Masking (Not Masking) Up: An STS Visual-Intersectional Approach to Understanding Publics

and Science in Times of Rapid Change

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23 February 2023

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Abstract

In this paper we argue that a visual-intersectional approach can advance the field of science and technology studies (STS). Although there is a small but important body of work using visual methods in STS, it has rarely incorporated intersectional approaches. We use visual imagery about mask wearing during the COVID-19 pandemic as a case study to illustrate the potential power of a visual-intersectional approach in STS. We chose masks for three reasons. First, debates about mask-wearing were rich with visual imagery, from home-made signs posted in homes and businesses to professionally designed and printed imagery circulated by public health agencies. Second, recommendations about face coverings outside of healthcare settings changed dramatically in the first 18 months of the COVID-19 pandemic, providing an opportunity to analyze how rapidly changing scientific recommendations were debated in the public sphere. Finally, as masks entered the public sphere, they quickly became evocative technologies, deeply imbued with cultural and political meanings. By focusing on signs about masks in the United States, we demonstrate how integrating visual methods of data collection and an intersectional, visual analytical lens can strengthen STS by developing deeper understandings of (a) publics and science in times of uncertainty, (b) public health as a distinct form of scientific expertise, and (c) the role of humor and place-specific messaging in science. We close with analytic priorities for future research on mask use that could advance STS theories of the collective construction of scientific knowledge and productively inform the development of public health interventions.

Introduction

Recommendations about face coverings outside of healthcare settings changed dramatically in the first year and a half of the COVID-19 pandemic. Conflicting scientific recommendations about mask use, issued in counterpoint with dismissive statements by some public officials, opened up the space for a variety of actors, including individual households, politicians, businesses, and public health agencies to contribute to knowledge-making and knowledge-claims about mask use. National agencies, transnational nongovernmental organizations, diasporic and community groups, and public health agencies at all levels of government within and across national borders began debating the need for and efficacy of masks for the general public. Face masks quickly became evocative technologies, deeply imbued with cultural and political meanings and inextricable from the intersectional dynamics in which masks emerged as key devices in the fight against COVID-19.

Drawing on masks as a case study, we propose a visual-intersectional methodological and analytical approach to advance STS scholarship on publics and science and the uptake of technology in times of rapid change. Although some STS scholars use visual methodologies (e.g., Bell 2010; Galison & Hogan 2000; Gooding 2010; Mitman 2010; Salter et. al 2016; Wylie et al. 2017) or intersectional approaches (e.g., Joyce, James & Jeske 2020; Bhatia 2018; Shim 2014), seldom are the two approaches combined (e.g., Mann & Grzanka 2020). This paper combines visual methods and analysis with an intersectional analysis to demonstrate the approach's potential to advance STS research.

Although COVID-19 is a worldwide pandemic, the political, medical, and cultural responses to mask wearing, knowledge-making, and knowledge-claims about mask use are made in particular national (e.g., Chen 2021; Gibson 2021; Li & Nicholson Jr. 2020; Van Gorp 2021),

transnational (e.g., Ma & Zhan 2020; Zhang 2021), and local cultural settings (e.g., Padilla 2020). Mask use is, in other words, "highly variable and embedded, within cultures, within countries and geopolitical entities, within class structures, within professional and educational contexts" (Knowles, Pearl & Ray 2022, 119). Recognizing this, we focus on the U.S. to make the case for visual-intersectional approach in STS, though we thread transnational concerns throughout[1]. Our methodological innovation stands to advance STS theory in three ways. First, this paper foregrounds the visual. Building on critical STS scholarship that examines the role of images in the co-constitution of expertise and scientific authority, we propose that mask use and nonuse are fundamentally public visual practices fraught with complex significations (Bell 2002; Joyce 2008; Balsamo 1996; Burri & Dumit 2008; Fishman et al. 2016; Haraway 1988; Sturken & Cartwright 2001). As such, images of masks are key data points that warrant critical analysis, even though images are rarely treated as such in the extant STS literature (but see Dumit 2004; Galison 1997; Lynch & Woolgar 1990; Mitman 2010). Analyzing images that seek to compel or condemn mask use offers a way of investigating a scientific discussion that has taken place in highly visual and public terms–a discussion that cannot be fully captured by focusing on text alone.

Second, because mask use became politicized so rapidly, an intersectional approach is essential to understanding the social construction of mask use in particular locations. Since the turn of the 20th century, the use of masks in public spaces has resurfaced repeatedly as a tool and image "of political articulation and transformation" (Lynteris 2021). Within the U.S., mask wearing quickly became associated with racial, gendered, and partisan identities and social

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[1] Though a thorough accounting of the relationship between transnationalism and intersectionality is beyond the scope of this paper, Bhatia (2018) provides a useful framework for holding intersectional and transnational concerns in STS simultaneously and complementarily.

positions. Orientalist stereotypes of "Yellow peril" and a "model minority" contributed to the "creation, circulation, and perpetuation of 'mask culture' as an essentialized element of 'Chineseness' or 'Asian-ness' in Western public discourse" (Zhang 2020, 11). These stereotypes were fostered by media in its coverage and commentaries about the pandemic by picturing "Chinatown or Asian people in masks" with stories that were irrelevant to Chinatown or China (Li & Nicholson Jr 2020, 8). At the pandemic's outset, other racial and ethnic minorities, especially African Americans, expressed concern that mask use—by Black men in particular— might be met with fear, racism, and intimidation or harassment by police (Christiani et al. 2021; Taylor 2020). In addition, mask wearing has consistently been associated with political party Republican (red state)/Democrat (blue state) identification in the U.S. (Madhani & Kellman 2020; Padilla 2020). These diverse cultural meanings infused the signs that were made by government agencies, local businesses, and households about mask-wearing. An intersectional approach, as introduced and advanced by Black feminist and other women of color scholars and activists throughout the 19th and 20th centuries (Collins 2019; Crenshaw 1989), illuminates how race, gender, political identification, and other dimensions of difference co-produce mask signage.

Third, we argue that studying visual messaging about mask use through a visual-intersectional lens advances STS's understanding of the relationships between publics and scientific expertise. STS has a long history of studying the relationships between science and publics (Hackett 2008). From examining the complex relationships between and among science and publics (e.g., Wynne 1992, 1995) to the way citizens participate in and shape science (e.g., Allen 2003; Kimura & Kinchy 2019; Ottinger 2013), STS scholarship has shown that people's understanding of and participation in science is heterogenous, nonlinear, and contextual (Epstein

1998; Wynne 1992, 1995). Such an approach rejects the idea that people dismiss science because of lack of knowledge, but rather shows how people draw on values and contexts to create their understanding of what constitutes scientific research and their acceptance or rejection of scientific knowledge (Reich 2016). Within a subfield of STS, members of the public are imagined as users who are crucial to design processes (Joyce 2008; Joyce, Peine, Neven & Kohlbacher 2016; Oudshoorn & Pinch 2003). An emphasis on users highlights how laypeople act upon and transform technologies and science (Cowan 1985; Mamo 2008; Mamo & Fishman 2001; Oudshoorn & Pinch 2003; van den Scott et al. 2016), including what is now referred to as "making and doing" in STS discourse. Within this literature, however, little attention has been given to public health as a specific type of expert knowledge and how it might differ from medical or other scientific approaches to knowledge and well-being. Use of a visual-intersectional approach shows ways in which science is always local, particular and about power, and how this may be consequential for public health policy and practice.

To develop our argument for a visual-intersectional approach, we analyze images of signs about mask wearing that were posted during the COVID- 19 pandemic in three states in the U.S.: Massachusetts, Pennsylvania, and Tennessee. The use of three different locations helps illustrate how a visual-intersectional approach might advance STS theory and practice, because each of these sites possess some continuities (e.g., location in the U.S.) and discontinuities (i.e., political orientations, racial makeup, population size) that especially lend themselves to intersectional analysis. We then suggest some analytic priorities for future research on mask use that could advance STS theories of the collective construction of scientific knowledge and also productively inform the development of public health interventions.

Visual Methods and STS: Seeing and Doing Masks Multidimensionally

Vision and visualization have preoccupied some STS scholars (Burri & Dumit 2008; Galison 1997), particularly those working in critical feminist and antiracist strands of the field (Fishman et al. 2017), whose work has investigated the epistemic and political consequences of images and imaging in technoscience (Haraway 1997). Vision has been a key metaphor and heuristic for thinking about crucial feminist STS concepts such as standpoint, gaze, and witnessing (Haraway 1988). STS scholars have also considered how vision and visualizing are central to political mobilization and critique (Radley & Bell 2007, Bell 2009). The establishment of new social practices requires anchoring, "the visible, public enactment of new patterns so that 'everyone can see' that everyone else has seen that things have changed" (Swidler 2005, 87). In turn, these social practices create discursive possibilities and new ways of understanding and experiencing things by creating or altering visual and discursive space. More broadly, some STS scholars position images as central rather than ancillary to the production and deployment of technoscience (Author 2 2018; Joyce2008).

Analyzing visual representations of masks demonstrates how a visual-intersectional approach advances STS because it highlights the scalar, reciprocal nature of innovation, technology use, and the making of expertise (Fortun 2009). During the coronavirus pandemic, masks have provided tangible evidence of a microscopic virus and brought a substantial technoscientific project into everyday life by extending mask wearing from medical settings into the outside world (Martinelli et al. 2021). Face masks are highly visible objects that cover the primary site of human communication and are exhibited by wearers and seen by others in public places (Inglis & Almila 2020). They both obscure and signify identity, often simultaneously (Inglis ND; van Gorp 2021).

In the U.S., individual households, businesses, civic institutions, and public health departments created and displayed signage to help generate new social norms about mask use as the science and policy recommendations about them evolved through the first year and a half of the pandemic. The combination of a lack of federal leadership, recommendations to shelter-in-place when possible, and changing scientific recommendations created an environment ripe for public engagement and critique of science by a range of actors. Making and posting signs about the necessity or futility of mask use became visible public enactments of positions about science and the new moral order (Swidler 2005). Ignoring the visible dimension of this engagement with science would mean missing important data sources and modes of communication.

Intersectional Approaches

The rise of intersectionality as an approach to analyze systemic inequity has been documented extensively throughout the humanities and social sciences (Carbado & Harris 2018; Collins 2015; May 2015; Nash 2008). Intersectionality's emergence in academic scholarship in the 1980s and 90s challenged "single-axis" approaches to the study of race and gender (Crenshaw 1989). Specifically, a focus on prototypical subjects of feminist and race studies—white women and Black men (all straight, all cisgender)—fails to recognize institutional violence toward Black women (Crenshaw 1991). Intersectional inquiry into the history of science has likewise uncovered the intermingling of biological race realism, racial eugenics, and sexology in the co-production of important scientific and social categories, such as homosexuality and transgender (Snorton 2017; Somerville 2000).

Intersectionality is the leading paradigm for critical feminist and anti-racist inquiry because it can account for ways systems of inequality overlap and co-produce one another, notably the inter-relationship between white supremacy and heteropatriarchy (Cho 2002).

Beyond the mere recognition that "life is complicated" (Williams 1991) and that individuals possess more than one identity at the same time (Bowleg 2012), intersectionality offers several theoretical contributions. These include understanding social identities and systems as historically and culturally embedded; recognizing that knowledge systems are embedded in dynamic and historically contingent systems of inequality; adopting a transdisciplinary approach to inequality that draws upon a range of methods and tools to uncover and address social problems; and conceiving of scholarship as a tool for illuminating injustices and promoting positive social transformation (Collins & Bilge 2016). The intersectionality paradigm has had a transformative impact across multiple disciplines (Moradi et al. 2020).

Epidemiological and public health research since the onset of the pandemic has illustrated the intersectional dimensions of COVID-19's impact on multiply marginalized groups. Despite the ubiquity of messaging such as "the virus does not discriminate" and "we're all in this together," the pandemic's effects largely mirror existing global economic and public health inequities (Grzanka et al. 2020; Bowleg 2020). For example, an overwhelming amount of epidemiological evidence has documented that people of color (men and women) and people over 75 years old in the U.S. are more likely to contract and suffer severe effects from the disease caused by COVID-19 (Bassett, Chen & Krieger 2020; Cooper & Williams 2020; Yanez et al. 2020). These effects are produced by the social and economic conditions that leave racial and ethnic minorities in the U.S. in positions of structural vulnerability to illness (e.g., limited access to health care, food insecurity, poorer school systems, and unsafe neighborhoods). The intersectional consequences are also evident in the patterns of social responses to the pandemic, such as the unequal distribution of economic consequences of lockdowns on certain sectors of the economy (e.g., tourism, food, and hospitality industries), the designation of certain high-risk,

low-wage jobs that are done in-person as "essential" (regardless of the availability of vaccines or personal protective equipment [PPE]), and the difficulty of self-isolating in crowded living conditions. These inequities are cross-cut by race, class, and gender, because social positions in the global economy and society are shaped by racism, sexism, and capitalism–not as parallel forces, but as co-constitutive ones.

As an important site of STS inquiry, signage about mask use must likewise be understood in intersectional relief. This means attending to the various ways that race, gender, social class, ability status, age, and other dimensions of social inequality infuse the signs that are posted in windows, neighborhood sidewalks, entryways and other public settings by households, civic organizations, and businesses. An intersectional lens highlights how science is always local, particular, and about power. Intersectionality pushes critical analyses beyond the study of differences per se (e.g., between-group comparisons) and toward the nuanced, complex ways that collisions of social forces, such as racism and heterosexism, may produce distinctive forms of inequity and injustice (e.g., sexual racism). Analysis of publics and science necessitates an inductive, intersectional approach to account for how science is understood and negotiated on the ground in dynamic contexts during a global pandemic.

Our visual-intersectional methodology also draws on situational analysis (SA), an approach to qualitative inquiry that feminist STS scholar Adele Clarke developed as a critique and extension of grounded theory (Clarke et al. 2003; Clarke 2005). Like intersectionality, SA foregrounds power, structure, and meaning making across all sites within a given situation, connecting individuals' views and beliefs to structural contexts. Moreover, SA attends to difference, that is "outliers," in data. SA highlights difference by analyzing each case in-depth to bring out diverse experiences and knowledges. In doing this, SA adds another way of

interpreting data to qualitative research – which traditionally looks for recurring themes, a practice that often ends up emphasizing what people have in common or that which occurs most frequently, instead of illuminating groups' varied experiences by taking outliers seriously.

Publics and Science

During the pandemic, volumes of scientific data were produced in a very short time across local and national contexts. Medical professionals, policy makers, science journalists, and laypeople had to assess this new information quickly in a high stakes environment. Given the high case fatality rate, the pandemic quickly assumed proportions of a worst-case situation (L. Clarke 2005), so experts and laypeople needed to assess or communicate probabilities in the face of terrifying possibilities (Senier 2008). Moreover, the decentralized structure of the public health infrastructure in the U.S. meant that public health experts at all levels of government (e.g., city/town, state, nation) needed to craft recommendations quickly and communicate variable risks associated with a range of infection control methods (masks, social distancing, quarantining) to people living and working in different places and contexts.

Scientific and policy communities were slow to recommend masks as a health intervention, and there were critical shortages of masks and other PPE in the early months of the pandemic. Thus, the consequences of the pandemic were distributed unevenly across the population because of intersectional, structural vulnerabilities (e.g., some people could not stay at home and some worked in essential jobs without PPE [Bowleg 2020]). Laypeople also had to make sense of infection control methods, including recommendations about how and when to use masks while scientific recommendations were evolving rapidly. Laypeople filled important voids left by the PPE shortage, unclear messaging from the scientific community, and politicians' slow actions by both making masks and creating signs about mask use. The proliferation of visual

signage created a ripe environment for studying how publics interpret and act on scientific recommendations.

Mask signage also offers a case to investigate public health as a particular form of scientific expertise—one that differs from the biomedical model in that it focuses on population health and public interventions. In the U.S., science about COVID-19 was emerging and evolving at lightning speed after years of sustained attacks on mainstream science and defunding public health (; DeSalvo et al. 2021; Trust for America's Health 2020). Combining visual and intersectional methods with STS's sensitivity to publics and science can illuminate how laypeople use visual means to make sense of complex and rapidly evolving scientific debates and communicate their beliefs about science to others.

Most STS scholarship on the public understanding of science interrogates the creation of biomedical knowledge and examines lay-expert conflict in clinical decision-making (Clarke et al. 2003; Epstein 1998; Kerr, Cunningham-Burley, & Amos 1998). To date, STS scholars have paid far less attention to the creation of epidemiologic knowledge (Amsterdamska 2005; Brown & Mikkelsen 1997; Rier 2003, 2004; Shim 2014) or lay-expert differences in interpreting public health decision-making (Lupton 1995; Petersen & Lupton 1997). With few exceptions (e.g., Reich 2016; Mitman 2010), STS scholars have not generally grappled with the distinction between biomedical knowledge (and recommendations on individual health changes) versus public health recommendations (targeted toward community benefit, and which often rely on individuals acting even if the action would not have a huge impact on their health) (Rose 1994).

Because expert recommendations about mask use stressed the importance of masks for protecting both individual mask-wearers and the community at large, applying STS concepts and methods to signs about mask practices can extend theories of publics and science (cf. public

understanding of science) and understandings of how laypeople communicate scientific expertise

alongside moral considerations in rapidly changing contexts. Medical sociologists and public

health ethicists have written about the moral dimensions of public health interventions (Cristian

Rangel & Adam 2014; Lee 2007; Saguy & Gruy 2010; Smith 2015; Tengland 2012), but an STS

visual-intersectional approach can help us understand the way experts frame messages about

individual risks and communal benefits and convey them to assumed generic and/or particular

audiences, and how these public health messages compare to the home-grown signs about masks

made by businesses, households, and civic organizations.

Applying a Visual-Intersectional Approach to Masks

At the start of stay-at-home orders in March 2020 and throughout the pandemic, we used

cellphones to create hundreds of digital images of mask signage posted in neighborhoods and

other public places where we live and work. Informational signage exploded in towns and cities

as a variety of stakeholders tried to establish new norms such as wearing masks when indoors

(and outdoors during the summer of 2020) to slow the spread of COVID-19. The proliferation of

informal visual messages was driven by many factors, including the politicization of and failure

of leadership about COVID-19 by the Trump administration, lack of scientific knowledge about

appropriate interventions, professional norms within scientific communities to speak only when

they have deep certainty about an issue, shortages of PPE (prioritizing their use for healthcare

providers), and recommendations to stay at home (Brown & Mikkelsen 1997; Rier 2003). As

social scientists, we noted the creativity, variety, and proliferation of homemade signs and public

health signs at a time many people were staying home, many businesses were shuttering, and

laypeople and experts were trying to keep up with changing recommendations. We focused on

three locations—Massachusetts, Pennsylvania, and Tennessee—to demonstrate how the debates

about mask usage reflected local and particular intersectional realities about the pandemic's

consequences. As we created photographs and then compared the photographed images during

virtual conversations, we were struck by the need for an STS approach that would

simultaneously put images in the center of analysis *and* do so in a way that brought the

intersectional dimensions of visual artifacts to the forefront.

Our approach is "a process of seeing guided by theory" (Harper 2000: 717). Not meant to

be an exhaustive study of mask signage, our use of images highlights the importance of

foregrounding the visual. Consistent with SA, we selected examples – from among those made

by members of the team in our respective locations – that bring out the diverse contributions of a

visual-intersectional analysis to STS. All the examples convey messages *about* mask-wearing.

From a *visual* STS perspective, we collectively discussed and analyzed each image and identified

its content, referents, and contexts. We stopped and stared "trebly hard in order to rupture the

taken-for-grantedness of 'good looking' in which we usually (read 'naturally') dwell" (Clarke

2005, 223). First, we asked, "how can we decode the scene, unsettle its wholeness, and break the

frame?" "What codes are embedded in it (e.g., colors, framing, kinesic codes of bodily gesture

and / or positioning)?" Second, "what is the social and historical context of the production of the

image about mask wearing and the expectations of viewing?" "How is this context reflected in

and communicated by the image?" To put this question a bit differently, "What are the social

contexts within which the image was produced 'and the social relations within which the image

is embedded at any moment of viewing?'" (Banks 2001, 11). Third, "What kind of work is the

image doing?" "Who does the image tell us we should be, what we should do, and how to do it?"

From an *intersectional* perspective, we asked, first "What are the multiple social categories that

build on and work together in this image within and beyond the frame (e.g., race, class, gender,

sexuality, age)?" Second, "What are the intertwined social structures and processes in this image (e.g., crosscutting dynamics of power, sexism and racism, heteronormativity and economic inequality)?" Third, recognizing that all knowledge is situated (Haraway 1988), when we worked through the images we asked, "How do our situated positions affect our interpretation of the images?" That is, how might our race, gender, sexuality, class, and locale shape our analysis of the images?

In the discussion below, we use visual artifacts, that is digital images of signage about mask use that we collected during the pandemic to illustrate how a visual-intersectional analysis advances STS theory and practice about publics and science. We analyze each image in-depth to bring out diverse experiences and knowledges, rather than to identify patterns across images. We selected handmade and professionally designed signs about masks; signs with text only and with both image and text; signs posted alone or with other signs; signs that incorporated messages about masks alongside other information; and signs posted inside businesses and outside in public settings. We excluded images of "real" masks as worn by people. We did not conduct interviews with individuals, business owners, or scientific professionals to explore their intentions about making or posting signs, nor did we explore audience receptions or how they may have differed by individuals or by intersectional groups given that our focus aims to show the value of a visual-intersectional approach to STS.

Masks are Political, Racialized and Gendered

During the global protests against police brutality that began in May 2020 and coincided with the COVID-19 pandemic, masks became intertwined with contemporaneous and largely non-overlapping social protest movements: right-wing opposition to pandemic-related restrictions, including mask mandates, and Black Lives Matter (BLM) protests of police killings

of unarmed African Americans. In the U.S. photographs and videos of nearly all-white crowds of

unmasked and heavily armed Americans protesting government response strategies (Censky

2020; Ward 2020) stood in stark visual contrast with images of unarmed and masked BLM

protesters (Abell 2020; Elder 2020).

Intersectional inequalities shaped diverse public responses to the pandemic, including

mitigation strategies such as masking. Recommendations to wear masks in public places

overlapped with longstanding and culturally entrenched white people's fear of masked Black

men (Christiani et al. 2021) and Black men's worry that following public health

recommendations to cover their faces in public would expose them to racial profiling and police

harassment (Taylor 2020). Relatedly, Asians and Asian-Americans who had a history of wearing

masks as a public health intervention were concerned about being targeted if they wore masks in

the U.S. during the pandemic's height (Ren & Feagin 2021; Cao & Sun 2021); they wore masks

selectively as a strategy to protect themselves both against COVID-19 and against racism (Ma &

Zhan 2020). Indeed, between March 2020 and December 2021, a total of 10,095 incidents of

hate against Asian American and Pacific islander people were reported to Stop AAPI Hate and

almost half of the incidents (48.7%) took place in public spaces (Stop AAPI Hate n.d.; Li &

Nicholson 2020). The making of signs about mask usage (or not) took place in this broader

terrain. A visual-intersectional approach helps orient critical inquiry toward the racial and

gendered dimensions of signs about masking, as well as other intersecting social dynamics that

collide with public understandings of science in ways that are both patterned and unusual

instantiations of structural inequalities.

The first image illustrates some of the ways signs about masks offer visual clues about

how extant inequalities interact with and at times challenge the manifestation of scientific

knowledge and emergent technologies (Figure 1). The sign posted in the window of the Reef, a

Caribbean-themed bar and restaurant in the Philadelphia South Street business district, states that

masks are required for service. The photo in the center of the sign, surrounded by all-caps

lettering, is of a Black man with a Reef-branded mask. While public and public *health* discourse

in the media amplified narratives about Black men concerned that mask use would expose them

to increased racial-gendered surveillance and potential violence from white people (Taylor

2020), this image can be read as portraying Black men as agents rather than targets (i.e., of

gendered forms of anti-Black racism). The sign demands conformity to mask use as a condition

of service in a space populated by Black people, while depicting a Black man modeling the

requisite behavior. In this sense, the image destabilizes dominant narratives that position Black

men as responding to gendered white supremacy in everyday life by avoiding mask use, and

instead situates Black men as modifying behavior in response to COVID-19. Further, while

dominant narratives might suggest that a Black man in a mask should be feared, this image

shows a Black man choosing to take action that will protect himself and others from the spread

of Covid. Like many of the images we encountered about mask use, this sign at the Reef invoked

race and gender ideology while simultaneously unsettling dominant cultural narratives about

race, gender, and public health.

Figure 1. Reef Restaurant and Lounge, Philadelphia, PA, July 2020. Credit: Kelly Joyce.

Public Understandings of Masks is About Place

Handmade signs quickly became vehicles that mediated people's interactions with their local worlds during periods of city, state, and national orders to stay at home and curtail business activity. The images we showcase here demonstrate the importance of place in public conversations about the risk of infection with COVID-19. Geographically located places are "unique spot[s] in the universe" ranging from armchair to coffee shop, neighborhood, city, and nation, and have physicality and form as well as meaningfulness and values that are recognizable, flexible, and inevitably contested (Gieryn 2000, 464). Place is always also about intersectional inequalities. In the following examples (Figures 2 and 3), small business owners enacted scientific phenomena in ways that drew on ideas about gender, race, and place. In Figure

2 a papier-mâché mask-wearing figure of a white, blue-eyed mermaid with iridescent green strands of hair, a strand of pearls, and two red clam shells "covering" her breasts, stood at the entrance of an inn in the town of Oak Bluffs on an island off the coast of Massachusetts. The sign greeted tourists to the historically Black summer beach community and gave instructions about how to protect themselves by social distancing while checking into the inn and wearing a mask in all common areas during their stay. The mermaid appears to be white, but she is positioned in a historically Black vacation community; with a mask on, pearls tied around her neck, and long hair made out of tinsel, she is obviously intended to be humorous and otherworldly. Simultaneously, she communicates strict COVID-19 mitigation strategies, including outdoor mask use, *and* draws on dominant ideas about "womanhood" as white, blue-eyed, straight-haired, thin, and pearl wearing.

Figure 2. Masked Mermaid with Shells, Oak Bluffs, MA, September 2020 Credit: Kelly Joyce.

Figure 3 was posted in the window of a sports bar in Philadelphia, Pennsylvania. Two signs were taped together. One sign featured a picture of a popular white player from the Eagles, a Philadelphia-based football team in the National Football League. It asked patrons to stay distant from each other using the player's height of 6' 5" as a guide: "Please stay one Carson Wentz away from other guests/tables." But an intersectional analysis brings out more place-based complexities. The juxtaposition of the Carson Wentz sign below a Black Lives Matter (BLM) sign in the window of the Green Room bar reflected intersections of concurrent social protests about mask use and the violent protests that swept the nation after the murder of George

Floyd in Minneapolis, and were particularly prominent in Philadelphia, that unfolded during the summer and fall of 2020 (ACLU 2020). The words, "Let's make this simple Philly" belie the multiple interrelated social structures and processes running through the signage in the window of The Green Room that were highly visible in Philadelphia. Positioning a BLM sign above a white football player communicated that BLM and COVID-19 were intimately intertwined in Philadelphia, a city that is approximately 40% Black and progressive, where many groups connected the two. The Green Room bar signs overlap protests against racism and police brutality with protecting public health by combining a request that shows and tells patrons to respect "social distance so we can save lives AND watch football" and states that "BLACK LIVES MATTER." Finally, we note that the imagery draws heavily on themes of professional sports spectatorship, and while not necessarily exclusionary of women, is infused with notions of masculinity.

The three-dimensional mermaid and the two-dimensional football player signs relied on geographically specific imagery and iconography to grab attention (e.g., the mermaid would be out of place in Philadelphia), place-specific communication about wearing masks and maintaining physical distance (e.g., for patrons of an urban bar or an island inn), and gender norms (a tall, white, and athletically successful man and a thin, white, scantily clad female), and racial politics (BLM infused public health messaging about Covid in Philadelphia). A visual-intersectional analysis can illuminate instances in which publics' interpretation of and communication about rapidly changing science is situated in and suffused with place, race, and gender.

Figure 3. The Green Room, Philadelphia, PA, September 2020 Credit: Susan E. Bell

Communicating about Masks Employs Humor and Creativity

At the start of the pandemic, COVID-19 humor began to circulate online in Israel, Italy, Nigeria, Pakistan, Poland, Puerto Rico, and South Africa (Gibson 2021). In the U.S. as well, humor quickly emerged in signage as a tactic to encourage people to don masks (Figures 4 and 5). Such tactics draw on ideas about race, gender, and sexuality, among other dimensions of difference. In Figure 5, a local coffee shop used humor to encourage compliance with the local indoor mask mandate in Massachusetts. Mask humor at the top and bottom of a chalkboard that stands outside Mocha Motts literally frames its menu and hours of operation. The top of the signage jokes, "You have really nice eyes :)," the words and smiley face playing with a new

(masked) face and new personhood that includes mask-wearing. Continuing the play, at the

bottom of the chalkboard are the words, "Throw on a mask and come on down. We can't wait to

see the top half of your beautiful face."

Figure 4. You Have Really Nice Eyes :), Oak Bluffs, MA, October 2020. Credit: Kelly Joyce

The sign's message plays with ideas about feminine beauty and youthful flirtation, combining all

customers (who would typically range in age, gender, race, and occupations) into an aggregate group

with "nice eyes." That the coffee shop is frequented by heteromasculine, working-class and middle-

class, mostly white men further activated the humor by subtly implicating (homo)sexuality vis-a-vis

flirtation (the customers' "nice eyes"). Scholars have long noted that humor is an important site of

intersectionality, and that humor is structural and intimately connected to social and historical contexts

whereby the ability to use humor and to laugh with or at humorous stimuli are asymmetrically

distributed across social groups (Grzanka and Maher 2012). Our visual-intersectional approach shows

how people sought to use humor during the pandemic to compel particular forms of behavior, linking

mask use not only to emergent scientific knowledge and meaning making, but also to extant unequal

social dynamics that shape and constrain who can and cannot deploy humor to compel changes in

public behavior in public spaces. While certainly reflecting broader, macro-sociological currents, visual

mask-related humor is a fundamentally local process that relies upon regional and contextual

intersectional factors to make something funny and influence group norms.

The two signs in Figure 5 – one above the other –posted on plexiglass barrier at a local craft

brewery in a Knoxville, Tennessee neighborhood also demonstrate the use of place-based humor in the

public understanding of science. At the time, the staff was all-white and the vast majority of the patrons

were white, middle-class, SUV-driving locals who frequented the bar after bike rides and hikes in

Knoxville's extensive network of trails known as the "urban wilderness" and some would arrive

shoeless or shirtless. Viewed in this context, the signs connote more than their simple instructions. In

the top sign, a white, grey-haired, black-framed glasses wearing person waves a finger at patrons with

the admonition "Don't make us ask/Wear a mask" with the authority of a scolding, nerdy elder. On the

sign below, a familiar public health phrase about appropriate attire for customers ("no shirt no shoes no

service") begins with a new phrase, "no mask."

Figure 5: Hi-Wire Brewing Company, Knoxville, TN, July 2020. Credit: Patrick Grzanka

Though these preemptive requests for mask-use compliance may not appear particularly

remarkable in isolation, considering regional context yields insight. The brewery was one of only a

handful in Knoxville that adhered to CDC recommendations on masking, making the space unusual in

the region. Using humor as well as tying the mask request to other public health mandates aimed to de-

escalate the request to wear a mask in a highly contested context. Together, in micro-sociological

context, both mask signs reflect and reinforce a social milieu of white, Southern, heteromasculine, outdoors/active culture even as they challenge the broader region's disregard of masks as technologies of intervention.

Figures 4-5 illustrate how local businesses and institutions used humor to communicate scientific knowledge and encourage mitigation strategies by engaging publics. A visual-intersectional approach situates the deployment and uptake of humor about masking in overlapping, co-producing systems of inequality.

Science is Mobilized by Both Sides of the Mask Debate

We turn now to mask signage that illustrates how people responded to the rapidly proliferating science of COVID-19 by creating imagery that broadcasted their interpretations of science to their neighbors and others. Some of these images responded to initial worst-case scenarios (e.g., high mortality rates and transmission outdoors even during fleeting encounters) and urged compliance with mask use, while others scorned science, valorized individual freedom, and absolved people who might resist mask wearing. On the "pro-science, pro-mask" side (Figure 6) is a colorful sign handwritten with bright colored markers and posted in front of a Philadelphia row house during a city-wide emergency "stay at home" order, which prohibited all public and private gatherings of any number of people outside a single household. The sign admonished passersby to "wear a mask!" In contrast to the humorous messages we observed in the previous section, this confrontational sign evoked Darwin, situated its message in germ theory, and singled out joggers, dog walkers, and bike riders for special condemnation. Posted two weeks after Pennsylvania's governor asked everyone to wear a cloth mask in public, it speaks directly to the negotiation of spatial relations on city sidewalks and streets, new forms of etiquette about who should be wearing masks in public, and social sanctions about mask

wearing. The sign called out specific groups of people for being less evolved, grown up, and

respectful than its maker, who assumed a position of moral and intellectual high ground.
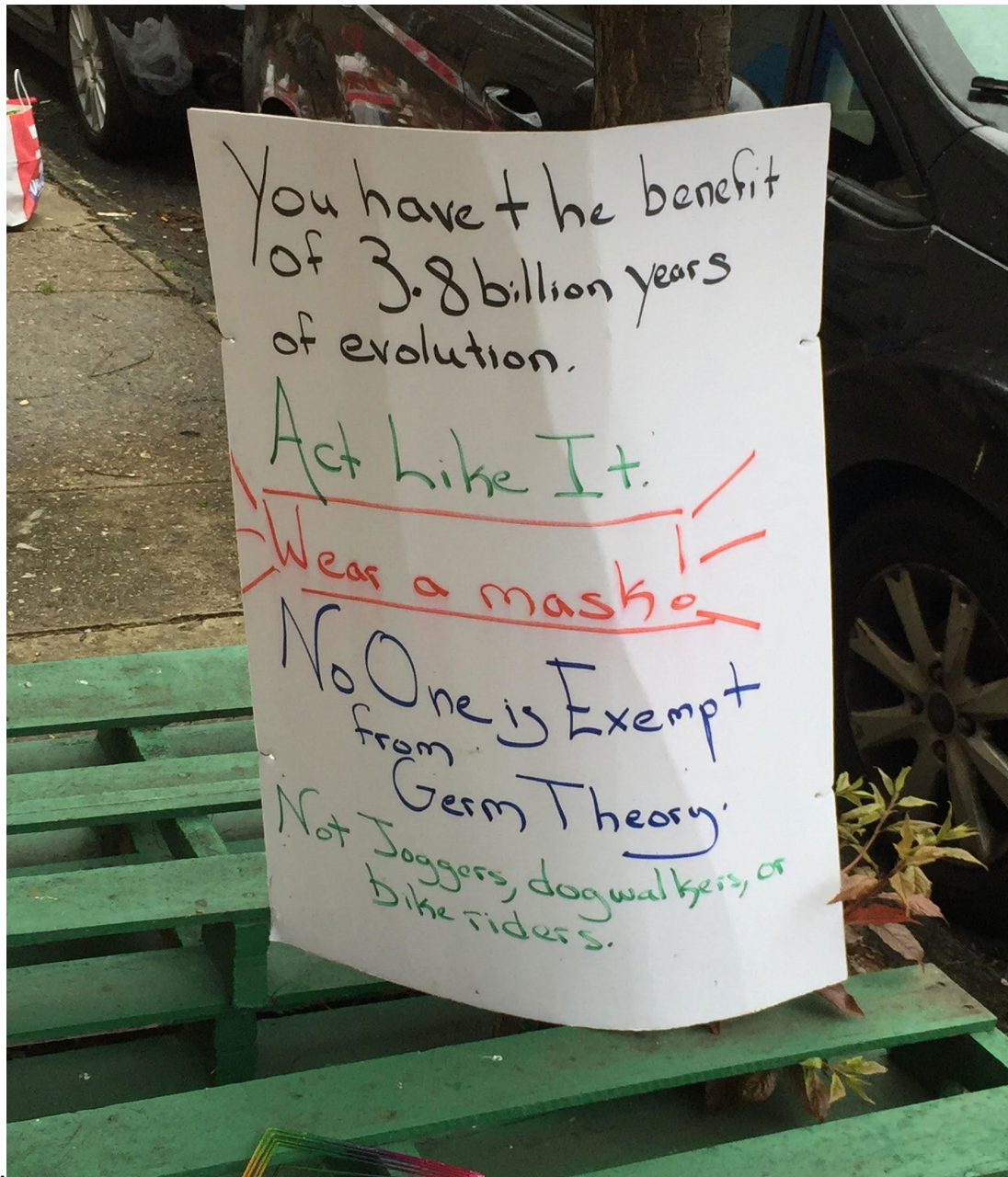

Figure 6. Wear a Mask! Philadelphia, PA. April 2020. Credit: Susan E. Bell

Figure 7. Unmasking lawn signs, Boston, MA. October 2021. Credit: Laura Senier

On the "anti-science, anti-mask" side (Figure 7) is a pair of yard signs in a Boston

suburb. The red "FOLLOW THE SCIENCE: UNMASK THE KIDS," sign can be purchased

online from a nonprofit organization, Unmask the Kids, which was founded by a group of

parents to support "the rights of the smallest citizens" (unmaskthekidsamerica.org). This sign

equated science with unmasking and asked parents to protect their children by removing their

masks. The point is underscored by the sign next to it, reporting what everyone knows (and

science has demonstrated for hundreds of years), that "OXYGEN IS ESSENTIAL." This sign

leaves the obvious unstated, that without oxygen people die, ergo, good parents who follow

science should unmask their children. Taken together, this pair of yard signs call on parents to

embrace a particular interpretation of ethical and scientific information and stop masking their

kids; they likewise implicitly criticize schools, public health departments, and state officials for

making kids wear masks. Notably, though race is not explicitly referenced in the images, these

signs invoke whiteness implicitly by signaling prominent conservative anti-mask politics that

swept the country and particularly suburban and rural areas in the U.S. throughout 2020 and

2021. The defiance of rules and laws around mask use became a hallmark of white anti-

government and anti-science politics from the early pandemic onward. Even the display of

signage encouraging individuals to flaunt masking rules is a representation of privilege—if not

race and class privilege, specifically—insomuch as racially surveilled and poor subjects may not

be afforded the same degrees of leniency to flagrantly break rules they may also perceive as

arbitrary and unfair (e.g., traffic enforcement cameras concentrated in poor areas, marijuana

possession laws).

Figures 6 and 7 use affect and visceral imagery to mobilize ideas about science as a moral

imperative–but in essentially opposite directions. Further, they exemplify how debates about the

effects and effectiveness of wearing masks during the COVID-19 pandemic were not waged

solely in peer-reviewed journals or online. Visual signs posted in quotidian places where people

live, walk, bicycle, and drive also communicated ideas about what was evidence-based and

morally appropriate, even though some of that evidence did not reflect accepted scientific norms

for validity and reliability.

Public Health Institutions and Messaging About Masks

Public health agencies also produced visual signs to put forth visual claims about

pandemic interventions on websites, on buildings' outdoor and indoor walls, and on public

transportation. Prior work in STS has analyzed how scientific diagrams in public health

campaigns reflect ontological and epistemological dimensions of disease spread (Lynteris 2017).

Analyzing the images developed by public health agencies throughout the pandemic illustrates

how organizations present complex and evolving scientific information for their audiences in

hopes of encouraging behavior that would not only protect individuals but also halt the spread of

the disease and therefore protect vulnerable communities. By the midsummer of 2020, studies

showed that asymptomatic people could transmit the virus; even if an uninfected person took

steps to protect themselves by wearing a mask, they were still at risk from asymptomatic carriers

who were not masked. Thus, public health messages quickly became more explicit about

multiple methods (quarantine, social distancing, and mask usage) to protect not only oneself, but

also people who were highly exposed (e.g., healthcare workers, essential workers) or who were

especially vulnerable to the virus (e.g., old people, immunocompromised people). As the

importance of mask-wearing and the mechanism of virus transmission became clearer, local and

state public health agencies targeted mask-wearing in particular. Here we highlight two signs—

one from Massachusetts and one from Tennessee—to illustrate the value of a visual-

intersectional approach to investigate publics and science.

Public health agencies are tasked with making critical health information legible to the

public, but in doing so they also have to navigate scientific norms that call for accuracy and

detail. . In Figure 8, "How to Select and Wear a Mask," the Massachusetts Department of Health

poster displays 4 types of masks and two categories of mask-wearers. The image allows people

to visually compare masks and choose a mask type according to their social position as either

"the general public" or "healthcare personnel in the health care setting."

Figure 8. How to Select and Wear a Mask. Credit: Massachusetts Department of Public Health. Mass.gov/maskinfo

There are 4 vertical panels, with alternating dark and light blue backgrounds; each panel displays an individual's head and torso in front of a white square with two blocks of text under the human bodies that are aligned across the panels. The image directs a left-to-right reading, from the least protective cloth mask to the most protective surgical N95 filtering mask, and a top-down, "list-associated" reading that connects mask-types with social categories (Lynteris 2017). The human figures have generic contours with variations of race, gender, and body size; two are slightly left facing and two are forward-facing. The inclusion of diverse bodies and genders represents a shift from previous public health discourse that used generic (implicitly white male) figures to stand in for all humans. Nonetheless, a visual-intersectional reading illuminates that the two panels on the left erase social and economic vulnerabilities that put some members of "the general public"

at greater risk of contracting COVID-19 or dying from it. In addition, all bodies across the 4

panels are young. Old people are not depicted as members of the general public or the healthcare

workforce. Bringing a visual-intersectional lens to analyzing figure 8 puts a spotlight on the

ageist bias embedded in it, both the heightened vulnerability of old people to COVID-19 and

their participation in the healthcare workforce.

"How to Select and Wear a Mask" was translated into 13 languages to communicate with

a linguistically diverse public. The sign represents visual communication of nuanced science

about the effectiveness of masks in protecting against infection with COVID-19: the need for

nose wires in cloth or disposable masks for the general public, filtering masks (KN95 and N95)

that are also "appropriate for use by the general public," and the difference between KN95, N95,

and surgical N95 masks. In contrast to the signs made by individuals and businesses, the

inclusion of such detail expects a high degree of scientific literacy among viewers, which may or

may not be met. A visual-intersectional approach can enrich STS's sensitivity to publics and

science by parsing how public health institutions present scientific information for diverse

publics.

Figure 9 from the Knox County (Tennessee) Health Department illustrates its

#StayInTheGame campaign that occurred as vaccines became available and as health advice

about masking became even more complex. This image appeared in the summer of 2021, after

the vaccine became widely available and mask mandates were relaxed in the U.S. This was a

brief window when public health agencies, including the CDC, hoped that the arrival of the

vaccine would mean masks would no longer be necessary in many indoor and outdoor spaces.

The poster's playful cartoon styling and sports imagery renders messages about masking

less threatening and palatable in a state where white conservatives resisted public health actions

that might infringe on what they viewed as personal liberties. The poster aims to be inclusive, showing diverse genders and races, but like Figure 8, the images include only youthful bodies. The information presented is also complicated, explaining the relationship between vaccination and mask-wearing, including the two-week mask-wearing period post vaccination. Its design requires viewers to go back and forth between image and text, reading down to compare public health recommendations for "fully vaccinated people" and "unvaccinated people," to understand the message about masks.
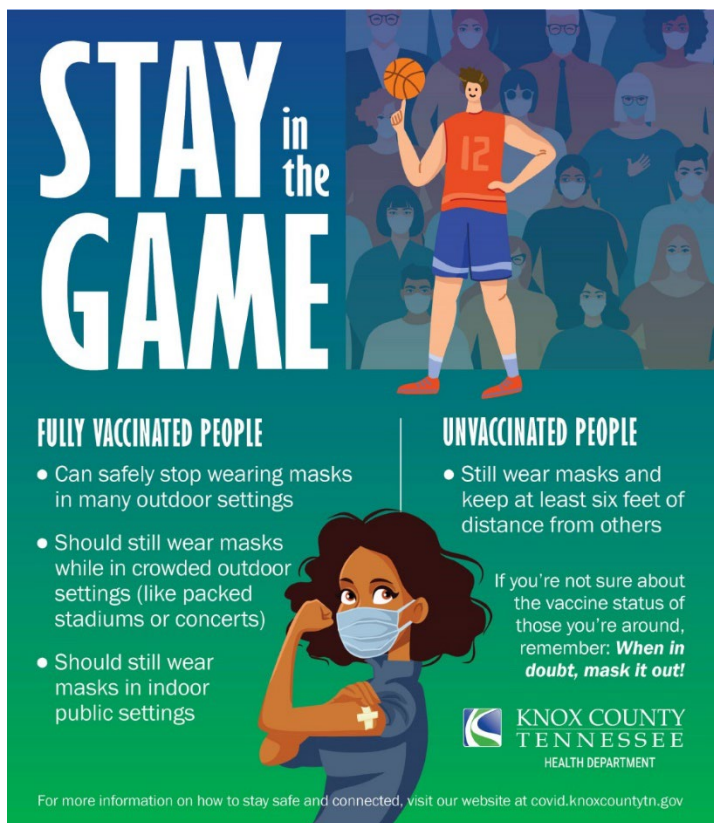

Figure 9. #StayInTheGame Poster. June 2021 Credit: Knoxville, TN Department of Public Health

        #StayInTheGame uses race, gender, and age to convey information about mask use and vaccination. The white male young basketball player is depicted as not wearing a mask, suggesting that he is already vaccinated. In doing so, this image recreates an idea that whiteness

and masculinity are associated with reason and the moral good (Bordo 1995). White men, it suggests, followed the science and were among the first to get vaccinated. In contrast, the racialized young Black or Brown woman in the foreground has a bandage to denote recent vaccination. Because she is newly vaccinated, she is still wearing a mask. Linked to the adjacent text, the image of the woman signals that one should continue wearing a mask for two weeks after being fully vaccinated. Her pose, standing at an angle to the viewer with her arm raised in a fist, also suggests that getting vaccinated is empowering. Her raised fist, which is a symbol that has been used by women at work social movements (since the Rosie the Riveter poster first entered the U.S. visual vernacular during World War II) and by Black Power movements (since the Black Panthers introduced it in the 1960s) conveys strength and resilience. The spectators sitting cheek to cheek watching the basketball game are wearing masks, positioned behind the basketball player and looking at him, showing the behavior that according to #StayInTheGame is safe for fully vaccinated people. The differentially masked and vaccinated characters in Figure 9 are evocative of a wide range of meanings about race, gender, and age that are fundamentally intersectional. In other words, to examine these (or any) images of people wearing masks (or not) solely in terms of race or gender or age would efface the complex realities of mask use, as well as vaccination and other health-related behaviors, among diverse populations as the pandemic evolved.

Our analysis of public health images shows how a visual-intersectional approach that draws on SA contributes to an STS understanding of publics and science. As with interventions made by individuals, businesses, and civic initiations, public health agencies understood that the terrain of the mask debate was visual. They deployed resources to develop locally specific messaging about mask wearing—ones that drew on local identities and politics—and an

understanding of diverse publics to encourage folks to wear masks. Both examples demonstrate a tendency to include complex information instead of the simple "wear the mask" or "don't wear the mask" kind of message crafted by laypeople.

Conclusion

Throughout the pandemic, lay people and public health experts visually communicated their understanding of mask wearing in highly local and contextual ways that were informed by local contexts and broader social forces. We capitalized on their turn to the visual to make an argument for a visual-intersectional approach to science that can make sense of the work publics and scientists do in the visual domain. We analyzed images of signs in three locations— Massachusetts, Pennsylvania, and Tennessee – which is both a pragmatic choice (we "sheltered in place" in these states) and tactical (we could highlight how the local, particular, and power are involved in publics and science debates that took place in the visual domain). Following SA's insistence on difference in data (Clarke 2005), we analyzed each image in-depth to bring out diverse experiences and knowledges, rather than to simply identify patterns or continuities across images. Although identifying patterns is important to better understand broad trends in the public understanding of science, calling attention to difference provides critical insight into power dynamics. Throughout, we have shown that signs about mask wearing are fundamentally visual practices fraught with complex meaning.

In each of the examples, we considered the contexts embedded in and reflected by the image, its materiality and design, the work the image is doing, and the categories that intersect and work within and beyond the frame in different sites. Together the examples allow us to understand the charged and changing terrain of debates about science and public health as well as how dimensions of difference co-produce science that otherwise would be difficult to

apprehend. First, a visual-intersectional approach helps orient critical inquiry to racial, gendered, and other intersecting dynamics in signs about masking. On one hand, we showed the role of place-specific messaging in science. With figure 3 (The Green Room), for example, we showed how geographically specific imagery and iconography, gender norms, sports spectatorship and the politics of racial justice intersect in two juxtaposed signs. One sign tells patrons to respect a social distance of 6' 5" and shows them a mask-wearing football player and the other tells them that Black Lives Matter. We decoded the scene, explicated how the social and political context are reflected and communicated, and identified the multiple social categories that build on and work together in the image within and beyond the frame. On the other hand, we showed the role of humor in messaging about wearing masks. Our visual-intersectional analysis of figure 6 (You Have Really Nice Eyes :), for example, drew out the word and image playfulness that mixes ideas about gender, youth, and sexuality to encourage customers – heteromasculine, working-class and middle-class, mostly white men – to comply with the local indoor mask mandate in Massachusetts. Such an analysis has implications for expert visual communication. Public health, which has learned that publics are diverse, could also take up the use of humor and place when communicating about interventions.

Second, a visual-intersectional approach shows ways in which public health is a distinct form of scientific expertise. Figure 9 (#StayInTheGame), for example, was produced during a stage of the pandemic when vaccines had become available and public health officials needed to convey a much more complicated message about masking than the other images included in our review. Rather than operating on a simple binary of mask on or off, Figure 9 shows people taking steps to protect themselves and others (e.g., masking even though one has been recently vaccinated) in a variety of ways. Moreover, both Figures 8 and 9 include visual representations

of people who carry multiple social identities, moving away from the use of generic figures of white, young men to communicate public health messages. Our analysis demonstrates how erasure can occur alongside making diverse social groups visible and confusion can appear alongside distillations of complicated messaging.

Third, a visual-intersectional approach illuminates relationships between publics and science during times of uncertainty. With figure 6 (Wear a Mask!) and figure 7 (Unmasking lawn signs), for example, we showed how laypeople responded to the rapidly proliferating science of COVID-19 to mobilize ideas about science as a moral imperative. In the space created by wide-spread uncertainty and stay-at-home recommendations, publics took positions about masks as technologies of intervention, actively contributing to scientific and social norms. Through our analysis, we explicate how the social and political context are reflected and communicated in the "pro" and "con" signs.

To conclude, we have made the case for a visual-intersectional approach by demonstrating how to read lay and expert visual communications about masks during COVID-19. A visual-intersectional approach should become central in science and technology studies, especially when the actors themselves are primarily using visual means to produce and debate science or technology. Adding a visual-intersectional approach increases the flexibility of the STS methodological toolkit so that scholars can theorize the visual dimensions of science with sustained attention to overlapping systems of inequality. We have focused on the contribution of a visual-intersectional approach to understanding signs about masks in public settings. Future visual-intersectional research on masks could include interviews with sign makers and people who posted signage to explore their intentions and with sign audiences to consider how individual and social groups' reception may differ; research could develop cross-national

comparisons; or longitudinal studies to map the emergence of new COVID-19 social practices,

discursive possibilities, and sciences; and so forth. These efforts could advance STS theories of

the collective construction of scientific knowledge and inform the development of public health

interventions with and beyond COVID-19. More broadly, we invite readers to use a visual-

intersectional approach in a variety of domains to better understand how the visual is an

important site of exchange in science and between scientists and publics—one that is always

marked by power and difference.

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