedding videos of gesture translations (right) into the presentation tool Keynote. As AQI got more severe, her gestures transitioned from subtle hand and arm movements into full-body gyrations.

the smell of coffee sound like? We have no idea...) but overwhelmingly fun, generative, and provocative. These exercises uncovered many themes, such as: What does it mean to sketch *for* a sensory experience versus to sketch *in* a sensory experience?

In our explorations, we often used visual sketches to communicate sounds, gestures, and tastes. We also natively sketched in non-visual modalities, performing gestures (Figure 2) or voicing sounds, leveraging techniques such as vocal and sonic sketching [13, 20]. For example, contrast the approaches we took to adapting the visual AQI severity scale into taste (Figure 3): Wirfs-Brock collected foods from her kitchen that matched the colors in the scale, assembled them, and ate them; whereas Graze brainstormed a taste and texture experience—a piece of toast that gets more and more burnt until it is inedible—and described it with illustrative words. Wirfs-Brock was sketching *in* taste, using foods as materials; Graze was sketching *for* taste using spatially distributed, handwritten text. Sketching *in* food allowed us to directly access the embodied sensory experience of taste, whereas sketching *for* food opened up space to imagine the sensory experience in our minds and engage memory. Further, whether we were sketching *for* a sense or sketching *in* a sense, we often used text annotations to supplement the sketches, raising questions about the role of language: How does our ability (or inability) to describe sensory experiences in words influence our sensory translations?

In the workshop, we will explore the ways that sketching *for* versus sketching *in* a sensory modality might unlock new interpretations and data representations. Additionally, we will explore themes inspired by projects in multisensory data perceptualization that are not so explicitly focused on sketching. For example, textile data representations, such as Devendorf's *Wear* [11], a living garment that collects force data and plays it back as subtle changes in color, raise questions about how to document and share ephemeral,

physical data experiences. And *Data Bakery* [10], a project by Desjardins, represents smart-plug data as recipes home owners can use to bake cookies based on their home electricity use patterns. We are curious how we might extend recipes—sets of instructions someone can follow to re-create a sensory experience in their own local space—to document and share sensory sketches. Finally, Friske and Wirfs-Brock's project exchanging personal yarn and sound data artifacts, while intentionally withholding a legend to provoke new interpretations, brings in dimensions of collaboration and the role of the reader in re-creating data representations [14]. These explorations, and others, raise questions we hope to explore in our workshop:

- *How can we better understand the challenges of ideating in diverse sensory modalities?* We hope to examine sensory translation work and "sketching" as it is already practiced in other sensory spaces (taste, sound, etc.).
- *Which kinds of data parameters and data sets are most suited for each sensory perception modality?* By conducting activities that use different kinds of data — time series data, network data, geospatial data, etc. — we hope to reflect on the relationships between data format and sensory modality.
- *What tools and practices can support sensory translation activities?* Working in a remote environment lets us interrogate how collaborative, digital contexts influence the practice of sensory translation.
- *Who is intentional sensory translation as a generative practice for? Designers? End users? Educators? Data scientists?* We hope to invite participants with interdisciplinary backgrounds who can engage with this issue.
- *How does the language we use to describe this practice of sketching across the senses influence the practice itself?* Thus far, we've discussed terminology including intra-sensory,

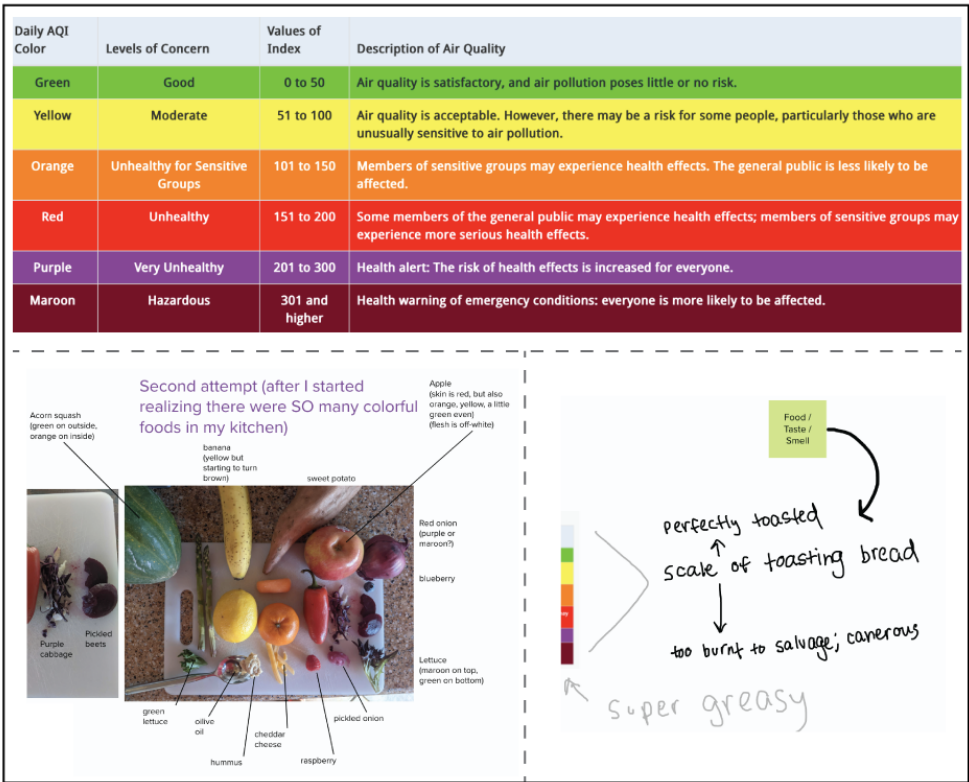| Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Figure 3: Top: The AQI color-scale [1], which Wirfs-Brock and Graze translated into food sketches. These examples illustrate the distinction between sketching *in* a sensory modality and sketching *for* a sensory modality. Bottom left: Wirfs-Brock created her sketch using food as a medium. Bottom right: Graze created her sketch using text as a medium.

trans-sensory, multisensory, or simply sensory, and we hope our participants can help us arrive at the most appropriate word for this practice.

- *How is sketching a sensory data representation different from prototyping one?* Through hands-on activities for sketching across the senses, we hope to explore what sketching can uniquely add to data design practices.

By involving a community of people with diverse, interdisciplinary backgrounds in our workshop, we hope to explore these questions and to develop, undertake, document, and share more sensory translation experiments. By compiling participant reflections on these questions, as well as examples of sensory translation and new exercises participants will develop, we hope to use this workshop to grow a community of curious practitioners of sketching across the senses.

2 ORGANIZERS

Jordan Wirfs-Brock (lead and primary contact) explores how to bring data into our everyday lives as a creative material using participatory data representations that engage all the senses, especially sound. Jordan is a PhD candidate in Information Science at the University of Colorado, Boulder. Previously, she was a data journalist covering the energy industry, where she made complex data stories approachable using animations, live performances, and visualizations.

Max Graze (co-lead) is a data visualization engineer at MURAL who comes from a research-focused, academic background. She is driven to use data visualization as a means to engage in her many passions, which include linguistics and fermentation, with the end goal of creating physicalizations and installations out of these themes.

Laura Devendorf designs, develops and studies technologies that destabilize practice in order to prompt creative, thoughtful, and attentive engagements with the everyday. She is an assistant professor of Information Science and an ATLAS Institute fellow at the University of Colorado, Boulder where she directs the Unstable Design Lab. She has organized ACM CHI and CSCW workshops on subjects of "Disruptive Improvisation" tactics for design, broader approaches to designing for care, and research through design. Her current research focuses on using textiles to speculate on futures for sustainable and inclusive electronics practices.

Audrey Desjardins is an interaction design researcher who speculatively and critically examines how people live with technology. She designs interactive artifacts and systems that reimagine the familiar co-existence of humans and things, often in the mundane space of a home. She is an assistant professor in the School of Art + Art History + Design at the University of Washington, where she

directs Studio Tilt. She has organized workshops at ACM CHI and DIS on the topics of research through design, first-person methods, and the design of technology for the home.

Visda Goudarzi is a music technologist working at the intersection of audio and human-computer interaction. She designs and performs with interactive and participatory sonic interfaces. Her research interests include auditory interfaces, interactive and participatory design, sound and music computing, live coding, and data sonification. She is an Assistant Professor of Audio Arts and Acoustics at Columbia College Chicago and works as the principal investigator for the Austrian funded project COLLAB (Collaborative Creativity as a Participatory Tool for Interactive Sound Creation). Visda also performs live electronics as a member of intra-sonic electronic duo.

Mikhaila Friske researches how the act of translating data into different material crafts uncovers tensions and meaning in the information that has been enumerated and compressed. Their previous work has focused on working across materialities and practices that center humans and materials over technology and data. They are a graduate student in the Information Science at the University of Colorado, Boulder and are a part of the Unstable Design Lab.

Brian Keegan is a computational social scientist who explores the role of disruptions on social behaviors like online collaboration. He is an assistant professor in the Department of Information Science at the University of Colorado, Boulder. His research primarily uses quantitative methods like network, spatial, and text analysis that have fascinating constraints and opportunities for representing data through non-visual senses. He has previously organized panels at ACM CHI and CSCW around online deviance, social data analytics, and cannabis informatics.

3 WEBSITE

All workshop organization materials, including the call for participation, will be posted on our website: **sensorysketching.com**. After the workshop, we plan to use this website to showcase participant submissions (if they choose), examples of sensory translation, and the activities that we will develop during the workshop.

4 PRE-WORKSHOP PLANS

As we build a community of creative technologists interested in developing techniques for sensory translation, we are particularly committed to inviting people who have not traditionally attended CHI, such as dancers, chefs, and electronic musicians. In addition to reaching out to potential participants through our website and social media, we also hope to leverage connections with groups such as the Data Feminism Slack channel and the Data Visualization Society to reach data designers who may not traditionally be part of the CHI community. Leaning into the spirit of our workshop theme, we are committed to developing multisensory recruitment materials (i.e., videos, animated gifs, audio, gestural diagrams, etc.).

5 WORKSHOP FORMAT: VIRTUAL

We are planning a **single full-day *virtual* workshop**, with remote participants and organizers. This format allows us to interrogate one of our central themes: *What tools and practices might support sketching across the senses in remote, collaborative environments?* One of the principles of sketching is that sketches need to externalize and document ideas and experiences [7]: But how do you document and externalize a smell or a texture sketch in a way that you can share it with a colleague in a different time zone? To face this challenge head on, we will pair remote participants for hands-on group exercises (*i.e.* icebreaker, sensory telephone) and use the workshop itself as a learning opportunity to surface solutions. Additionally, throughout the workshop we will use digital note-taking strategies, such as MURALs or Padlet boards, to document ideas and reflections from remote participants so that we can share them afterward.

With a virtual/remote structure, we will have participants in a range of time zones. We recognize that six hours of planned content may be too much for remote participants. Thus, we plan to have two three hour blocks (morning and afternoon), with the morning block happening synchronously and the afternoon block designed so that remote participants can do the activities synchronously *or* asynchronously and share the outcomes on their own schedules. To accommodate remote participants, we will host our workshop on a video conferencing platform such as Zoom. For accessibility, we will enable the live transcription feature in Zoom for the participant presentations. The rest of our workshop consists of hands-on, interactive activities, thus we won't need live captioning. However, we will make sure to provide accessible text instructions for all of the hands-on activities.

6 WORKSHOP STRUCTURE

Our full proposed schedule of activities is in Figure 4. In the morning synchronous session, we will first showcase participants' previous work through a series of 2-minute lightning presentations. Next, participants will perform exercises in sketching across the senses, followed by reflective discussion. The afternoon session will include a sensory walk, where participants will explore their local environment; log what they see, hear, smell, fell, taste, and touch; and translate those observations into other sensory modalities. Then, in small groups participants will develop new exercises to support sketching across the senses, pilot the exercises with each other, and document them for the workshop website. We will adapt this activity for asynchronous remote participants by pairing them up; they can create their new sensory sketching exercises individually, exchange them with their partner to pilot, and submit them to our website at any time after the workshop.

Between the morning and afternoon sessions, we will host an informal lunch via Zoom where breakout rooms will focus on different discussion topics or mini-tutorials. We will have a facilitator at each lunch breakout room.

7 POST-WORKSHOP PLANS: SUPPORTING A COMMUNITY OF PRACTICE

After the workshop, we plan to use our website to showcase the new activities for sketching across the senses that participants will develop during the workshop, examples of participants' sensory translations, and reflections from the workshop. The workshop website will serve as an ongoing resource for designers seeking to incorporate sensory translation into their own practice. We also

Morning Session: Synchronous for All Participants		
9:00 am to 12:00 pm	**Welcome & Multisensory Icebreaker Activity**	Each participant introduces themselves with a sound, gesture, taste, texture, etc., as well as a dataset (30 min)
	Showcase Participant Submissions	Share 2-minute video or live presentations of participant responses to prompts about sketching practices, sensory translation projects, or preliminary sensory data representation ideas (45 min)
	Break	(15 min)
	Sketching Exercise 1: Ordinal Scales	Participants start with visual sketches of ordinal scales and translate them into sound, taste, touch, and gesture (25 min)
	Discussion (small groups)	Reflecting on ordinal scales sketching activity (15 min)
	Sketching Exercise 2: Sensory "Telephone"	Participants start with a data visualization, translate it into another sensory modality, pass the translation to another person, who translates that translation into another modality; repeat several times; reflect and discuss (35 min)
	Discussion (entire group)	How can we document and share these sensory translations? (15 min)

12:00 pm to 1:30 pm	**Lunch Break: Brown bag discussions in small groups**	Each discussion group will have a Zoom facilitator and connected breakout room. Potential round-robin table topics include: • *What should we call the practice of sensory translation (trans-sensory, multisensory, intra-sensory, something else)?* • *Are there only five senses, or additional senses we should consider?* • *Mini-tutorials on how to sketch in sound with SuperCollider* • *What is the difference between sketching, prototyping, perceptualization, and representation?*

Afternoon Session: Synchronous or Asynchronous, Depending on Participant Time Zones		
1:30 pm to 4:00 pm	**Welcome Back**	Short discussion about lessons learned in the morning (10 min)
	Sketching Exercise 3a: Sensory Walk	Participants explore their environment by noting, "What do I see/hear/touch/smell/taste?" (25 min)
	Sketching Exercise 3b: Translating Walk Data	Participants translate their observation data from the sensory walk into other modalities (30 min)
	Discussion	Discussing the sensory walk and translation exercise (10 min)
	Break	(15 min)
	Develop New Sensory Translation Exercises	In small groups (sync) or individually (async), participants develop a new exercise for sensory translation (25 min)
	Swap & Pilot New Exercises	Participants swap their new exercises, perform them, and provide feedback to the exercise creators (25 min)
	Document Exercises We've Developed	Participants revise new sensory translation exercises based on pilot feedback and add them to our website via a template form (25 min)
	Wrap-up & Discussion	Where do we go from here? (15 min)

Figure 4: A run-down of the proposed activities in our workshop

anticipate it being a useful resource for educators who might use the sensory sketching exercises in their classrooms, as well as HCI researchers seeking to engage participants in contextual inquiry and design-based workshops.

Using this compendium of sensory translation activities, after the workshop we hope to coordinate a series of remote, collaborative "sketch-ins" for participants to continue sharing this practice and

to bring in a broader community. Depending on the interests of our participants, we may also share examples and activities for sensory translation as a newsletter in the style of *Audio Playground* [4] or *Learning to Love you More* [23] that shares provocative prompts for sensory translation and showcases crowd-sourced examples.

8 CALL FOR PARTICIPATION

What does it mean to taste a timeline, hear a network, or touch a categorical scale? This workshop engages the phenomenon of *synesthesia*, when a stimulus in one sensory modality provokes an experience in another. We will explore how translating between sensory modalities might support creative technology design by focusing on the domain of data representation and the method of sketching: **How can we sketch across the senses in order to creatively map data to experience?**

We invite researchers, artists, and creative practitioners—especially if you work or play in a range of sensory modalities: musicians, dancers, athletes, chefs, sculptors—to join us at this one-day, virtual workshop. To apply, please submit a 2-minute video or 2-4 page paper (excluding references, using the single-column ACM Template) that addresses *one* of the following prompts:

- How do you engage sketching and related practices (in any sensory modality) in your work?
- How do you move across and between the different senses in the work you do?
- Share a specific data set you are interested in and some rough ideas for how you might represent it in a range of senses (sight, sound, taste, etc.).

Please submit your video or paper via the Google Form on our website, **sensorysketching.com**. Submissions will be selected based on their ability to spark lively discussion, and accepted submissions will be posted on the workshop website. At least one author of each accepted submission must attend the workshop. All participants must register for both the workshop and at least one day of the conference.

REFERENCES

[1] AirNow.gov. 2018. *Air Quality Index (AQI) Basics.* Retrieved October 8, 2021 from https://www.airnow.gov/aqi/aqi-basics/

[2] Kristina Andersen, Laura Devendorf, James Pierce, Ron Wakkary, and Daniela K. Rosner. 2018. Disruptive Improvisations: Making Use of Non-Deterministic Art Practices in HCI. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal QC, Canada) *(CHI EA '18).* Association for Computing Machinery, New York, NY, USA, 1–8. https://doi.org/10.1145/3170427.3170630

[3] Leonardo Angelini, Zuzanna Lechelt, Eva Hornecker, Paul Marshall, Can Liu, Margot Brereton, Alessandro Soro, Nadine Couture, Omar Abou Khaled, and Elena Mugellini. 2018. Internet of Tangible Things: Workshop on Tangible Interaction with the Internet of Things. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (CHI EA '18).* Association for Computing Machinery, New York, NY, USA, 1–8. https://doi.org/10.1145/3170427.3170634

[4] Maryam Bandukda, Aneesha Singh, Catherine Holloway, Nadia Berthouze, Emeline Brulé, Ana Tajadura-Jiménez, Oussama Metatla, Ana Javornik, and Anja Thieme. 2021. Rethinking the Senses: A Workshop on Multisensory Embodied Experiences and Disability Interactions. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems.* Association for Computing Machinery, New York, NY, USA, 1–5. https://doi.org/10.1145/3411763.3441356

[5] Joanna Berzowska, Aisling Kelliher, Daniela K. Rosner, Matt Ratto, and Suzanne Kite. 2019. Critical Materiality: Creating Toolkits and Methods for Engaging Materiality in HCI. In *Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction* (Tempe, Arizona, USA) *(TEI '19).* Association for Computing Machinery, New York, NY, USA, 691–694. https://doi.org/10.1145/3294109.3295656

[6] Jas Brooks, Pedro Lopes, Judith Amores, Emanuela Maggioni, Haruka Matsukura, Marianna Obrist, Roshan Lalintha Peiris, and Nimesha Ranasinghe. 2021. Smell, Taste, and Temperature Interfaces. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems.* Association for Computing Machinery, New York, NY, USA, 1–6. https://doi.org/10.1145/3411763.3441317

[7] Bill Buxton. 2010. *Sketching user experiences: getting the design right and the right design.* Morgan Kaufmann.

[8] Matthew Chalmers and Areti Galani. 2004. Seamful interweaving: heterogeneity in the theory and design of interactive systems. In *Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques (DIS '04).* Association for Computing Machinery, New York, NY, USA, 243–252. https://doi.org/10.1145/1013115.1013149

[9] Jialin Deng, Yan Wang, Carlos Velasco, Ferran Altarriba Altarriba Bertran, Rob Comber, Marianna Obrist, Katherine Isbister, Charles Spence, and Florian 'Floyd' Mueller. 2021. The Future of Human-Food Interaction. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems.* Association for Computing Machinery, New York, NY, USA, 1–6. https://doi.org/10.1145/3411763.3441312

[10] Audrey Desjardins, Jena McWhirter, Min Jung Koo, Philbert Widjaja, and Nick Logler. 2021. *Data Bakery, url =https://www.studiotilt.design/data-bakery, lastaccessed =October 13, 2021,.*

[11] Laura Devendorf. 2021. *Wear.* Retrieved October 13, 2021 from http://artfordorks.com/wear/

[12] Laura Devendorf, Kristina Andersen, and Aisling Kelliher. 2020. Making Design Memoirs: Understanding and Honoring Difficult Experiences. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20).* Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3313831.3376345

[13] Inger Ekman and Michal Rinott. 2010. Using Vocal Sketching for Designing Sonic Interactions. In *Proceedings of the 8th ACM Conference on Designing Interactive Systems* (Aarhus, Denmark) *(DIS '10).* Association for Computing Machinery, New York, NY, USA, 123–131. https://doi.org/10.1145/1858171.1858195

[14] Mikhaila Friske, Jordan Wirfs-Brock, and Laura Devendorf. 2020. Entangling the Roles of Maker and Interpreter in Interpersonal Data Narratives: Explorations in Yarn and Sound. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (Eindhoven, Netherlands) *(DIS '20).* Association for Computing Machinery, New York, NY, USA, 297–310. https://doi.org/10.1145/3357236.3395442

[15] Courtney Lynn Gallagher. 2017. Sketching for Ideation: A Structured Approach for Increasing Divergent Thinking. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '17).* Association for Computing Machinery, New York, NY, USA, 106–111. https://doi.org/10.1145/3027063.3048424

[16] Gabriela Goldschmidt. 1991. The dialectics of sketching. *Creativity Research Journal* 4, 2 (Jan. 1991), 123–143. https://doi.org/10.1080/10400419109534381 Publisher: Routledge _eprint: https://doi.org/10.1080/10400419109534381.

[17] Gabriela Goldschmidt. 2017. Manual Sketching: Why Is It Still Relevant? In *The Active Image: Architecture and Engineering in the Age of Modeling,* Sabine Ammon and Remei Capdevila-Werning (Eds.). Springer International Publishing, Cham, 77–97. https://doi.org/10.1007/978-3-319-56466-1_4

[18] John E Harrison. 2001. *Synaesthesia: The strangest thing.* Oxford University Press, USA.

[19] Douglas R Hofstadter. 1997. *Le ton beau de Marot: In praise of the music of language.* Basic Books New York.

[20] Vincent Isnard, Marine Taffou, Isabelle Viaud-Delmon, and Clara Suied. 2016. Auditory sketches: very sparse representations of sounds are still recognizable. *PloS one* 11, 3 (2016), e0150313.

[21] Chang Hee Lee, Dan Lockton, John Stevens, Stephen Jia Wang, and SungHee Ahn. 2019. Synaesthetic-Translation Tool: Synaesthesia as an Interactive Material for Ideation. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) *(CHI EA '19).* Association for Computing Machinery, New York, NY, USA, 1–6. https://doi.org/10.1145/3290607.3312849

[22] Giorgia Lupi and Stefanie Posavec. 2018. *Observe, Collect, Draw!: A Visual Journal* (illustrated edition ed.). Princeton Architectural Press.

[23] Yuri Ono Miranda July, Harrell Fletcher. 2002. *Learning to Love You More.* Retrieved October 8, 2021 from http://www.learningtoloveyoumore.com/index.php

[24] Sara Price, Kerstin Leder Mackley, Carey Jewitt, Gijs Huisman, Bruna Petreca, Nadia Berthouze, Domenico Prattichizzo, and Vincent Hayward. 2018. Reshaping Touch Communication: An Interdisciplinary Research Agenda. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (CHI EA '18).* Association for Computing Machinery, New York, NY, USA, 1–8. https://doi.org/10.1145/3170427.3170603

[25] Hugo Scurto, Baptiste Caramiaux, and Frederic Bevilacqua. 2021. Prototyping Machine Learning Through Diffractive Art Practice. In *Designing Interactive Systems Conference 2021 (DIS '21).* Association for Computing Machinery, New York, NY, USA, 2013–2025. https://doi.org/10.1145/3461778.3462163

[26] Jakob Tholander, Klas Karlgren, Robert Ramberg, and Per Sökjer. 2008. Where all the interaction is: sketching in interaction design as an embodied practice. In *Proceedings of the 7th ACM conference on Designing interactive systems (DIS '08).* Association for Computing Machinery, New York, NY, USA, 445–454. https://doi.org/10.1145/1394445.1394493