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Symbolic annihilation through design: Pregnancy loss in pregnancy-related mobile apps

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Abstract

Pregnancy is a significant life event for many. Using mobile apps to manage pregnancies is common. Pregnancy loss is a common complication associated with stigma that impacts one's wellbeing, relationships, sense of self, and more. While pregnancy loss is important to many experiencing it, it is unclear to what extent pregnancy-related mobile apps account for it and consider associated users' needs in their designs. We conducted a feature analysis of 166 pregnancy-related apps. We found that their main features focus on information, tracking, reminders, and social contact, and that 72% of these apps do not account for loss, 18% explicitly account for it, and 10% passively do so. We theorize this lack of consideration as *symbolic annihilation through design*. We argue that such annihilation is partly shaped by intensified mothering ideologies, further stigmatizes pregnancy loss, and perpetuates a normative, linear portrait of the pregnancy experience which is harmful and marginalizing.

Keywords: pregnancy, pregnancy loss, miscarriage, feminist, symbolic annihilation, symbolic annihilation through design, mobile apps, intensified mothering, stigma

Introduction¹

Pregnant individuals or those intending to become pregnant often turn to mobile apps to help manage their experience (Hughson et al., 2018; Lupton and Pedersen, 2016; Tripp et al., 2014). These apps can be helpful; for example, they facilitate access to medical information and social support (Lupton and Pedersen, 2016). However, they also tend to reinforce heteronormative, stereotypical, and gendered notions of reproduction (e.g., excluding those in non-heterosexual relationships or those without partners) (Rich and Miah, 2014; Thomas and Lupton, 2016). In discussing the politics of artifacts, Winner (1980) argues that while the contexts within which technologies exist matter, it is also important to pay attention to the technologies, their characteristics, and the meanings associated with those characteristics. As we will argue, pregnancy-related apps also have politics. Pregnancy loss is a rich context in which to examine the politics of technological artifacts such as pregnancy-related apps. As feminist scholar Layne (2003) argues, pregnancy loss provides “opportunities for challenging and reworking dominant cultural scripts” (Layne, 2003: 1889) similar to other reproductive experiences that depart from prescribed storylines. While a wide market exists for apps for pregnancy and conception assistance, it is unclear how these apps account for the experiences of users whose pregnancies do not end happily.

Approximately 1 in 4 identified pregnancies in the US end in loss (Savitz et al., 2002). Pregnancy loss remains a common yet stigmatized reproductive health complication with negative wellbeing implications such as depression and post-traumatic stress disorder (Neugebauer and Ritsher, 2005). It also impacts people's relationships, sense of self, and identity (Fairchild, 2009)—demarcating a “before” and an “after.” Stigma surrounding pregnancy loss, lack of support and acknowledgment, and the absence of pregnancy loss in our societal narratives contribute to challenges associated with it (Silverman and Baglia, 2015).

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Reactions from one's environment are crucial to validating one's experience and harmful when not supportive online and off, pointing to gaps in support after loss (Andalibi, 2020; Andalibi and Forte, 2018a; Fairchild, 2009). Beyond social aspects, the design of technologies that individuals use during pregnancies can also be invalidating after a loss occurs (Andalibi and Garcia, 2021). Individuals' needs change during the course of a pregnancy (Prabhakar et al., 2017). Therefore, it is imperative that technologies that people use during pregnancy—and that partially shape the pregnancy's environment—account for these changes, including when pregnancies do not proceed as desired. It is important to critically examine where and how these technologies' designs fail to be inclusive. By "design" here we broadly refer to inter-connected technological features and their embedded values that mediate interactions and shape the extent to and the ways in which diverse users can achieve their goals.

We conducted a feature analysis of 166 pregnancy-related mobile apps to systematically assess how they account for pregnancy loss and uncover other features that they provide to their users. We identified four main categories of features related to tracking, information, reminders, and social connection. We also identified three levels of inclusion of pregnancy loss through our analysis: exclusion (i.e., no mention whatsoever) occurred in 72% of the analyzed apps, active inclusion (e.g., ability to log pregnancy loss, links to articles about loss) occurred in 10%, and passive inclusion (e.g., mentioned by users but not accounted for by the design itself) occurred in 18%.

We draw from Winner's (1980) notion of artifacts' politics as a lens to interpret findings. We argue that by largely dismissing loss, pregnancy-related apps contribute to its stigmatization. We build on feminist media scholarship (Gerbner and Gross, 1976; Tuchman, 1979) to argue that those whose pregnancies do not fit the "happy ending" trajectory are targets of *symbolic annihilation*—how media "ignore, exclude, marginalize, or trivialize a particular group" (Merskin, 1998). We call this *symbolic annihilation through design*, defined as how technology design reinforces stereotypes about humans or phenomena and sustains social inequities like marginalization and stigmatization. Symbolic annihilation through design makes it hard for those experiencing loss to find the resources and support that they need. It also portrays a linear, normative, and unrealistic narrative of pregnancy that fails to account for a common complication. We advocate that pregnancy-related app designs should combat symbolic annihilation. We also contextualize pregnancy loss within other silenced gendered experiences, and argue that the symbolic annihilation of pregnancy loss in pregnancy apps is shaped by the larger discourse of *intensive motherhood* (Hays, 1998).

Related Work

Mobile apps shape and reproduce norms, values, and beliefs (Lupton, 2014), create new practices, and are productive forms of power and authority (Goggin, 2011; Mackenzie, 2016). As sociocultural artifacts, they are products of humans' decisions, assumptions, and norms within the contexts in which they are designed and used, signaling what conditions are or are not important (Lupton, 2014). While technologies' social context matters, it is also important to closely examine technologies and embedded values themselves (Winner, 1980).

Scholars have examined mobile apps using feature analysis and critical discourse analysis, for example to map and/or critique the design landscape for specific contexts such as pregnancy (Peyton, 2014; Peyton et al., 2014) and mood tracking (Caldeira et al., 2018). We build from this work to interrogate the politics of pregnancy-related apps, particularly regarding how they engage with pregnancy loss.

Pregnancy apps are a major part of pregnancy experiences for many (Hughson et al., 2018; Lupton and Pedersen, 2016; Tripp et al., 2014), and pregnancy's technological mediations can tell us much about cultural constructions of gender and health (Upton, 2001). Johnson (2014) argues that apps and more broadly what she calls "maternal devices" (i.e., assemblages of technologies specific to pregnancy such as

mobile apps, social media support groups, dietary charts, charts for foetal movements, etc.) are geared towards certain agendas, such as active self-assessment, lifestyle, health, and learning, pointing to the impact these apps and their politics have.

Reasons for using pregnancy-related apps include accessing information about fetal development and the pregnant body (Lupton and Pedersen, 2016), other pregnancy-related information (Hearn et al., 2013; Johnson, 2014; Lupton and Pedersen, 2016; Rodger et al., 2013), not having needs met through prenatal care (Kraschnewski et al., 2014), tracking weight, diet, or appointments, keeping photos, and engaging in discussions with others (Lupton and Pedersen, 2016). Overall, these apps have value, play important roles, and are commonly used.

An analysis of pregnancy apps in 2015 categorized them into three groups: entertainment, pregnancy information, and pregnancy and fetal monitoring (Lupton and Thomas, 2015). Another analysis of pregnancy apps in iOS found that while they provide static medical information, they do not provide ample opportunities for social support, exclude fathers, are gendered, and mainly focus on fetal development and pregnant individuals' physical wellbeing (Peyton and Wisniewski, 2020). This past work's goal was examining the extent to which existing apps support the holistic pregnancy experience (Peyton and Wisniewski, 2020); however, pregnancy loss or negative outcomes did not surface in these works, even though loss *is* part of the holistic pregnancy experience for many.

Prior work has also identified problems with pregnancy apps. These include information credibility and trustworthiness (Declercq et al., 2014) and privacy and security (Dembosky, 2013; Scott et al., 2015). Moreover, one critical analysis argues that they reinforce stereotypical, heteronormative, and gendered notions of reproduction, framing the pregnant body as a "site of risk" and vulnerable to threats, depicting the "good" expecting mother as someone who devotes all her attention to the pregnancy, and suggesting that such apps may instill anxiety, self-responsibility, and blame in those who do not meet these expectations (Thomas and Lupton, 2016). For example, one common feature in pregnancy apps, as we also uncovered, tracks a pregnancy's progress. This is not apolitical; celebrations of pregnancy developments can turn apps into tools to help perform "good" (expectant) motherhood or maternal femininity (Littler, 2013; Neiterman, 2012). Furthermore, these apps typically do not acknowledge those ambivalent about pregnancies, those who do not engage in close self-monitoring, those who do not have partners, or those in non-heterosexual relationships (Rich and Miah, 2014; Thomas and Lupton, 2016).

Beyond pregnancy-related apps specifically, researchers have noted how menstruation tracking apps have heteronormative assumptions and stereotypically feminine aesthetics (Epstein et al., 2017), or how sexuality and reproduction apps are gendered and reinforce normative assumptions about reproductive bodies (Lupton, 2015).

Critical studies of other new media such as forums and blogs similarly suggest that interactions on these platforms tend to reinforce dominant narratives about what it means to be a "good mother" (Brady and Guerin, 2010; Madge and O'Connor, 2006). With respect to pregnancy loss, social media-focused scholarship suggests that anonymous sharing in online groups is beneficial (Geller, 2012) and may facilitate sharing to known audiences on non-anonymous platforms (Andalibi and Forte, 2018a). Prior social media scholarship has also examined factors that inform people's decisions to disclose experiences with loss (Andalibi and Forte, 2018a) or respond to such disclosures (Andalibi and Forte, 2018b), disclosure strategies (Andalibi et al., 2018), and outcomes (Andalibi, 2019). Lastly, technology-enabled interventions can reduce negative mental health effects associated with pregnancy loss (Kersting et al., 2011). However, the design landscape surrounding pregnancy loss remains largely unexplored.

In summary, this body of work highlights 1) the importance of accounting for pregnancy loss in designing new and social media, showing how they can be sites for social support, coping, and even norm shifts such as through challenging stigma; 2) the importance of critically examining existing technologies (e.g., mobile apps) and their features; 3) challenges with pregnancy-related mobile apps; and 4) that negative reproductive outcomes are largely absent from prior work at the intersection of reproductive health and new media despite their impact and commonness. We build on this body of work to examine how pregnancy-related apps account for pregnancy loss in their designs. To do so, we address the following research questions:

RQ1. What features are incorporated into the design of pregnancy-related mobile applications?

RQ2. How and to what extent do pregnancy-related mobile applications account for pregnancy loss in their design?

We note that while previous work provides insights about pregnancy apps' features broadly, our choice to include RQ1 was informed by the need to have a more recent and relevant analysis in which to ground RQ2—our main question.

Methods

Data collection

The data collection followed an iterative process and led to the analysis of a set of 166 unique apps.

Determining scope. The goal was to uncover how and to what extent existing pregnancy-related mobile apps that individuals might be using when a pregnancy loss occurs account for pregnancy loss. These include 1) apps related to pregnancy loss specifically; 2) apps geared towards individuals who are currently pregnant; 3) apps for those who experience infertility and intend to become pregnant; and 4) apps related to reproductive health more broadly. Apps related to infertility management were included because they often have a “pregnancy mode” that tracks the development of a pregnancy if a user successfully conceives, and a loss may occur during that pregnancy.

Search. We first searched for apps with “pregnancy loss” and “miscarriage” as search terms, as well as “stillbirth,” “fetal loss,” and “prenatal loss,” as well as “pregnant,” “pregnancy,” and “pregnancy tracking,” “fertility,” and “infertility.” Finally, we looked up words like “reproductive health” and “reproductive wellbeing.” We covered both Android and iOS apps. To complement our search queries, we also evaluated the recommended apps that the app stores' algorithms recommended as “similar” apps.

Inclusion and exclusion criteria. We included apps that were framed as providing help and resources through pregnancy loss, pregnancy, and experiences related to loss and pregnancy, mainly infertility. We also included apps that were generally about health but that included pregnancy as an explicit topic in their description. Some apps appeared in our search results that we did not include as they were mainly for entertainment purposes, such as apps for baby names and pregnancy simulation games. We also excluded apps in languages other than English, paid apps, and apps that were tailored to partners of pregnant persons.

Data analysis

Creating the codebook. Once we gathered the 166 relevant apps, we randomly assigned ten apps to four coders to analyze their features. This random selection led to four apps being assigned to more than one coder, leading to a total of 36 unique apps coded by the team. The coders followed an open coding

procedure, allowing for flexibility in developing the codebook (Strauss and Corbin, 1998). Each thoroughly explored the features of their assigned apps and created codes independently. They then met to discuss their apps and codes in detail, clarified differences and similarities between their codes, and came up with shared codes for prevalent features. These were used to analyze the remaining apps. Our codebook included a total of 14 feature codes (see Results). We paid particular attention to how pregnancy loss was discussed or accounted for in these apps, leading to an additional three codes.

Coding the data. Once we developed the codebook, the remainder of the apps were randomly divided between three of the same coders such that two coders coded each app, first separately, then meeting to discuss their apps and every code until consensus was reached. We had a 100% agreement rate, unsurprising given that the coding left little room for interpretation. For example, an app either included a forum or it did not. No new codes were developed during this process.

Results

Pregnancy-related Apps' Features

In response to RQ1, our analysis led to four main feature categories: 1) tracking, 2) information, tips, and advice, 3) reminders and planning assistance, and 4) social connection. While some of the tracking features also included information and tips, we included them under tracking because that was their main functionality and framing. We provide percentages for each individual code and the larger categories.

1. Tracking (76%). We observed four main ways tracking was incorporated into pregnancy apps' designs; 76% included at least one tracking feature.

Tracking physical changes (59%). The most common feature was personal progress documentation. This included logging weight, pictures (allowing uploading pictures of the "bump"), or blood pressure. For example, for pregnancy tracking apps, tracking weight would refer to tracking weight gain throughout the pregnancy. For fertility tracking apps, tracking periods would allow the app to predict later cycles and windows of fertility.

Fitness, diet, and nutrition tracking (47%). The second most common feature was information and advice about maintaining a healthy diet, nutrition, and fitness as well as tracking nutrition intake. Typically, apps contained articles about foods to avoid or consume and safe exercise positions to try while pregnant, and they allowed users to log food intake.

Journaling (34%). Some apps incorporated journaling so that users could document and express their experiences and feelings.

Tracking emotional and mental wellbeing and mood (28%). Some apps enable people to track their emotions and moods.

2. Information, tips, and advice (62%). Three codes fell under this category; 62% of the apps included at least one of the three features. While all were concerned with providing information, we coded for them separately because some focused on particular topics. These included the following:

Weekly description of body's and pregnancy's development (44%). The third most common of all observed features allowed for weekly descriptions of the pregnant body and the fetus's development. Typically, the apps asked users to input their due date and would tell them how many weeks in they were into their pregnancy. This was often accompanied by weekly descriptions of bodily changes and the progression of the pregnancy. A common feature compared fetus's size to vegetables and fruits. For example, the app Glow Nurture describes the size of one's fetus, gives information on what the user can expect in each week of pregnancy, and provides tips and tricks for that phase of pregnancy. Other apps were not as descriptive; for example, Pregnancy Today-Baby Tracker gives a brief overview of the size and development of the fetus at any given week.

Links to external resources on related topics (43%). Many apps included pointers to external resources on related topics such as sexually transmitted diseases (STDs), abortion, or adoption. It is worth noting that these topics all carry some stigma and do not align with the normative view of pregnancy and parenthood. **General weekly practical information and tips (40%).** This referred to advice about how to make one's pregnancy as easy and healthy as possible on a weekly basis. This included advice about topics such as discomforts one might start to experience, nutrition, or when it might be time to buy new clothes.

3. Reminders and planning assistance (40%). We observed two main ways that reminders were incorporated in these apps' designs; 40% of apps included at least one of these features.

Medical reminders (33%). Some apps included reminders about getting a specific vaccine, setting an OB/GYN appointment during a particular time in the pregnancy, existing appointment reminders, or doing scans and blood tests.

Preparation reminders (25%). These included reminders about creating a "birth plan" or buying certain items.

4. Social connection (30%). We observed five main ways that these apps incorporated support for social connections; 30% included at least one of these features.

Forums (17%). Some apps included forums for people to post within specific topics, share experiences, exchange support, or ask questions.

Links for other individuals to follow along (11%). Some apps allowed the user to link their account on the app with another's account so that they could follow the pregnancy's progress.

Profiles (8%). Some apps included a profile feature that allowed for browsing and connecting with other users.

Private messaging (8%). Some apps facilitated private messaging among users. While having a profile and private messaging sometimes overlapped, they did not always.

Coach (4%). Some apps included "coaches" a user could talk to or ask questions from. Coaches communicated with users through a messaging system.

Pregnancy loss in pregnancy-related mobile apps

To investigate how pregnancy loss was accounted for to answer RQ2, we divided apps into three groups: 1) those that actively and explicitly included pregnancy loss (18%), 2) those that passively included pregnancy loss (10%), and 3) those that excluded pregnancy loss, meaning they did not mention it in any way (72%). Our findings show that even when loss is accounted for, it is rarely done in a way that is sensitive to the needs of those experiencing it. For example, some apps that claim they allow logging pregnancy loss do so without naming the event and simply let the user "exclude the cycle," without any acknowledgment or providing any resources for coping or moving forward. Others that allow logging the loss delete the pregnancy and its associated data once the loss is recorded. Others hide the option to report a loss, so it is difficult to know that is even a feature. For an example, see Figure 1.

Active inclusion refers to including features such as options to log a pregnancy loss, informational articles on topics such as identifying warning signs of a loss, articles on coping with the emotional aspects of a loss, and forums for conversations about loss. Active inclusion means directly engaging with pregnancy loss (in contrast to passive inclusion described next) through the app's features and designs.

Logging a pregnancy loss often meant going into the settings of the apps, which were sometimes very hard to find, and entering the loss into the pregnancy data. This would sometimes mean that the app would delete all the data related to that pregnancy, as if it never happened. This would also mean that the individual would not be able to use that data in conversations with healthcare providers or others.

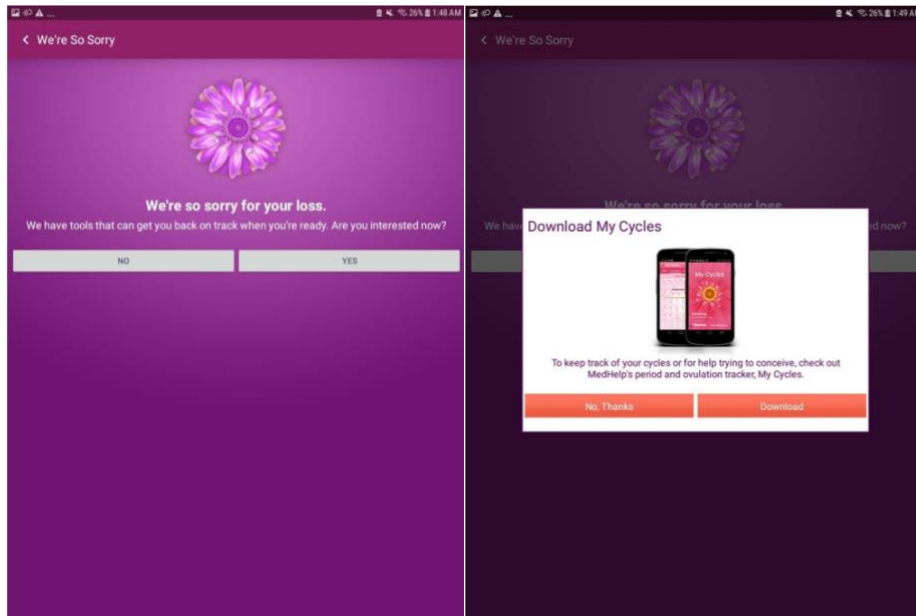


Figure 1. These are screenshots from the “I’m Expecting – pregnancy App,” counted as explicitly including pregnancy loss. However, once a loss is logged, the user sees the page on the left, including a message of being sorry for the loss. The app ignores the significance of this loss and states that there are tools when the user is “ready” to “get back on track,” assuming that “getting back on track” is the only thing they need. If the user selects “yes” they are directed to download a sister app to help them track their cycles and conceive, with the background saying “We’re so sorry.”

Passive inclusion of pregnancy loss refers to loss is not being directly addressed in the app’s features but present in the system through mentions in generic (not loss-specific) forums by users, or in a way in which the user would not come across the topic unless actively searching for it. In these apps, the concept of pregnancy loss was only accessible after in-depth exploration and was not attainable to the average user.

Exclusion of pregnancy loss means that there is no mention of pregnancy loss. Apps in this category did not include loss in passive or active ways.

Discussion

We contextualize our findings using two lenses: The politics of artifacts (Winner, 1980) and symbolic annihilation (Gerbner and Gross, 1976; Tuchman, 2000). First, we use Winner’s (1980) notion of artifacts’ politics to interpret our findings. We build on that interpretation and on feminist media scholarship (Gerbner and Gross, 1976; Tuchman, 2000) to argue that individuals whose pregnancies do not fit the “normative, happy ending” trajectory are targets of symbolic annihilation. We introduce the concept of *symbolic annihilation through design* and provide suggestions as to how technology designers might combat symbolic annihilation. We then situate pregnancy loss within a broader range of silenced gendered experiences, and suggest that the symbolic annihilation of pregnancy loss in pregnancy apps is part of the larger discourse of *intensive motherhood* (Hays, 1998). While we introduce the concept of symbolic annihilation through design here in the pregnancy context, the concept is a useful tool for interrogating new media technologies regarding how they account for—or do not account for—particular groups’ needs, especially those at the margins whose experiences are silenced.

Pregnancy loss: from books to the mobile technology landscape

In her feminist account of pregnancy loss in America, Layne (2002, 2003) describes how the rhetoric of the women's health movement in books, magazines, and educational resources portrays birth scenarios and pregnancy as idyllic and rosy, and how negative outcomes such as loss are erased.

First, Layne (2003) argues that the movement's attention to the cruciality of women being in control of their bodies contributes to both stigma and blame by the self and others when desired pregnancies do not have happy endings, highlighting an "American moral obligation to always be happy, a hegemonic narrative preference for narratives of linear progress, for stories with happy endings, and a culture of meritocracy which holds individuals responsible for misfortune" (p. 1889). In parallel, we argue that dismissing loss in pregnancy-related apps exacerbates the stigma associated with loss.

Second, Layne (2003) posits that emphasis on happy endings aggravates the experiences of those whose pregnancies do not end happily. Such an emphasis is present in feminist women's health activism and biomedical approaches to pregnancy. She argues that the women's health movement has systematically marginalized negative reproductive outcomes. Further, books and classes erase and neglect experiences of loss. For instance, *Our bodies, Ourselves* (often referred to as the "bible for women's health") segregates negative outcomes, sometimes excludes them, or groups them in chapters on "some exceptions to the normal child bearing experience" (Layne, 2002) This dictates what is "normal" and what is not. Our findings highlight parallels in the mobile app landscape regarding both how loss and other stigmatized reproductive experiences are addressed. For example, we found that many apps included pointers to *external* resources on topics such as sexually transmitted diseases (STDs), abortion, or adoption, signaling that these do not belong in a space dedicated to pregnancy management.

Furthermore, we found that pregnancy-related apps include features around information, tracking, reminders, and social contact. These meet some important needs during pregnancies (Lupton and Pedersen, 2016). However, most apps do not account for needs of pregnancies that do not end happily. For example, apps include mood tracking. Individuals experiencing loss often experience depression and post-traumatic stress disorder (Neugebauer and Ritsher, 2005); yet, any accounting for the emotional toll of loss occurs through separate forums or links to *external* sources if at all. Such design sends the message that when a pregnancy loss occurs, a user must cope with the loss "outside" of these spaces they have used to manage the pregnancy up to that point.

As reviewed, other prior work suggests that pregnancy-related apps tend to reinforce dominant narratives about "good" (expecting) motherhood (Brady and Guerin, 2010; Madge and O'Connor, 2006) and linear ideal reproduction scenarios. Discussions in this work do not include pregnancy loss, but discuss other limitations, such as how apps are gendered and heteronormative, depict what "good" (expecting) motherhood is like, and instill blame for not meeting the expectations of a "good" (expecting) mother (Thomas and Lupton, 2016), or exclude partners (Peyton and Wisniewski, 2020). We show how these apps also portray and design for happy endings rather than potentially undesired yet realistic turns that a pregnancy can take.

The politics of pregnancy-related apps

In his foundational essay "Do artifacts have politics?" Winner (1980) argues that technologies have "political properties." By "politics," he means "arrangements of power and authority in human associations as well as the activities that take place within those arrangements" (Winner, 1980: p. 123). He asserts that "specific features in the design or arrangement of a device or system could provide a convenient means of establishing patterns of power and authority in a given setting" (Winner, 1980: p. 134). Simply put,

technologies and their features include possibilities to order human activity in certain ways to push certain agendas forward. Winner uses the example of bridges over Long Island highways that would not allow buses to drive through. Their design enforced a certain political agenda and social effect: limiting the access of low-income and racial minorities to certain spaces (Winner, 1980).

This offers a useful a lens for revealing the politics of pregnancy-related apps that our findings highlight. We suggest that these apps' politics assert whose needs are central and whose are marginal (and therefore lack authority and power), as communicated through design. Specifically, we empirically show that pregnancy-related app designs assert that tracking, information, reminders, and social contact are important during *some* pregnancies. The finding that pregnancy-related apps include these features resonates with prior work (e.g., Peyton and Wisniewski, 2020), although terminologies may be different. However, our key contribution is empirically showing how these features particularly focus on healthy pregnancies. We show how accounting for users' needs falls short when a pregnancy loss occurs and when a linear pregnancy is disrupted. We suggest that these apps inherently position linear, rosy pregnancies as the authoritative narrative and shape how loss is experienced by ignoring the needs and existence of users who experience losses.

Symbolic annihilation through design

In this section we argue that ignoring pregnancy loss through the design of pregnancy-related mobile apps, even unintentionally, impacts those who experience loss through *symbolic annihilation*. We call this impact *symbolic annihilation through design*.

Symbolic annihilation was first introduced by feminist media scholars in the 1970s. Gerbner and Gross (1976) noted that representation in the fictional world implies social existence and absence in it leads to symbolic annihilation, associating symbolic annihilation with absence. Later, Tuchman (1979, 2000) expanded on Gerbner's definition. Through an analysis of traditional mass media content (i.e., television, magazines, newspapers), Tuchman (2000) argued that through ignoring women or representing them in stereotypical roles, the mass media symbolically annihilate women. Tuchman's conceptualization of symbolic annihilation includes omission, trivialization, and condemnation. Such annihilation reinforces stereotypical conceptions of the affected individuals and helps maintain social inequities (Gerbner and Gross, 1976; Tuchman, 2000).

Other scholars have used the concept of symbolic annihilation to articulate how marginalized groups such as Native Americans (Merskin, 1998), Black women (Coleman and Yochim, 2008), LGBTQ individuals (Venzo and Hess, 2013), and Muslims (Mir and Paschyn, 2018) experience symbolic annihilation in traditional mass media. Others have examined symbolic annihilation of historically marginalized groups in community archives (Caswell, 2014) and games, as an example of new digital media (Huntemann, 2015).

We build on this work and expand the concept of symbolic annihilation to mobile apps. We argue that symbolic annihilation can occur through technology design, which we call *symbolic annihilation through design*, similarly reinforcing stereotypes about phenomena or individuals and sustaining social inequities like stigmatization and marginalization. Specific to pregnancy loss, exposure to messages through media impacts beliefs, values, attitudes, and expectations (Paik and Comstock, 1994). Stigma, lack of acknowledgment, and the absence of pregnancy loss in our societal repertoire exacerbate the loss experience (Silverman and Baglia, 2015). Symbolic annihilation of pregnancy loss through design is harmful and invalidating to those who experience losses, perpetuates stigma surrounding loss, and reinforces normative narratives about pregnancy and pregnant individuals' experiences. While we focused on pregnancy loss inclusion within pregnancy-related apps to develop the concept of symbolic annihilation

through design, we suggest that the concept is useful for interrogating how technologies consider certain groups' needs, especially those experiencing marginality and stigma.

Design to combat symbolic annihilation

We advocate that pregnancy-related apps should directly engage with pregnancy loss through their design. Winner (1980) states that “to recognize the political dimensions in the shapes of technology does not require that we look for conscious conspiracies or malicious intentions” (p. 125). Similarly, we do not suggest that there are malicious intentions in designing these apps. Layne (2002) argues that pregnancy loss and other negative reproductive outcomes should be at the center of women's health agendas. Given our findings and that technologies have been appropriated and designed for managing reproductive health, feminist media design should also account for unfortunate experiences.

We advocate that pregnancy-related apps should center both individuals whose pregnancies proceed as expected *and* those whose pregnancies take undesired turns, rather than subjecting the latter to *symbolic annihilation through design*. How such technological inclusion would look should be determined using participatory methods (Schuler and Namioka, 1993) that engage with individuals who use pregnancy-related apps, both those who have and have not experienced losses. However, we maintain that any such designs should not perpetuate and amplify the stigma associated with loss, and should instead raise awareness and educate all—not just those who experience loss. Pregnancy-related app design should be aligned with the needs and values of those impacted by pregnancy *and* its complications, including and beyond loss.

Pregnancy loss as situated within a range of gendered silenced experiences

Pregnancy loss is situated within a broader range of gendered, silenced, experiences. As Layne (1997) argues, pregnancy loss is subject to what Foucault (1990) calls the “triple edict of modern puritanism – ‘taboo, nonexistence, and silence’”. Layne references Foucault: “There is not one but many silences, and they are an integral part of the strategies that underlie and permeate discourses” (p. 27). In this view, silence *is* part of the discourse, rather than being separate from it. In this section we situate pregnancy loss within a range of silenced discourses and experiences (e.g., traumatic birth stories). We build on the “intensified motherhood” theory (Hays, 1998) to illustrate how symbolic annihilation through design is problematic, how it can be a useful lens in other silenced contexts, and how it is situated within intensified motherhood ideologies that keep everything but positivity at bay (Das, 2019).

Examples of silenced experiences beyond loss include infertility (Becker, 1994; Letherby, 2002a, 2002b), abortion (Harden and Ogden, 1999), having children when diagnosed with HIV (Barber et al., 2019), or feeding children formula milk (Lee, 2008). Even desiring pregnancy is stigmatizing for some, such as those approaching menopause, LGBTQ individuals, women with disabilities, single women, or women in not socially approved relationships (Campbell, 1999; Lorber and Moore, 2007). Silencing contributes to marginalization and lack of agency and control. Indeed, pregnant individuals have historically been subject to control and surveillance (Oakley, 1984). In fact, activism and scholarship in relation to breaking gendered silences has been central to feminism (Selimovic, 2020). Motherhood and reproduction in particular have been key, and yet contested, themes in feminist discourse (Neyer and Bernardi, 2011; Peterson and Engwall, 2013).

Scholars have theorized silencing of a range of women's experiences within gendered frameworks, such as “intensive motherhood” (Hays, 1998). Intensive motherhood is a central concept in the sociology of motherhood. It describes the ideology that mothering is child-centered, emotionally absorbing, labor-intensive, and financially costly. Modern day Western society sees “intensive mothering” as required of a “good mother” (Hays, 1998).

Prior work has examined representations of birth, infertility, and related topics in the media (Benedictis et al., 2019; Tyler and Clements, 2009), for example finding that women are shown to not have control over their birth interventions on TV (Benedictis et al., 2019). In the online context, Das (2017) shows how traumatic and difficult birth stories are silenced, highlighting an aversion to sharing and hearing difficult stories. Das argues that pregnancy is a “disciplinary body project” which women are instructed to enjoy, where for example a mother who does not feel pain, or bears pain but does not call it pain or take pain medication, is celebrated. Das (2019) describes how in online groups “ideal birthing women” who “attended classes, practiced affirmations, listened to self-hypnosis tapes, [and] practiced movements with [their] birth partner[s]” intentionally avoided women who sought to share difficult birth stories (p. 21). Das theorizes aversion to sharing and hearing difficult birth stories online as an aspect of intensive motherhood. Part of intensive motherhood is keeping everything but positivity at bay, where only positive birth stories must be told and heard (Das, 2019). Lupton argues that intensive motherhood and a society that holds women responsible for pregnancy outcomes leads to motherhood’s beginning prior to birth (Lupton, 2013), which as we describe below, becomes even more complicated when a loss occurs.

Building on the work described here, we argue that the intensive motherhood ideology extends to pregnancies that lead to losses and partly shapes the loss discourse as well as how loss is accounted for in mobile apps. As our findings show, the once-pregnant person is left on their own to cope with the loss and experience harm from mobile apps largely organized around an expected child, rather than an expecting person. As such, we argue that symbolic annihilation of loss through design and the features that pregnancy apps include unrelated to loss (e.g., tracking, information, reminders, and social contact) are in part shaped by the intensive mothering ideology: A “good” and “responsible” mother uses these features to cater to the unborn child while the pregnancy is in progress. The once-pregnant and expecting person’s needs are no longer a subject that matters to these apps’ designs once the pregnancy has taken an undesired turn. Butler asks fundamental questions about what “matters”: “what qualifies as bodies that matter, ways of living that count as “life,” lives worth protecting, lives worth saving, lives worth grieving” (Butler, 1993: p. 16). Interrogating mobile apps’ treatment of pregnancy loss as a silenced and gendered experience articulates mechanisms through which such “mattering” is demonstrated through design, and ways design can render visible a wider range of experiences that matter but that the societal, including the socio-technical, discourse represents as not mattering.

Further examining the contexts within which socio-technical systems account for a range of silenced experiences (e.g., infertility, abortion) is an area for future work, and a first step to paving the way to better designing these systems. Through a deep focus on one silenced experience, we provide the lens of *symbolic annihilation through design* that we anticipate will be useful for interrogating other silenced experiences in socio-technical systems’ design.

Limitations and opportunities

While we sought to include all relevant apps, it is possible that we missed some. For example, it is possible that the recommendation algorithm that showed us other relevant apps through our search queries, have missed some relevant apps that exist but did not show up in our search either; or that there were apps that do not use any of the keywords we used. That said, the likelihood of these scenarios practically is low. While each was independently analyzed by two coders and then discussed to reach 100% agreement, it remains possible that the coders missed some features or coded some incorrectly. We included apps that were free and in English; it is possible that paid apps or those in other languages include features not surfaced in our data. However, given the steps taken, our core arguments regarding the importance of accounting for loss in pregnancy-related apps and the dire lack of its inclusion currently, as well as the concepts we develop, still hold. Lastly, future work could explore how experiencing symbolic annihilation

through design in one platform (e.g., pregnancy tracking app) might relate to one's way of engaging (or lack thereof) in others (e.g., social media).

Conclusion

Many pregnant individuals use mobile apps to manage pregnancies. We examined how these apps account for pregnancy loss through their design and functionality. Our findings showed that pregnancy loss is rarely accounted for. Drawing on Layne's (2002) feminist work, we showed how issues observed in women's health books and resources extend to the modern mobile app landscape. Using Winner's (1980) politics of artifacts as a lens, we described these apps' politics signaling whose needs are considered central and whose are considered marginal. We then built on feminist media scholarship (Tuchman, 2000) to argue that individuals whose pregnancies do not fit the prescribed happy-ending pregnancy trajectory are targets of what we term *symbolic annihilation through design*. We define symbolic annihilation through design as how technology design reinforces stereotypes about humans or phenomena and sustains social inequities like marginalization and stigmatization. It is a useful concept with which to interrogate technologies and make visible how they do or do not consider particular groups' needs and maintain social inequities and power. Situating pregnancy loss within a broader range of silenced gendered experiences, we suggest that the symbolic annihilation of pregnancy loss in pregnancy apps is part of the larger discourse of *intensive motherhood* (Hays, 1998). Finally, we advocate that pregnancy-related apps, and other technologies by extension, should combat symbolic annihilation through design to facilitate the inclusion of those who would otherwise experience harm due to feeling excluded, erased, or invalidated.

ⁱ We recognize that reproductive health terminology such as that used to refer to pregnant individuals or what they are expecting is political. When referring to prior studies, we often use their terminology. However, we maintain gender neutral terms where possible without changing prior work's meaning, as not all pregnant individuals are women or conceive of themselves as mothers.

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References

- Andalibi N (2019) What Happens After Disclosing Stigmatized Experiences on Identified Social Media: Individual, Dyadic, and Social/Network Outcomes. In: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, Glasgow, Scotland Uk, 2 May 2019, pp. 1–15. CHI '19. Association for Computing Machinery. DOI: 10.1145/3290605.3300367.
- Andalibi N (2020) Disclosure, privacy, and stigma on social media: Examining non-disclosure of distressing experiences. *ACM Transactions on Computer-Human Interaction* 27(3): 18:1-18:43. DOI: 10.1145/3386600.
- Andalibi N and Forte A (2018a) Announcing Pregnancy Loss on Facebook: A Decision-Making Framework for Stigmatized Disclosures on Identified Social Network Sites. In: *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*, Montreal QC, Canada, 2018, pp. 1–14. ACM Press. DOI: 10.1145/3173574.3173732.

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-
- Andalibi N and Forte A (2018b) Responding to Sensitive Disclosures on Social Media: A Decision-Making Framework. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25(6): 31:1-31:29. DOI: 10.1145/3241044.
- Andalibi N and Garcia P (2021) Sensemaking and Coping After Pregnancy Loss: The Seeking and Disruption of Emotional Validation Online. *Proceedings of the ACM: Human-Computer Interaction (PACM: HCI), CSCW*.
- Andalibi N, Morris ME and Forte A (2018) Testing Waters, Sending Clues: Indirect Disclosures of Socially Stigmatized Experiences on Social Media. *Proceedings of the ACM on Human-Computer Interaction 2(CSCW)*: 1–23. DOI: 10.1145/3274288.
- Barber TJ, Borok T, Suchak T, et al. (2019) Having children outside a heterosexual relationship: options for persons living with HIV. *Sexually Transmitted Infections* 95(2). BMJ Publishing Group Ltd: 99–101. DOI: 10.1136/sextrans-2018-053670.
- Becker G (1994) Metaphors in Disrupted Lives: Infertility and Cultural Constructions of Continuity. *Medical Anthropology Quarterly* 8(4). [American Anthropological Association, Wiley]: 383–410.
- Benedictis SD, Johnson C, Roberts J, et al. (2019) Quantitative insights into televised birth: a content analysis of One Born Every Minute. *Critical Studies in Media Communication* 36(1). Routledge: 1–17. DOI: 10.1080/15295036.2018.1516046.
- Brady E and Guerin S (2010) “Not the Romantic, All Happy, Coochy Co Experience”: A Qualitative Analysis of Interactions on an Irish Parenting Web Site. *Family Relations* 59(1): 14–27. DOI: 10.1111/j.1741-3729.2009.00582.x.
- Butler J (1993) *Bodies That Matter: On the Discursive Limits of ‘Sex’*. Psychology Press.
- Caldeira C, Chen Yu, Chan L, et al. (2018) Mobile apps for mood tracking: an analysis of features and user reviews. *AMIA Annual Symposium Proceedings 2017*: 495–504.
- Campbell A (1999) *Childfree and Sterilized: Women’s Decisions and Medical Responses*. Cassell.
- Caswell M (2014) Seeing Yourself in History: Community Archives in the Fight Against Symbolic Annihilation. *The Public Historian* 36(4): 26–37.
- Coleman RRM and Yochim EC (2008) Symbolic Annihilation. In: *The International Encyclopedia of Communication*. American Cancer Society. DOI: 10.1002/9781405186407.wbiecs124.
- Das R (2017) Speaking About Birth: Visible and Silenced Narratives in Online Discussions of Childbirth. *Social Media + Society* 3(4). SAGE Publications Ltd: 2056305117735753. DOI: 10.1177/2056305117735753.
- Das R (2019) The mediation of childbirth: ‘Joyful’ birthing and strategies of silencing on a Facebook discussion group. DOI: 10.1177/1367549417722094.
- Declercq ER, Sakala C, Corry MP, et al. (2014) Major Survey Findings of Listening to Mothers(SM) III: Pregnancy and Birth: Report of the Third National U.S. Survey of Women’s Childbearing Experiences. *The Journal of Perinatal Education* 23(1): 9–16. DOI: 10.1891/1058-1243.23.1.9.
- Nazanin Andalibi. Symbolic annihilation through design: Pregnancy loss in pregnancy-related mobile apps. *New Media & Society*. Pages 1-19. 2021 <https://doi.org/10.1177/1461444820984473>

-
- Dembosky A (2013) Pregnancy apps raise fresh privacy concerns. Available at: <https://www.ft.com/content/1c560432-2782-11e3-ae16-00144feab7de>.
- Epstein DA, Lee NB, Kang JH, et al. (2017) Examining Menstrual Tracking to Inform the Design of Personal Informatics Tools. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems - CHI '17*: 6876–6888. DOI: 10.1145/3025453.3025635.
- Fairchild JL (2009) *What might have been: The communication of social support and women's post-miscarriage narrative reconstruction*. Ph.D. University of Kentucky, United States -- Kentucky. Available at: <http://search.proquest.com.ezproxy2.library.drexel.edu/docview/858610979/abstract> (accessed 8 October 2015).
- Foucault M (1990) *The History of Sexuality, Vol. 1: An Introduction*. Reissue edition. New York: Vintage.
- Geller PA (2012) The role of emerging technology in women's response to pregnancy loss. *Expert Review of Obstetrics & Gynecology* 7(1): 19–23. DOI: 10.1586/eog.11.80.
- Gerbner G and Gross L (1976) Living With Television: The Violence Profile. *Journal of Communication* 26(2): 172–194. DOI: 10.1111/j.1460-2466.1976.tb01397.x.
- Goggin G (2011) Ubiquitous apps: politics of openness in global mobile cultures. *Digital Creativity* 22(3): 148–159. DOI: 10.1080/14626268.2011.603733.
- Harden A and Ogden J (1999) Young women's experiences of arranging and having abortions. *Sociology of Health & Illness* 21(4): 426–444. DOI: 10.1111/1467-9566.00165.
- Hays S (1998) *The Cultural Contradictions of Motherhood*. Yale University Press.
- Hearn L, Miller M and Fletcher A (2013) Online healthy lifestyle support in the perinatal period: what do women want and do they use it? *Australian Journal of Primary Health* 19(4): 313–318. DOI: 10.1071/PY13039.
- Hughson J-AP, Daly JO, Woodward-Kron R, et al. (2018) The Rise of Pregnancy Apps and the Implications for Culturally and Linguistically Diverse Women: Narrative Review. *JMIR mHealth and uHealth* 6(11): e189. DOI: 10.2196/mhealth.9119.
- Huntemann N (2015) No More Excuses: Using Twitter to Challenge The Symbolic Annihilation of Women in Games. *Feminist Media Studies* 15(1): 164–167. DOI: 10.1080/14680777.2015.987432.
- Johnson SA (2014) "Maternal Devices", Social Media and the Self-Management of Pregnancy, Mothering and Child Health. *Societies* 4(2): 330–350. DOI: 10.3390/soc4020330.
- Kersting A, Kroker K, Schlicht S, et al. (2011) Internet-based treatment after pregnancy loss: concept and case study. *Journal of Psychosomatic Obstetrics & Gynecology* 32(2): 72–78. DOI: 10.3109/0167482X.2011.553974.
- Kraschnewski JL, Chuang CH, Poole ES, et al. (2014) Paging 'Dr. Google': does technology fill the gap created by the prenatal care visit structure? Qualitative focus group study with pregnant women. *Journal of Medical Internet Research* 16(6): e147. DOI: 10.2196/jmir.3385.
- Nazanin Andalibi. Symbolic annihilation through design: Pregnancy loss in pregnancy-related mobile apps. *New Media & Society*. Pages 1-19. 2021 <https://doi.org/10.1177/1461444820984473>

-
- Layne LL (1997) Breaking the Silence: An Agenda for a Feminist Discourse of Pregnancy Loss. *Feminist Studies* 23(2): 289–315. DOI: 10.2307/3178398.
- Layne LL (2002) *Motherhood Lost: A Feminist Account of Pregnancy Loss in America*. New York: Routledge.
- Layne LL (2003) Unhappy endings: a feminist reappraisal of the women's health movement from the vantage of pregnancy loss. *Social Science & Medicine* 56(9). Reproduction Gone Awry: 1881–1891. DOI: 10.1016/S0277-9536(02)00211-3.
- Lee EJ (2008) Living with risk in the age of 'intensive motherhood': Maternal identity and infant feeding. *Health, Risk & Society* 10(5). Taylor & Francis: 467–477. DOI: 10.1080/13698570802383432.
- Letherby G (2002a) Challenging Dominant Discourses: Identity and change and the experience of 'infertility' and 'involuntary childlessness'. *Journal of Gender Studies* 11(3). Routledge: 277–288. DOI: 10.1080/0958923022000021241.
- Letherby G (2002b) Childless and Bereft?: Stereotypes and Realities in Relation to 'Voluntary' and 'Involuntary' Childlessness and Womanhood. *Sociological Inquiry* 72(1): 7–20. DOI: 10.1111/1475-682X.00003.
- Littler J (2013) The Rise of the "Yummy Mummy": Popular Conservatism and the Neoliberal Maternal in Contemporary British Culture. *Communication, Culture & Critique* 6(2): 227–243. DOI: 10.1111/cccr.12010.
- Lorber J and Moore LJ (2007) *Gendered Bodies: Feminist Perspectives*. Roxbury Publishing Company.
- Lupton D (2013) Introduction. In: Lupton D (ed.) *The Social Worlds of the Unborn*. London: Palgrave Macmillan UK, pp. 1–11. DOI: 10.1057/9781137310729_1.
- Lupton D (2014) Apps as Artefacts: Towards a Critical Perspective on Mobile Health and Medical Apps. *Societies* 4(4): 606–622. DOI: 10.3390/soc4040606.
- Lupton D (2015) Quantified sex: a critical analysis of sexual and reproductive self-tracking using apps. *Culture, Health & Sexuality* 17(4): 440–453. DOI: 10.1080/13691058.2014.920528.
- Lupton D and Pedersen S (2016) An Australian survey of women's use of pregnancy and parenting apps. *Women and Birth: Journal of the Australian College of Midwives* 29(4): 368–375. DOI: 10.1016/j.wombi.2016.01.008.
- Lupton D and Thomas GM (2015) Playing Pregnancy: The Ludification and Gamification of Expectant Motherhood in Smartphone Apps. *M/C Journal* 18(5). Available at: <http://journal.media-culture.org.au/index.php/mcjournal/article/view/1012> (accessed 9 February 2020).
- Mackenzie A (2016) The Performativity of Code: Software and Cultures of Circulation - Adrian Mackenzie, 2005. *Theory, Culture & Society*. Available at: <http://journals.sagepub.com/doi/10.1177/0263276405048436> (accessed 9 February 2020).

-
- Madge C and O'Connor H (2006) Parenting gone wired: empowerment of new mothers on the internet? *Social & Cultural Geography* 7(2): 199–220. DOI: 10.1080/14649360600600528.
- Merskin D (1998) Sending up Signals: A Survey of Native American Media Use and Representation in the Mass Media. *Howard Journal of Communications* 9(4): 333–345. DOI: 10.1080/106461798246943.
- Mir S and Paschyn C (2018) Qatar's Hidden Women: Symbolic Annihilation and Documentary Media Practice. *Visual Communication Quarterly* 25(2): 93–105. DOI: 10.1080/15551393.2018.1456932.
- Neiterman E (2012) Doing pregnancy: pregnant embodiment as performance. *Women's Studies International Forum* 35(5): 372–383. DOI: 10.1016/j.wsif.2012.07.004.
- Neugebauer R and Ritsher J (2005) Depression and Grief Following Early Pregnancy Loss. *International Journal of Childbirth Education* 20(3).
- Neyer G and Bernardi L (2011) Feminist Perspectives on Motherhood and Reproduction.: 20.
- Oakley A (1984) *The Captured Womb: A History of the Medical Care of Pregnant Women*. B. Blackwell.
- Paik H and Comstock G (1994) The effects of television violence on antisocial behavior: A meta-analysis. *Communication Research* 21(4): 516–546. DOI: 10.1177/009365094021004004.
- Peterson H and Engwall K (2013) Silent bodies: Childfree women's gendered and embodied experiences. *European Journal of Women's Studies* 20(4). SAGE Publications Ltd: 376–389. DOI: 10.1177/1350506812471338.
- Peyton T (2014) Pregnancy Ecologies As Teachable Moments For The Lifecourse: Changing The mHealth Design Paradigm. In: *Proceedings of the 18th International Conference on Supporting Group Work*, Sanibel Island, Florida, USA, 9 November 2014, pp. 269–271. GROUP '14. Association for Computing Machinery. DOI: 10.1145/2660398.2660438.
- Peyton T and Wisniewski P (2020) Improving a Design Space: Pregnancy as a Collaborative Information and Social Support Ecology. In: Arai K and Bhatia R (eds) *Advances in Information and Communication*. Cham: Springer International Publishing, pp. 505–525. DOI: 10.1007/978-3-030-12388-8_36.
- Peyton T, Poole E, Reddy M, et al. (2014) 'Every Pregnancy is Different': Designing mHealth for the Pregnancy Ecology. In: *Proceedings of the 2014 Conference on Designing Interactive Systems*, New York, NY, USA, 2014, pp. 577–586. DIS '14. ACM. DOI: 10.1145/2598510.2598572.
- Prabhakar A, Guerra-Reyes L, Efron A, et al. (2017) " Let Me Know If You Need Anything " : Support Realities of New Mothers. In: *Proceedings of Pervasive Health*, 2017.
- Rich E and Miah A (2014) Understanding Digital Health as Public Pedagogy: A Critical Framework. *Societies* 4(2): 296–315. DOI: 10.3390/soc4020296.

-
- Rodger D, Skuse A, Wilmore M, et al. (2013) Pregnant women's use of information and communications technologies to access pregnancy-related health information in South Australia. *Australian Journal of Primary Health* 19(4): 308–312. DOI: 10.1071/PY13029.
- Savitz DA, Hertz-Picciotto I, Poole C, et al. (2002) Epidemiologic measures of the course and outcome of pregnancy. *Epidemiologic Reviews* 24(2): 91–101.
- Schuler D and Namioka A (1993) *Participatory Design: Principles and Practices*. CRC Press.
- Scott KM, Gome GA, Richards D, et al. (2015) How trustworthy are apps for maternal and child health? *Health and Technology* 4(4): 329–336. DOI: 10.1007/s12553-015-0099-x.
- Selimovic JM (2020) Gendered silences in post-conflict societies: a typology. *Peacebuilding* 8(1). Routledge: 1–15. DOI: 10.1080/21647259.2018.1491681.
- Silverman RE and Baglia J (2015) *Communicating Pregnancy Loss: Narrative as a Method for Change*.
- Strauss A and Corbin J (1998) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd ed. SAGE Publications.
- Thomas GM and Lupton D (2016) Threats and thrills: pregnancy apps, risk and consumption. *Health, Risk & Society* 17(7–8): 495–509. DOI: 10.1080/13698575.2015.1127333.
- Tripp N, Hainey K, Liu A, et al. (2014) An emerging model of maternity care: smartphone, midwife, doctor? *Women and Birth: Journal of the Australian College of Midwives* 27(1): 64–67. DOI: 10.1016/j.wombi.2013.11.001.
- Tuchman G (1979) Women's Depiction by the Mass Media. *The University of Chicago Press Journals* 4(3): 528–542.
- Tuchman G (2000) The Symbolic Annihilation of Women by the Mass Media. In: Crothers L and Lockhart C (eds) *Culture and Politics: A Reader*. New York: Palgrave Macmillan US, pp. 150–174. DOI: 10.1007/978-1-349-62397-6_9.
- Tyler I and Clements J (2009) The Taboo Aesthetics of the Birth Scene. *Feminist Review* 93(1). SAGE Publications: 134–137. DOI: 10.1057/fr.2009.34.
- Upton RL (2001) 'Infertility Makes You Invisible': Gender, Health and the Negotiation of Fertility in Northern Botswana. *Journal of Southern African Studies* 27(2). Routledge: 349–362. DOI: 10.1080/03057070120050019.
- Venzo P and Hess K (2013) "Honk Against Homophobia": Rethinking Relations Between Media and Sexual Minorities. *Journal of Homosexuality* 60(11): 1539–1556. DOI: 10.1080/00918369.2013.824318.
- Winner L (1980) Do Artifacts Have Politics? *Daedalus* 109(1): 121–136.