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Visuals that Portray a Wind Farm

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Abstract

John Debes, the founder of the IVLA, argues that our first language is body language – visual and tactile information together helping us make sense of the world (Debes, 1972). During research of the public response to what could be the first freshwater offshore wind farm in North America, on Lake Erie, participants have a distinctly embodied understanding of environmental information. Their oral stories, drawings, and written responses reflect use of visual literacy that personifies wind turbines, the lake, fish and birds, and Earth's processes as human in nature. In return, participants' perception of the wind farm's features, size, and distance is skewed toward an immediate, physical presence. Between anthropomorphism and embodiment, what the general population sees as important in a large-scale sustainable energy project is very different from what is shown in technical documentation from scientists, engineers, and policymakers, complicating public decision making.

Keywords: technical communication, perception, embodiment, metaphor, environmental communication

Introduction

Visual literacy shapes human understanding. According to John Debes, "an object perceived by a child has little meaning until the child has a chance to touch, taste, or otherwise manipulate it" (Debes, 1972). Experiences, as lived through the human body, have a direct effect on how humans generate meaning. This happens through the assignation of signs and symbols in the form of language, which is predetermined by embodied notions of movement, place, and form (Lakoff & Johnson, 1980). By extension, our human embodied perceptions serve to "color" how we view the world and make out its workings. This research applies the concept of visual literacy to a study about environmental communication regarding a proposed wind farm. Our society needs to find better ways to communicate about the benefits and risks of large renewable energy projects, and ultimately, about the need to address the complex problem of global warming. Research investigating the determinants of visual literacy that affect the understanding of environmental concepts can help bridge the gap between scientific and policy technical documentation and public comprehension.

Roger Fransecky and John Debes define visual literacy as:

> A group of vision-competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret the visible actions, objects, and symbols natural and man-made, that he encounters in his environment. Through the creative use of these competencies, he is able to communicate with others. (Fransecky & Debes, 1972, p. 9)

Visual literacy supposedly consists of a "group" of competencies that various scholars of the subject have attempted to categorize into lists for evaluating ability, purpose, subject matter, and cognates to language (Fransecky & Debes, 1972; Kostelnick & Roberts, 2011; Moore, 1970; Porteweig, 2004). These competencies help define the modes of visual communication and how they refer to meaning structures, including alphabetic language, when interacting with the world. Each system of categorization offers a unique way to look at visual processing. For the purposes of this study, we will first take Maxine Moore's system of perceptual development to look at how participant responses lay on a continuum of increasing breadth of perception from individual conceptualization to decision making and enaction (1970), and then look at Fransecky and Debes's system to evaluate the content of participant drawings through mode and purpose (1972). Here is a broad overview of the project and research design in relation to visual literacy, and then a discussion of how visual literacy shaped participant responses and attitudes toward the wind farm project.

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A pilot offshore wind farm project on Lake Erie, called Icebreaker Wind, had been proposed by a public/private partnership called LEEDCo that first began looking at implementing this type of project back in 2004 and was in the final stages of approval for construction during summer 2019. If it were approved, it would be the first freshwater offshore wind farm in North America, located eight miles out from Cleveland, Ohio (LEEDCo, 2020). The Great Lakes are the largest source of freshwater globally. This pilot project would serve to open the development of the lakes to wind power, which had been proposed in many regions but not accepted yet. There was much public deliberation about the project in the local papers. But how did the public feel about this project, and how would they respond to the technical documentation about this wind farm that included much visual information in the form of photographs, technical illustrations, charts, and maps?

The problem is that experts and policymakers do not often consider public perceptions about environmental issues when putting together technical documents (Grabill, 2007; Simmons, 2008; Ding, 2014). This creates a gap in knowledge between those in power and the public, leading to misunderstandings and resistance to new projects, regardless of their possible benefits. This is not from any lack of education or intelligence in the public, but rather the existence of differences in viewpoint. Through surveys and interviews of 40 Northeast Ohio residents, this research project asked participants about their literacy (reading and writing habits), their environmental knowledge, and experiences. Then, the interviewer asked participants specific questions about the proposed wind farm and associated technical documents. Participants viewed a range of document types, from alphabetic text to partially illustrated, photographic, and video genres, to investigate the effects of modality changes. Participants had the chance to respond in written, oral, and drawn formats. In the end, small focus groups met to talk about the project and give their recommendations to policymakers.

Allowing participants to respond through drawing offered intriguing results. During face-to-face data collection with participants, participants drew directly on a piece of white printer paper with black sharpie markers of different widths in response to questions about their geographical and spatial knowledge. Having a blank slate, or tabula rasa did away with the predetermined nature of an online GIS mapping system that would automatically calculate distance, perspective, direction, location of roads and landmarks, and naming conventions that would influence participant decision making. The drawings relied solely on participants' internal knowledge of the local geography and their reflection of important monuments and locations in relation to Lake Erie, Cleveland, and the proposed wind farm.

It was only after asking participants to draw their own images of the wind farm and maps that they were shown an actual map of Lake Erie and photographic simulations of the proposed wind farm, and they were asked about the technical documents' validity in relation to their personal renditions. This method was chosen to reflect the most accurate, natural answers from participants, showing their viewpoint before tampering with it and introducing the technical documents. By being open to participant reactions, no matter how simple (in the form of quick drawings) or unobjective (emotional and irrational statements), new knowledge about how the general population regarded technical documentation about this large renewable energy project would be possible. Inconsistencies in participant responses to the technical documents were signs of disjuncture between what they expected to see and what was shown to them as objective reality. Different types of visually literate responses to technical documentation about the proposed wind farm directly affected participant understanding and acceptance of the human-environmental intervention.

When considering the drawings of the proposed wind farm that participants shared during the interviews, it was clear that their view of the wind farm was that of an immediate, close experience and the turbines were huge compared to the surrounding landscape features, including buildings, the lake, and even the city of Cleveland. But why would the majority of participants draw their rendition of the wind farm to such a large scale? Was it simply a matter of inability to portray proportion accurately, or not knowing how far out the turbines were to be placed, or having some predetermined image in their mind of how it should look? On the first count, it is true that proportion was not something that participants were concerned about correctly representing. However, if the drawings showed an inability to render proportion, it is more likely that their drawings would have shown a wide range of turbine sizes, from small to medium and large. But 76% of the turbines in the drawings were drawn to magnitudes hundreds of times larger than their accurate proportional size. On the second count, participants were told multiple times during the interview and in the text of the

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technical documentation that was shown to them that the wind farm was supposed to be built eight miles offshore.

It is conceivable that participants did not realize how tall objects such as the wind turbines would recede into the horizon at such a distance. But this also does not account for the consistency of the large size shown in participant drawings. Finally, if participants did have a predetermined idea of what the wind farm should look like and represented this in their drawings, why were they all so similarly large proportionally? This logical analysis of participant responses through the drawings is important to make despite its futility because it is easy to dismiss the study's findings because of misguided notions that participants were somehow deficient in drawing ability, perception of distance and proportion, or working only from subjective memory. It is impossible to know what the conceptual process was in participants' heads as they drew their renditions of the wind farm, but it is possible to analyze the results in relation to what participants said in their interviews and wrote in their surveys.

What tipped the balance toward embodied cognition was the finding that some participants claimed even after viewing the simulated photographs of the wind farm far out in the distance of the lake (as seen in Figure 1) that their huge drawings (see Figure 2) were correct: "It looks like what I thought it would look like" (interview, participant 24). One participant exclaimed when viewing the simulated photograph, "Aw, there's my beach picture… See, they're close together, like in my thing" (interview, participant 23). See participant 23's drawing in Figure 3.

Although these participants drew three turbines at basically the same size proportionally as the beach and water combined, they believed that the simulated photograph matched their work well. Other participants had similar reactions: they accepted the accuracy of the photographic visual simulations, even if they did not match up with their size expectations, and at the same time, they stood by their subjective representations of the proposed wind farm. Participants generally did not question the number of turbines portrayed in their drawings versus the number shown in the photographic simulations, even though this number varied from one to twenty, as shown in Table 1. The average number of turbines in participant drawings was five. The highest number of drawings showed six turbines, 10 out of 38 representations. So, the collective understanding of the number of turbines involved in the project was fairly accurate. But the distribution of results shows a highly variable response rate, with six drawings overrepresenting the number of turbines and 22 drawings underrepresenting the number of turbines.

Figure 1
LEEDCo Simulation (LEEDCo, 2021)

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Figure 2
Drawing 3, Participant 24

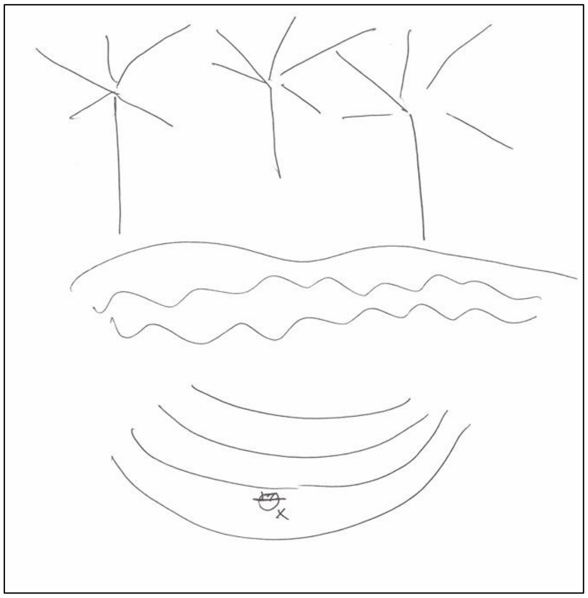

Figure 3
Drawing 3, Participant 23

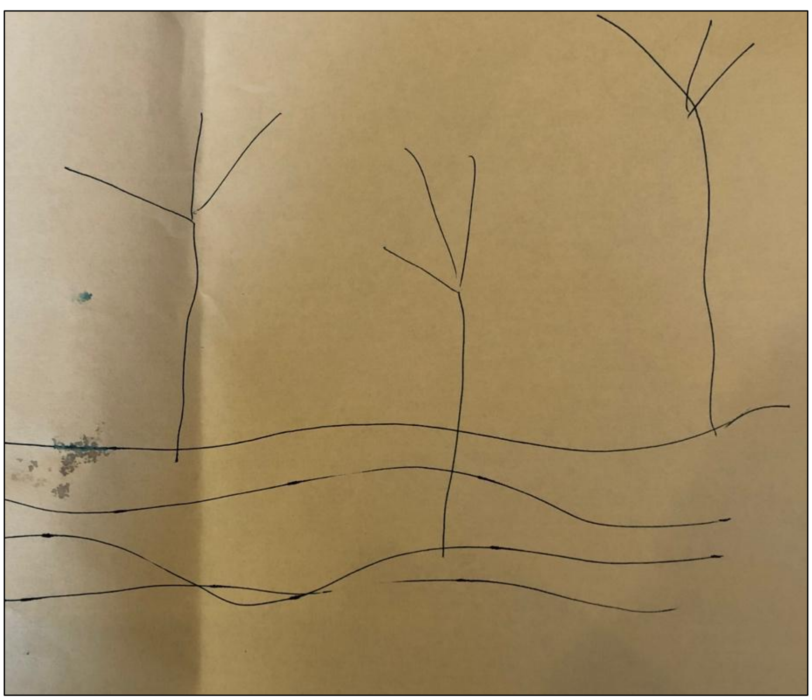

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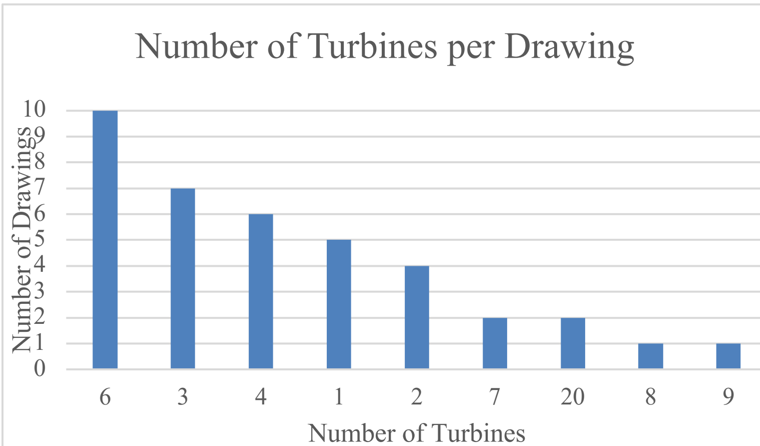
Table 1
Number of Turbines per Drawing



Some participants quickly realized that their drawings (seen in Figures 4 and 5) were flawed when compared to the technical simulations: “My happy wind farm is wrong!” (Interview, participant 26), “Looks like I definitely got it wrong … I feel a little stupid about my drawing now” (Interview, participant 18), and “I guess I should have drawn them smaller” (Interview, participant 31). While admitting differences between their drawings and the technical simulations, these participants seemed more dismayed by the content of the photographic simulations than upset about the inaccuracies of their drawings. As one participant stated, “they look weird just sticking out in the middle of the water” (Interview, participant 14), and another said, “It’s pointless … remember, I think they’re awesome” (Interview, participant 38). Between the minuscule size of the turbines in the technical simulation photos and the rather romanticized drawings created by participants, there was a disjuncture between the expectations of the public conception of the wind farm’s visual impact and what was shown in the simulations.

Figure 4
Drawing 3, Participant 26

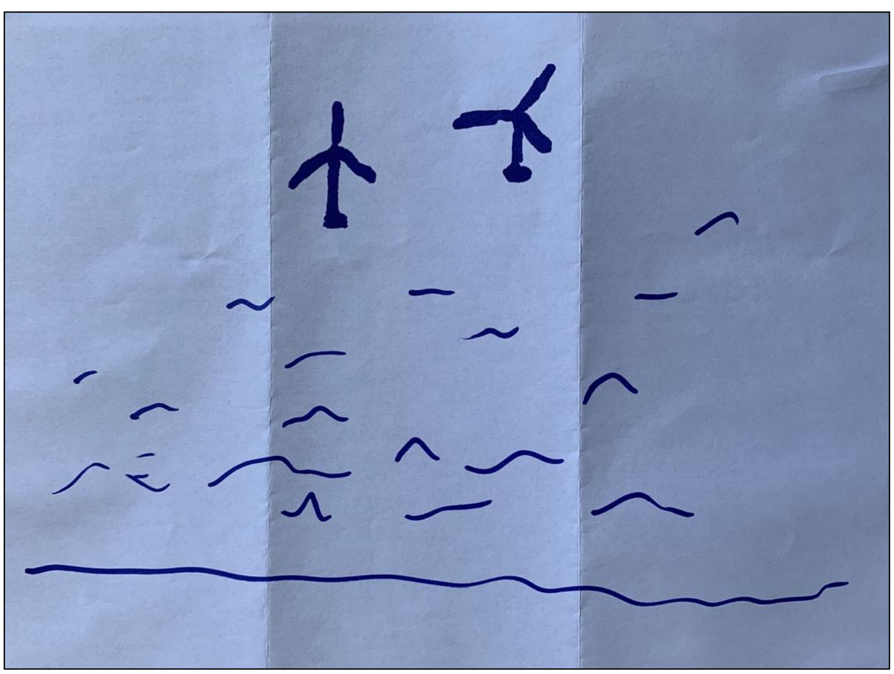


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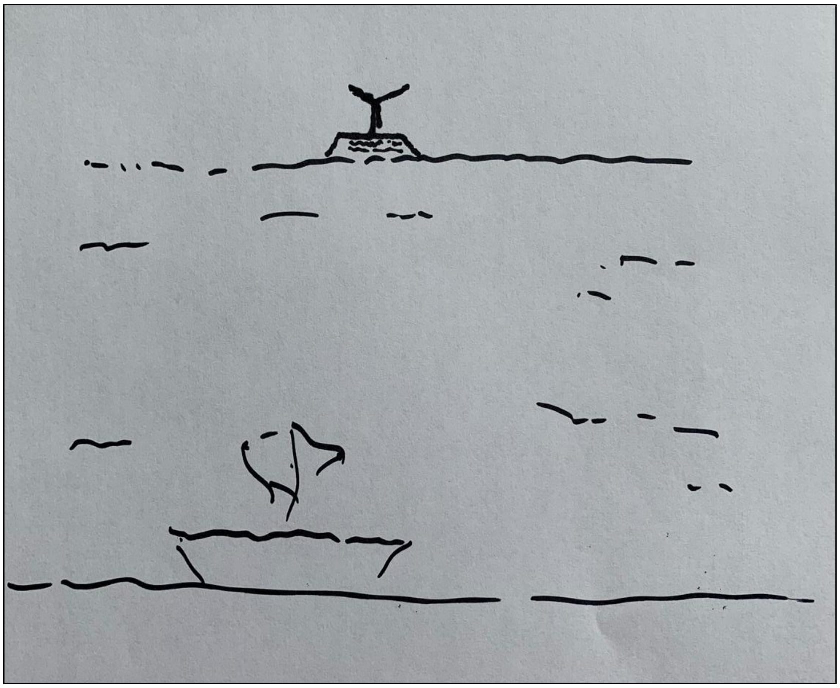
Figure 5
Drawing 3, Participant 18



The anticipated size of the wind turbines, for example, was disproportionately large compared to most other subjects in participant drawings, including buildings, the sun, and even Lake Erie. Of 38 representations of wind turbines, 29 were "huge" (designated as such in a qualitative evaluation, as in the drawing from Participant 31 shown in Figure 6), five were "large" as shown in Figure 7, and four were "small," as in Figure 8. The small representations can be considered close to, if not proportionally accurate, which made up 10.5% of turbine drawings.

Figure *6*
Drawing 3, Participant 31

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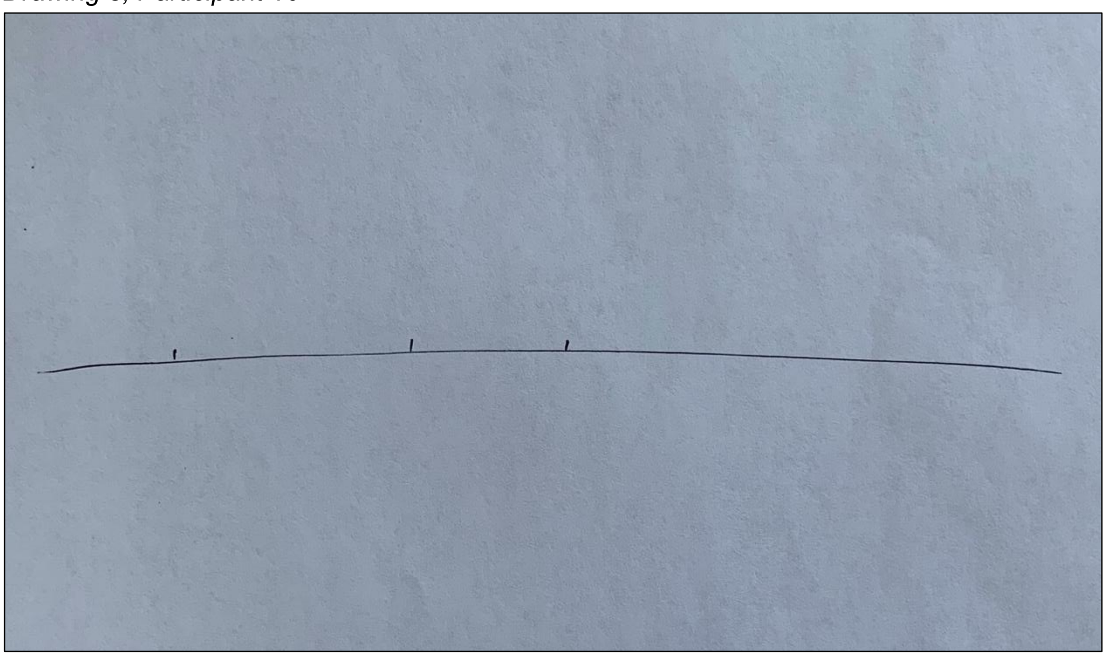
Figure 7
Drawing 3, Participant 36

Figure 8
Drawing 3, Participant 10



The ramifications of the public perception of large turbines in the proposed wind farm are staggering because if the perception is that these turbines will be magnitudes larger than in reality, then they will also be viewed by some as by default a nuisance, or to use the term that many participants did, the turbines will be an "eyesore." But it is not as simple as this because although the great size portrayal in participant drawings denotes a disruption to the view on Lake Erie, it also signifies the importance and greatness of purpose. Many participants, such as number 38, described the turbines as "awesome" and saw them as a

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symbol of progress and monumental awe-inspiring pride. What we are moving toward here is the understanding that it did not matter to participants that technically, the wind farm would be so small in the distance that they would barely be able to see it, even on a sunny clear day.

They wanted to have a close-up view and understanding of the turbines, so close that they could reach out and touch them, an embodied experience that could take in the ecological and social meanings and repercussions of building such a project on Lake Erie. This is why the simulation photographs were deemed woefully inadequate by most participants, even as they were considered one of the easiest technical documents to understand and were generally thought of as technically accurate. As one participant asked before they registered the turbines in the distance, "What is it simulating?" (interview, participant 13) and it does not seem that the document had a purpose for the public, but instead was created and used by LEEDCo and policymakers to fulfill a required visual impact analysis that was supposed to protect the public from unwanted visual disruption. LEEDCo also used this document at public information sessions to show the minimal disruption that would be caused by the construction of the pilot wind farm.

Even after participants were shown multiple simulated photographs, they claimed that their huge drawings were accurate. Something is going on here, where participants' expectations were not met by the type or format of information provided by the technical documents. John Debes, the founder of the IVLA, argues that our first language is body language – visual and tactile information together helping us make sense of the world. Participants in the study had a distinctly embodied understanding of environmental information. Their oral stories, drawings, and written responses reflect visual literacy through metaphor that personifies wind turbines, the lake, fish and birds, and Earth's processes as human in nature. Participants' perceptions of the wind farm's features, size, and distance were skewed toward an immediate, physical presence. The size of participant turbine drawings reflected an embodied, the immediate viewpoint of the wind farm, even if they are not proportionally accurate. In addition, in participant drawings and language, the wind project was personified, with turbines having a lifespan. Participants were concerned not just about the initial construction and energy output, but also about maintenance and ultimately their decommissioning, focusing on the needs and lifespan of the turbines and equipment. Images such as the waves pounding against a lighthouse made participants visibly concerned about the lake's dangers when considering the construction of such a project in a violent environment.

Between the anthropomorphism and embodiment, what the public saw as important in a large-scale sustainable energy project was very different than what was shown in technical documentation from scientists, engineers, and policymakers. The social connection was central, and using the human body as a reference point was key. Participant drawings showed the turbines variously alone or in groups of up to 20, even though they knew that the proposed wind farm called for exactly six turbines. The number of turbines represented was more a reflection of social relationships and personal identity than technical accuracy. So, what do these findings have to say about visual literacy and its development?

Ruth Moore (1970) organizes perceptual development of visual literacy into five steps

1) sensation
2) figure perception
3) symbol perception
4) perception of meaning
5) perceptive performance

Participants in this study generally met the sensation, figure, and symbol perception requirements, as shown in their representations of the wind turbines and their location. They recognized that the construction of the proposed wind farm would change the visual landscape, that the wind turbines would exist as independent figures in this landscape, and that their representation on paper was mostly symbolic for a whole host of mechanical systems encased by the wind turbine structures that would produce power. However, at the fourth meaning stage, Part A: "Mental manipulation of the identified form or pattern," participants failed in terms of "ability to reproduce forms, tunes, or syllables by memory" and "ability to overcome the constancies of brightness, color, size, and shape." The form, pattern, size, and shape of the wind farm were not successfully transferred from the technical readings and conversations that preceded

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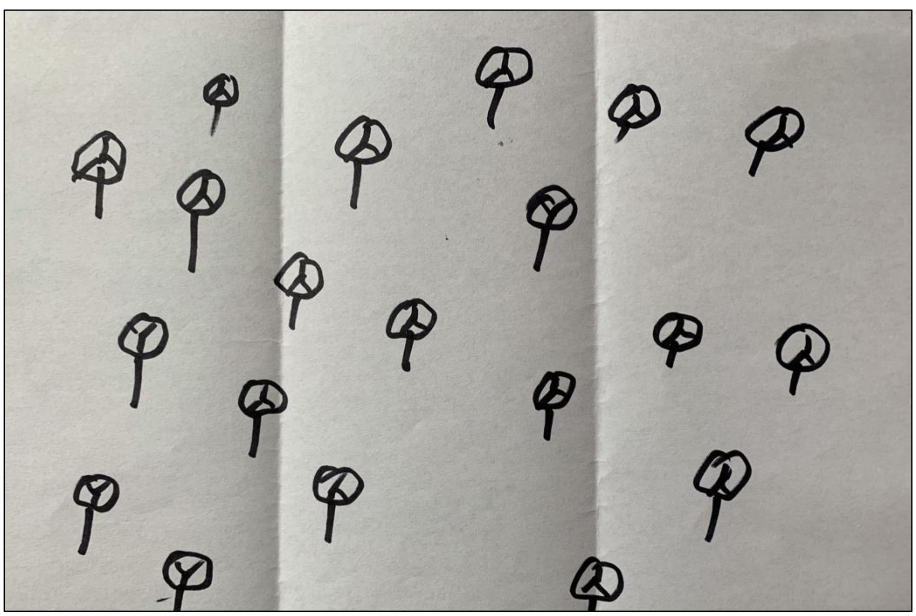
their drawings. This, in turn, adversely affected participants' perceptive performance, or the "ability to make complex decisions where many factors are involved … [including] successful analytical or global approach… diagnostic ability … [and] insight into personal, social, and political situations" (Moore, 1970).

From this analysis, it is possible to argue that it is a more significant leap to move from symbol perception to the attribution of meaning than to move through the first three stages. This leap was not possible for most participants in the study, and therefore the final step that allows for decision making and taking action on the issue was not attainable. The way that participants visualized the proposed wind farm project directly affected their understanding of the purpose and methods at play in the certification and approval process and technical documentation necessary for the project to begin construction. However, participants readily assigned personal meaning to the proposed wind farm project and conducted their own evaluation of its merits through their individual value systems. These values extended beyond technical operational considerations to include social, ethical, moral, and symbolic constructions.

Turbines were often referred to as "windmills" in the ancient farming relationship with wind power and grain grinding. The term "wind farm" was preferred to any other description, denoting a focus on harvesting the wind for community use. In Figure 9, Participant 34 drew their wind farm as if the turbines were arranged like the plot of a farm. Participants envisioned having a communal relationship with them. A total of 80% of participants believed that birds would be at risk from the turbines, even though technical documentation showed minimal risks to birds. Participants wondered how birds and bats "see" and how they would avoid the turbines. The overwhelming concern for bird mortality from the wind turbines reflected an empathic connection with an animal species that subsumed the rational, scientific findings that turbines do not significantly increase bird deaths.

Figure 9
Drawing 3, Participant 34



Participants valued symbolic renditions and qualities of the wind farm. They described the turbines as being beautiful, graceful, awesome, and making a pleasing pattern. Participant drawings often envisioned the turbines as flower-like structures, surrounded by the sun and birds flying by. These qualities are not often presented in technical documentation. Project managers assumed that people considered wind turbines a possible eyesore, but most participants saw wind turbines instead as a positive symbol of change. Finally, the maps that participants drew of the city of Cleveland showed that they had a high variation in

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geographical knowledge and limited attention to scale or proportion regarding distance. What was important to them remained large and centered in their drawings, revealing that communicating the proposed wind farm's exact geographic location would prove problematic.

Fransecky and Debes (1972) list the purposes or modes of visual communication as:

1) definition
2) description
3) enumeration
4) spatial arrangement
5) comparison
6) categorization
7) traveling eye (exploration)
8) chronology or process
9) idealization
10) directive utterances
11) fiction
12) personal emotional expression

The technical documentation about the proposed wind farm focused on the first six modes of visual communication in order to objectively describe the specifications of the project, but participants who were asked to express their perceptions of the project responded with the full range of these modes. For example, participants' concerns about the maintenance and ultimate decommissioning of the turbines viewed the project as not a one-time construction deal but a continually evolving process of electricity production that would take place over a period of time. In terms of idealization, "from a carefully selected set of pictures, something very close to the ideal … can be communicated visually. What is required is a careful selection of aspect and time and elimination of the imperfect or atypical" (Fransecky & Debes, 1972, p. 29). Participants chose to represent the wind farm in an idealized manner so that their understanding of the project was prioritized, to the exclusion of what would be deemed technically "accurate." Their drawings' persuasive function was generally naïve or primitive (in terms of lack of perspective) and raw in form, compared to the technical illustrations and photographs that were no less meant to persuade but was instead framed as "accurate."

Participants created a fictional world in their drawings of the proposed wind farm, as Fransecky and Debes describe, "a confabulation tailored with exquisite care for the feelings and images that would be created in the minds" of their audience, "to share, spontaneously or deliberately, feelings strongly held" (1972, p. 29). Their versions of the proposed wind farm were not "wrong," but rather illustrate the wide range of visual perceptions and literacy held by the public concerning complex environmental information. That technical documentation consciously avoids acknowledging the emotional and social connections that are broken and wrought by large-scale environmental projects is dangerously close to denying our imperfect humanity. It is impossible to truly understand the environment as separate from human embodied experience, which, when faced with information that is too "big" to comprehend, reverts to stories, myths, and fable to maintain the balance.

For example, humans have a complicated relationship with birds: they can at once symbolize a message or messenger (carrier pigeons or hawks), omen or portent (crows and storks), stand for national pride (eagles) or mean happiness (bluebirds). In the technical documentation about the wind turbines' effect on birds, the turbines are discussed as a possible danger to birds in route during their migration seasons, especially at night. But it is evident from the interviews with participants and public debate about potential wind turbine dangers to birds that there is much more at stake than a few birds' lives. Participants in the study show an emotional and perceptual attachment to birds that cannot be explained by logic, and their fears cannot be put to rest by deductive methods. One of the most common fallacies regarding wind power is that the turbines kill birds, but this is a sign not of misguided thinking; rather this is evidence of an ingrained link that humans have to birds when trying to understand the environment. Humans have used birds for a long time to carry messages across distances, for food and decoration, to tell the future, and as

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an animal familiar. Although most of these uses have been replaced by technology, industrial production, and science in the modern era, the traces of the birds' functions and relationships persist in the human mind. We use Twitter to send messages, stuff pillows with polyester filling instead of feathers, deploy algorithms to predict future events, and use mechanical drones to see images from the sky. However, the prototypical bird function remains intact and causes cognitive dissonance when it is not given a role to play in environmental communication.

In this study, participants were asked the question, "What are some of the risks involved with wind power to animals and humans?" (Appendix C). The majority of participants responded to the question about animal risks with concerns about birds, much fewer discussed fish, and other types of animals were mentioned in passing. Some participants were sure that the rotating blades of the turbines would kill birds:

> It is not very environmentally friendly for the bird population. So, I'm really aware of that and the pattern like I love the birds. They sleep while they travel. And so, if you put the wind power on that pass you kill massive populations of birds… Yeah, they kind of take turns and they fly as a flock and some of them are sleeping and not really seeing where they're going. Almost like on a bike you know when you trust the first rider to you being in the draft and you're not working as hard. And so, a lot of the birds get hurt with the wind power. (interview, participant 19)

And another participant stated that:

> But I have also heard that birds throw themselves, they don't know what's there, and that's it. And then a lot of birds are found at the bottom of these things. I imagine that can't be helped too much. Except we are losing a lot of birds. (interview, participant 38)

Many participants discussed the sensory perceptions, intelligence, and motives of birds when debating their potential ability to avoid the turbine blades of a wind farm, as is seen above in participant 19's assertion that birds sleep when they're flying in a flock and participant 38's belief that birds "throw themselves" at the turbines. It was clear that participants were struggling with imagining how a bird sees and senses objects from the air and whether those rotating blades would be difficult to avoid. For example:

> Having the wind turbine spin around is not going to kill that many birds. Sure it's going to kill birds… Again, the blades aren't slicing any birds in two… Well, buildings. I mean, Eagles have really good eyes. I can't see and hawks have really good eyes. I can't see them. Why did this guy fly into my window? I would think that they would have a little bit of peripheral vision. I don't know how their eyes work. (interview, participant 2)

This kind of debate about birds' perception occurred with most participants and usually ended with no resolution or final statement about the risk to birds. When the technical documentation about threats to birds is reviewed, little is mentioned about bird perception; instead, sheer numbers for bird mortality are provided, as in the document shown to participants after being asked about possible risks to birds.

The question of bird mortality would not have been a source of contention if it were not for the cognitive dissonance that preexisted for the activists, policymakers, and the public about the role of birds in understanding the environmental context the proposed project. The science shows that wind turbines do not unduly injure birds compared to other sources of mortality, based on behavioral studies. Still, they do not explain the perceptual and motor skills that birds have in order to avoid collisions with wind turbines. It is beyond the scope of this study to investigate the perceptual and physiological abilities of birds, but such research must exist, and it would go a long way to supporting the assertion that birds will typically avoid a moving or stationary object and that their eyesight is adequately strong to do so.

To speak further about the prototypical bird relationship with humans, there are numerous ways that we have used birds to "see" beyond our average ability to view things, such as using a "bird's eye view." We can only imagine what it is to fly and see the world from a higher vantage point, but what we are asking the public to do when talking about environmental issues is to do just this. A large-scale energy-producing wind farm is built at such a scale, and has repercussions for the wider landscape, such that participants must call on knowledge outside their everyday abilities – that of birds. By explaining this, there is the risk of appearing simplistic or reverting to folk knowledge that would normally appear in fairy tales; but if we are to understand where the public is coming from, it is necessary to value this type of knowledge-making. Birds

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here are at once a method of understanding for participants and an element of risk posed by the new technology. As such, their method of understanding is put at risk by the proposed project, and it obtains a sinister connotation as dangerous and "unknown" even though wind farms have been producing electricity safely for many years in other locations.

Public understanding and their renditions of technical visualizations diverge from renditions provided by experts and policymakers. Considering these findings, new document genres are possible, where participant expectations are valued and represented. Understanding the local population's visual literacy is key to figuring out how to successfully implement projects that can help humans avoid the risks of climate change. Participants in the research project were open to sharing their viewpoints and even got riled up about the proposed wind farm, wanting to learn more and even become involved. This kind of research has the potential to promote citizen science through greater attention to visual literacy and help technical communicators improve their strategies of document construction about a wide range of topics. The end goal is to provide technical communicators with practical solutions to communicate more effectively with the public through easily digestible textual and visual information.

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