Gendered innovation adoption:

The non-adoption of bird photography, 1899-1920*

Eun Young Song, University College London

Direct correspondence to Eun Young Song, The Bartlett School of Construction & Project Management, Room 241, 1-19 Torrington Place, University College London, London, WC1E 6BT, United Kingdom. E-mail: ey.song@ucl.ac.uk.

Abstract

Prior studies on innovation adoption have underscored that the refusal to adopt popular innovations becomes less accepted as such innovations spread. In this paper, I re-examine this prevailing account using the lens of gender. Focusing on the adoption of bird photography, a technologically advanced method to help save wild birds that became widespread in early 20th-century America, I examine how gendered expectations in society shaped the adoption of an innovation. Using a unique database coded from archival documents of the first American bird protection movement, which was prominent between 1899 and 1920, I find that the non-adoption of a technological innovation is rather accepted when the meaning of the innovation is gendered and its (non)adoption is accountably masculine (or feminine). Stemming from that historical case, the results of this study have contemporary relevance to understanding the role of gendered expectations in shaping innovation adoption, particularly in science and technology.

Keywords

Gendered expectations, non-adoption, and technological innovation.

"What was strange must be wrong; what was unusual must be improper. Shirley was judged." ― Charlotte Brontë, *Shirley*

The existing literature reiterates that the refusal to adopt popular innovations becomes less accepted as such innovations spread. Part of this comes from the assumption that innovations are beneficial (Dewar and Dutton 1986; Greve and Taylor 2000; McKendrick 2001; Rogers 1995). Social actors who do not adopt a given innovation, therefore, must have difficulty understanding it or accepting the need for change (Greve 2011, 949; Rogers 1995, 100). More importantly, the institutional account of innovation adoption underscores the high social cost of ignoring innovations that are widely diffused (DiMaggio and Powell 1983; Jonsson 2009; Strang and Tuma 1993). As an innovation obtains legitimacy through its spread (Greve 2011), external pressure to adopt it is found to increase (DiMaggio and Powell 1983; Strang and Tuma 1993). It becomes difficult to publicly ignore or object to the adoption of the innovation. For these reasons, refusal can become socially costly and is often considered temporary.

However, this prevailing explanation appears to rely on gender-neutral logic. It seldom considers that innovation (non)adoption can be interpreted in the same way as any other behavior that is engaged in with an eye to its accountability for one's gender. This is especially true in the adoption of technological innovations. From drones to spy cameras, new gadgets are not generally associated with women. A tech expo is typically imagined to be a room crowded with men testing and purchasing new products, unless the event specifically makes reference to women in tech. Although the gendered nature of technology adoption is often taken for granted, it has been of surprisingly little

concern in research on innovation adoption. Instead, women's lack of involvement in and non-adoption of technological innovations is often attributed to individual apathy or is simply taken to prove that women are not interested in science and technology.

In this paper, I revisit the prevailing explanation of the non-adoption of popular innovations through the lens of gender. Drawing on the historical case of the diffusion of bird photography, a technological innovation that emerged in the context of the first and only American bird protection movement, which occurred between 1887 and 1920, I investigate how the non-adoption of bird photography was viewed in society. Despite the proven benefit and popularity of the innovation, very few women bought cameras and took photos of wild birds. Contrary to the existing explanation, their non-adoption was appropriate and socially approved. To understand this phenomenon, I argue for a logic of gendered expectations — the way others expect him or her to behave as a man or a woman according to society's idealized masculinity and femininity — as a counterpoint to the gender-neutral logic on which most innovation adoption studies rely. In doing so, I identify how ideal masculine and feminine natures were constructed at that time and provide examples showing that men and women believe to be what others expect from them. Then, I hypothesize that movement participants would not adopt bird photography due to gendered expectations. The findings I reach support my argument that innovation adoption aligns with the way others expect an individual to behave according to his or her gender and that, therefore, the non-adoption of popular innovations is not always socially costly. Taken as a whole, this study as a case of gendered expectations has contemporary relevance to understanding the (non)adoption of technological innovations.

Gendered adoption of innovations

Bird photography

In this study, I situate my investigation of innovation adoption in the context of America's first bird conservation movement, which occurred between 1887 and 1920. This movement, called the "Audubon movement," was initially organized by a group of upper-middle-class men under the name of the National Audubon Society (NAS) in New York City in 1886. By the time the NAS was organized, a significant number of avian species had already disappeared as a result of human activity (e.g., 10,000,000 passenger pigeons were killed annually in the late 19th century [The National Association of Audubon Societies 1914]). Fearing the complete loss of American birds, 17,723 men and women signed up to join the movement to "protect American birds [that are] not used for food, from destruction for mercantile purposes" (National Audubon Society 1887, 20). As NAS membership almost tripled in the following year, female membership kept pace (National Audubon Society 1887). As many as 52% of NAS members were female by the end of World War I, and the increasing number of female participants made the NAS quite heterosocial, unlike contemporary male-only organizations in the public sphere (The National Association of Audubon Societies 1900, 161). United to save endangered species, both male and female participants in the Audubon movement actively engaged in various types of work, from lobbying Congress to educating the public. Their incessant efforts resulted in unprecedented reforms of state law, the establishment of bird reservations, and, ultimately, the enactment of the Migratory Bird Treaty Act, which legalized the protection of all migratory species

between the U.S. and Great Britain (acting on behalf of Canada) (The National Association of Audubon Societies 1903, 1905, 1909, 1918).

Among the many measures taken by the NAS members, bird photography (or taking still photos of wild birds) was a technology-inspired means of bird protection. Frank M. Chapman, who was the chief editor of the official NAS magazine, introduced this innovative method. He published a series of books about bird photography, which became popular among like-minded naturalists and made bird photography the mainstay of the NAS to this day (as seen in the annual Audubon Photography Awards). This new technology became one of the most viable substitutes for bird hunting and for taxidermy, which was a contemporary method of studying animals. It was a minimally invasive technology that enabled bird enthusiasts to gather specimens without killing them. At the same time, bird photography gave movement participants a means to study avian behavior and species distribution so that they could save birds from hunting. Photos of ransacked rookeries and bloodied birds also presented powerful testimony to the need for legal restrictions on bird hunting in America. Accordingly, movement participants quickly accepted bird photography as an innovative means of protecting birds.

Despite the merits of bird photography, only a handful of female participants adopted this innovation (see Figure 1), even though women were not merely nominal members of the movement. Female participants traveled, met locals, distributed educational leaflets, taught schoolchildren, and lectured in public about the importance of bird protection (The National Association of Audubon Societies 1918). They also organized a boycott of the use of bird skins and feathers, mobilizing approximately 900

women (e.g., Harriet Lawrence Hemenway and her cousin Minna Hall, who later launched the Massachusetts Audubon Society (Souder 2013)). In addition, the women were as wealthy as the male participants. Female lifetime members contributed half of the income of the NAS, and individual women donated large amounts of money to prevent the killing of birds (e.g., Mrs. Russell Sage, who donated $15,000 over a period of three years). Nevertheless, most female participants did not adopt bird photography, although they were clearly willing to protect birds and sufficiently wealthy to buy cameras and travel to rookeries.

==========

Insert Figure 1 about here

==========

Entrepreneurial traits

To understand women's non-adoption of bird photography, I develop an alternative thesis on innovation adoption through the lens of gender; more precisely, this is through the lens of gendered expectations in late 19th and early 20th century America. Society in this period was divided into two domains: the "public" domain of men (i.e., the market) versus the "private" domain of women (chiefly, home) (Cott 1997; Griswold 1988; Smith-Rosenberg 1986). Each domain dramatized society's idealization of masculine and feminine natures. In the public domain, men as independent individuals participated in breadwinning-related activities and competition in general. Many such activities involved physical tasks that showed a masculine nature. In contrast, women who pursued such activities outside the home were seen as unfeminine. Instead, it was thought, a woman's main social sphere should be her home, where she is dependent

upon a man, nurtures his children, and takes care of his family (Griswold 1988). In addition to her avoidance of masculine tasks, a woman was to wear light fabric dresses and headdresses adorned with delicate plumes for her daily outings to further symbolize aspects of her feminine nature, such as warmth and tenderness (Harper's Bazaar, 1888, 1889). Whether she genuinely believed in the prevailing view of women or not, a woman would comport herself based on others' expectations of feminine behavior. In doing so, she lived up to an ideal conception of femininity and effectively preserved her categorization as female in society.

Having identified the display of idealized masculinity or femininity in the period of study, I develop three hypotheses about how gendered expectations can shape behavior. First, women would be less likely to try out new technologies of bird photography that are associated with idealized masculinity. Researchers have long argued that innovations are likely to be adopted by individuals who have entrepreneurial traits (Rogers and Svenning 1969; Wejnert 2002; Yapa and Mayfield 1978). Such individuals voluntarily seek information about new methods and perceive little risk associated with new practices (Becker 1970; Greve 2011; Rogers 1995; Rogers and Svenning 1969; Sheth 1981; Wejnert 2002). Those characteristics are generally assumed to be individual rather than socially constructed (Bruni, Gherardi, and Poggio 2004; Thébaud 2015a, b).

However, key entrepreneurial traits such as autonomy and agency are grounded in masculinity, in stark contrast to the widespread belief in female dependency (e.g., Butler 1990; Schmutz and Faupel 2010). This observation holds its truth for late-19th-century America, where women's dependency on men was taken for granted. For

instance, when something went wrong with his bicycle, a male rider was expected to fix his flat tire by himself or at least decide what to do next. A female rider, however, was not only criticized for cycling alone (Bailey et al. 2013) but also expected to wait until a man offered his services for the mending of her bicycle, which he was believed to do better than she could (Aronson 1952, 308). People expected agentic behavior from men and not women. Entrepreneurial traits such as the ability to try and use new technologies became integral to idealized masculinity.

Because men's willingness to try innovations is easily justified, it is rather common to see men publicly exhibiting entrepreneurial traits (Bruni et al, 2004). This is particularly true when innovations draw on male-typed skills, such as those in the realms of science, technology, and engineering. Machinery and equipment that was developed from scientific knowledge was often designated to be in the domain of men. In fact, men wrote the articles about cameras and the value of taking photos in the NAS magazines; in these articles, the authors discussed the camera models and apparatuses that they had tried. They also provided detailed reviews of state-of-the-art technology. This is analogous to today's men who write new code for open-source software, leave detailed comments about programming, share unboxing videos on YouTube, and review new gadgets online. Through testing, using, and reviewing new technologies, a man can display his entrepreneurial qualities (West and Zimmerman 1987, 2009), whereas a woman who chooses not to engage in this still lives up to society's conception of the feminine. Thus, it can be concluded that female participants were unlikely to adopt bird photography as the articles reproduced the gendered expectations of society.

H1: The more articles written by men that featured entrepreneurial qualities, the less likely women were to adopt bird photography.

An innovation tinged with masculinity

According to the existing literature, innovations are likely to spread regardless of gender. As long as innovations are technologically superior, individuals adopt them to gain a competitive advantage (Dewar and Dutton 1986; Greve and Taylor 2000; McKendrick 2001). However, this view tends to overlook the fact that many technological innovations are gender marked. Special qualifiers must be added to exceptions to the rule. (e.g., from lady cycling [Fenton 1896] in the 19th century to female Linux developers, girlfriend-friendly PS4 games, and smartwatches for women in the 21st century). Such qualifiers are indicative of the assumption that men are essentially responsible for and are the main consumers/producers of technological innovations. This is also true in late-19th-century America, where bifurcated social domains and market activities offer male adopters an advantage over their female counterparts.

Bird photography involved more than new technologies and scientific knowledge at that time. Taking and publishing photos of wild birds was also strongly tinged with a masculine nature, which was often indicated or portrayed in photos. Carrying heavy equipment, such as cameras and tripods, and working in the wilderness were categorized as manly conduct (Beer 1983, 70-89), and such activities were captured in photos. Taking photos of wild birds often required lifting and moving large cameras while traveling in rugged terrain. In taking pictures of slaughtered birds, photographers

appeared to be entering the male domain of the masculine activity of hunting. These photos therefore conveyed an idealized, essentialized nature of men.

At first glance, it appears that women were unlikely to adopt this innovation because they internalized gender norms, which involve the tacit assumption that certain innovations are for adoption by men (Martin 2004). However, social actors do not necessarily internalize gender norms, even those that they believe are right (West 1984; West and Zimmerman 1987, 2009). Rather, they internalize expectations that others will comport themselves in a masculine or feminine manner, along with the need to present themselves as making sense in a cognitive way or being accountable in terms of society's desire for an idealized masculine or feminine nature (Bittman et al. 2003, 191; Fenstermaker and West 2002; Hall 1993). In the late 19th century as well, people expected each other to display idealized masculinity or femininity according to their gender. This expectation could lead women to feel that they should not adopt or should avoid certain innovations that were seen as tinged with masculine qualities. In such environment, the public expression of a masculine nature by a woman rarely makes sense because it is behavior at the risk of gender assessment (West and Zimmerman 1987, 136). Concern over encountering gender assessment or the fear of backlash (Brescoll 2011) is likely to lead social actors to behave according to gendered expectations in society. Given that gendered expectations in the late 19th and early 20th century were shaped by society's idealized masculine and feminine natures, both men and women were likely to behave in accordance with their need to make sense to one another and with their expectations of others' behavior. As a result, gendered expectations tend to constrain social actors to act in normative ways. These expectations

become reality and affect individual behavior.

Hence, the second hypothesis predicts that women would have been less likely to adopt bird photography, an activity that was categorized as being what people expected of men. Women's non-adoption of this innovation would be seen as appropriate, while the perceived social risks associated with the non-adoption of the innovation could be greater for an individual man (Wejnert 2002, 313).

H2: The more masculine features bird photography shows, the less likely women are to adopt it.

Feminine accountability in the adoption of bird photography

When an innovation is adopted by an individual, the adopter's gender may be exhibited through that adoption (Goffman 1976). An innovation that is predominantly adopted by men is more likely to be presented in accordance with desirable masculine qualities, whereas the same innovation adopted by women is likely to be presented in line with society's idealization of femininity. For instance, whereas male musicians who introduce aesthetic innovations and write original songs are often portrayed as autonomous intellectual geniuses, female artists who do the same thing are described as wives and mothers. At the same time, greater emphasis is given to the emotional authenticity underlying female artists' work, under the assumption that women feel and manage their emotions better than men (Schmutz and Faupel 2010). This suggests that the adoption of an innovation is likely to be seen as "natural" (Aldrich and Fiol 1994), not just because the innovation diffuses but also because it reproduces appropriate

attitudes and activities for men and women.

The existing literature leads us to expect that where bird photography was adopted by a woman, it was more likely to exhibit female gender. However, adopting bird photography implied the performance of behaviors expected of men. In this case, the female adopter would feel pressure to demonstrate that she was an "essentially" feminine being, despite appearances to the contrary (West 1984, 97-101). Woman who took photos of birds engaged in supposedly masculine behavior given that it was men who predominantly controlled household expenses and could decide whether individuals would be allowed to buy and use expensive, sophisticated cameras (Griswold 1988; Smith-Rosenberg 1986) ENDNOTE 1. Naturally, it was not only the adopter's gender that was exhibited through the performance of bird photography. Her innovation adoption also created pressure to render her behavior "accountable" (West and Zimmerman 1987, 2009) because innovation adoption seemed to defy the economic dependency that carried such symbolic weight as a marker of female gender (Brines 1994).

To make sense of the innovation adoptions that others expected of men, female adopters were most likely to display finely modified femininity. Feminine accountability is not uncommon in the adoption of technological innovations. A woman engineer who designed a new airplane chose not to participate in the maiden voyage, for which presumably only men were fit (Hughes 1945, 356). A female user praises PDAs (personal digital assistants) for the way they allow her to stay connected to all the people she "takes care of" (Kao and Tien 2003). Similarly, female photographers made sure to show themselves exhibiting ladylike qualities, by, for instance, having photos

taken of themselves being guided by men or looking after hatchlings. In this way, taking photos became accountably feminine. Cases of adoption by women could enable a compromise to be reached for femininity allowing women to adopt innovations tinged with masculine qualities. As long as feminine accountability was assured, this compromise permitted women to espouse bird photography in greater numbers, and the innovation adoption became gender appropriate. This leads to the last hypothesis: women's adoption of bird photography in an accountably feminine manner would encourage female participants to take and publish photos of wild birds.

H3: The more photos that are taken by women and feature feminine qualities, the more likely women are to adopt bird photography.

Data Source and Sample

The primary source of data for this study was *Bird Lore*, the official monthly magazine of the NAS, from 1899 to 1920 ENDNOTE 2. The magazine served as a 19th-century version of social media; it embodied the only public outlet for sharing photos. Photos published in the magazine usually included at least a sentence describing the main subjects in the photos. From *Bird Lore*, I obtained a total of 4,990 articles that either explicitly mentioned or implicitly assumed the benefits of taking bird photos and that clearly stated the gender and name of the contributor. From the same source, I also obtained a total of 486 photos taken by 210 individuals (see Figure 1).

I chose the individual as the unit of analysis. I considered every single individual who expressed his or her opinion on bird protection in the form of articles, letters,

poems, pictures, or drawings between 1887 and 1920. In total, 2,584 individuals presented their thoughts on bird protection at least once. After excluding administrative staff whose writings concerned organizational management, I used a final sample of 2,578 individuals in the analysis (1,798 men and 780 women).

Methods

Dependent variable

The dependent variable is the adoption of bird photography or the event of taking a photo. The individual observations are split annually to update covariates. Because each individual could have taken photos multiple times throughout the research period, individuals who took photos remained at risk of adoption until the end of observation in 1920.

Independent variables

To test the first hypothesis, I use the annual percentage of magazine articles written by men. In total, 3,837 articles were written by men. To test the second hypothesis, I use the annual percentage of bird photos that portray manliness and masculine tasks. Based on the descriptions of photos and their main subjects, I coded photos that picture either outdoorsmen (such as cameramen in bird colonies) or birds killed by men (e.g., bloodied egrets plucked by plume hunters) ENDNOTE 3. In total, 165 photos depict either case. All of these photos were taken by men. Lastly, I use the number of photos taken by women to test the third hypothesis: 16 women published 21 photos during the research period. All of these variables were 1-year lagged to capture causality. In the

testing of each hypothesis, each variable is moderated by gender: women are coded 1, and men are coded 0.

Control variables

In addition to the gender dummy, two individual-level variables are included to control for the individual tendency to adopt bird photography: (1) whether the individual held an official position and (2) whether s/he participated in the Christmas bird census, a substitute for the customary Christmas hunting. First, I control for certain individuals' tendency to take photos in their official capacity. These more highly placed individuals were obligated to show their work to ordinary members. They usually exhibited photos of themselves surveying rookeries or confiscating birds from hunters. In the analysis, I include a dummy variable for individuals who were held positions as presidents, editors, secretaries, field agents, special agents, or any official role in the organization, using the annual reports of the NAS. This variable was updated annually because individuals' positions changed over time.

Second, I include a dummy variable for individuals who participated in another seminal bird protection project, the Christmas bird census, to control for the individual tendency to adopt bird photography based on similar experience. Frank M. Chapman, who popularized bird photography, introduced the Christmas bird census in 1900. He proposed the idea of counting the variety of avian species in backyards instead of shooting birds during the Christmas hunting season. Because both the Christmas census and bird photography were proposed by the same man and were closely related to male activities, such as surveying outdoors and hunting, the men (and later their wives and

daughters) who completed the Christmas bird census were more likely to adopt bird photography. I code an individual as 1 if he or she reported at least one bird during the Christmas hunting season. I create this variable using a complete list of individuals and their reports obtained from the Christmas bird census sections of *Bird Lore*. This variable was updated annually because individual participation changed over time. Table 1 presents the descriptive statistics and bivariate correlations of all the variables mentioned above.

==========

Insert Table 1 about here

==========

Model

I use a Cox proportional hazard model in the analysis (and a non-proportional Weibull hazard model in the supplementary analysis, which is available online ENDNOTE 4). This model is preferable because it can handle failure times correlated within a subject (e.g., repeated events per individual) and makes no assumption about the exact timing of an event, presuming only that the event occurred within a given interval (Yamaguchi 1991). The Cox model controls for all time-related influences that affect all individuals equally; thus, society-level variables cannot be entered (their effects are not identified (Greve 2011, 958)). In the supplementary analysis, however, I controlled for society-level changes. Due to repeated observations of individuals, I estimated robust standard errors adjusted for clustering on each individual in both the main and supplementary analyses.

Findings

==========

Insert Table 2 about here

==========

Table 2 reports the tests of the three hypotheses. The baseline model with no predictor variables shows that individuals appointed to official positions were more likely to adopt bird photography than ordinary NAS members, and women were less likely to adopt the innovation than men. The effect of individual participation in the Christmas census on innovation adoption is not significant. These effects are consistent in the later models. The results of the supplementary analysis are consistent with the findings of the main analysis, with the exception of differences in statistical significance.

Entrepreneurial qualities

==========

Insert Figure 2 about here

==========

The first hypothesis predicts women's non-adoption of bird photography due to entrepreneurial traits being publicly exhibited by men. This hypothesis is supported in

Model 2. This result is contrary to the prediction of adoption theory that increased exposure to information on the actual and potential benefits of an innovation facilitates innovation adoption by individuals (Wejnert 2002; Yapa and Mayfield 1978). Although published articles apparently increased public exposure to the merits of bird photography, the same articles simultaneously conveyed gendered expectations. The (male) authors wrote about new cameras, lenses, and related technologies. Many of their articles were neither A-to-Z guides of photography nor user-friendly camera manuals (see Figure 2) but instead assumed that the audience had scientific knowledge or at least was willing to take the risk of using unfamiliar equipment. Meanwhile, the (male) subjects of the articles were trying and evaluating new technology. They used various types of cameras, films and plates without help from others. Furthermore, their reviews of different models suggested that men could choose their own device based on their judgment, as the following excerpts show:

> *The successful-bird photographer must possess a good camera, including a first-class lens, with at least an elementary knowledge of how to get the best results from it*… With the usual appliances a wide open stop will be found necessary with the rapid exposure required… A rapid telephoto lens is a great desideratum… The writer has used a 4 × 5 long-focus "Premo" with Bausch and Lomb Rapid Rectilinear lens (Zeiss-Anastigmat, Series II-A, 4 and 1/4 × 6 and 1/2), the focal length of the combination being about 6 and 1/4 inches (emphasis added, The National Association of Audubon Societies 1899, 6–8).

> The ‘Graflex’ is probably the finest and best-made camera of this class on the market, but the high price at which it is sold puts it beyond the reach of the average man's pocketbook, and its great weight makes it impracticable for field use except under the most favorable circumstances. *I consider the ‘Reflex,’ which is more reasonable in price, the most practical camera of this class, and a most valuable instrument for bird photography*. The focal-plane shutter, with adjustable slit, gives it a wide range of speeds up to one one-thousandth of a second, adapting it for use on the swiftest-flying birds, as well as for slow snapshots at stationary objects. (emphasis added, The National Association of Audubon Societies 1909, 104)

Where these articles demonstrated men’s entrepreneurial qualities, they usually noted how useful the innovation was for manly activities, such as hunting and scientific bird study. In fact, articles about animal photography presented taking photos of wild birds as “hunting with a camera,” “hunting without a gun” (Grinnell 1892), or “camera hunting” (Shiras 1895, 1900). Readers of these articles could easily picture photographers as recreational hunters engaging in masculine activity, such as buying new hunting equipment (e.g., cameras and plates), taking photos of birds in the wilderness, and exhibiting their hunting trophies (i.e., bird photos) in public. In addition to the aspect of hunting, articles stressed the scientific value of photos capturing the details of bird life (e.g., “The camera as an aid in the study of birds” (Roberts 1899)). Technical articles, similar to the one shown in Figure 2, tended to reproduce a contemporary masculine image of scientists and technicians. For men, adopting bird photography fulfilled expectations of what a man could and should do. For women,

their non-adoption of this innovation was gender-appropriate.

Idealized masculinity in photos

==========

Insert Figure 3 about here

==========

==========

Insert Figure 4 about here

==========

Model 4 supports the second hypothesis. With more images of masculine activity associated with bird photography, there were fewer photographs taken by women. First, photos of outdoorsmen were a straightforward image of men carrying new devices and working in the natural environment (e.g., a picture of a cameraman standing in a glade is captioned as follows: "B. S. Bowdish, Secretary of the New Jersey Audubon Society. He is one of the Audubon Societies' most active field men" [The National Association of Audubon Societies 1917, 457]). The main background of these photos was the domain of adventure: the wilderness (e.g., Figure 3, and a photograph of men installing a tripod on the sloping side of a hill, captioned as follows: "Mr. Forbush erecting a blind on great duck island. Audubon warden Joseph M. Grey on the left" [The National Association of Audubon Societies 1914, 386]). The explicit snapshots of male prowess in the photos confirmed the audience's perception that taking bird photos was appropriate for men, as corroborated by a female contributor:

> such a suit [a special outfit worn for bird photography] as I am describing will always look well and workmanlike… in spite of many improvements, the necessary kit, even if only a quarter-plate outfit, is heavy for a woman to carry (*unless she is very muscular*) without assistance… (emphasis original, The National Association of Audubon Societies 1915, 176–188).

Second, photos of confiscated birds, skins, and feathers provided a visual representation of male activities and men's achievements. Photos of bloodied birds (such as a "Heron from which plumes have been torn" [The National Association of Audubon Societies 1904, 40] and "Egret shot by Florida plume-hunter and back 'scalped' for the plume" [The National Association of Audubon Societies 1914, 77]) did more than simply justify the Audubon cause. These photos also created a mental image of violent hunting and fierce competition, all of which were consistently considered masculine.

In addition, photos exhibited men's achievements in hunting, literally and figuratively. Descriptions of hunted birds often reported the number of animals killed, and photos also captured hunters bearing trophies (e.g., Figure 4); a photograph of a man with a rifle wearing a wreath of quails is captioned as follows: "One hundred sixty-five quails shot by a Georgia 'sportsman' in a two-days [sic] hunt" [The National Association of Audubon Societies 1913, 153]). Photos of seized skins and feathers also brought to the fore the market price for plumes, suggesting that cameramen were defeating plume hunters in the economic domain (e.g., a photograph of a man pointing

to a pile of huge boxes captioned as follows: "$150000 worth of smuggled wild-bird plumage" [The National Association of Audubon Societies 1919, 325]). The success of hunters and confiscators would not be central in a photo and its description if the photo had intended only to solicit sympathy for hunted birds and to prompt a response from the public. In fact, the photographic portrayal of men's achievements in competition carried a symbolic meaning of idealized masculinity. None of the activities portrayed in the photos or the actions of the photographers could be understood under conceptions of the feminine. Rather, the non-adoption of this technological innovation made more sense to female participants.

Feminine accountability

==========

Insert Figure 5 about here

==========

The third hypothesis is supported in Model 6 at the 10% significance level. Women were likely to adopt innovations only where the same innovation adopted by other women was understood as feminine. As Figure 1 shows, very few women took photos of birds, but when they did, their photos often were accompanied by a short description of how the photographer had taken photos together with their family members (usually husbands) or friends. These photos reaffirmed normatively prescribed female duties, such as service to the household, the extended family, the friendship circle, and the community (Fischer 1988). In this way, female adopters displayed an idealized

femininity, and their adoption of this new technological innovation came to make sense.

Relatedly, most photos were taken indoors (e.g., "The winter bird-life group in the museum" [The National Association of Audubon Societies 1915, 269]) or near gardens and verandas (e.g., "Two robins at their bath" [The National Association of Audubon Societies 1917, 68]), as Figure 5 shows. Viewers of these photos could easily picture a lady of leisure taking photos of sparrows on her windowsill. These photos, which reflected feminine qualities, appealed to women and facilitated the adoption of bird photography by female participants.

As a few women began taking photos of wild birds in the late 1910s, women's bird photography came to reflect particular pursuits expressing the photographers' feminine "nature" (West and Zimmerman 1987, 126). Women had once been less likely to adopt this innovation, which was strongly tinged with the idealized masculinity. As female adopters presented themselves in accord with expectations of modesty in women, this innovation was more likely to be embraced by women, as Model 6 suggests.

Contrary to suggestions in the existing literature on innovation diffusion, women's adoption of bird photography did not encourage or legitimize men's adoption of it. As more women came to take photos of birds, the adoption rate of male participants did not increase, a lack of trend that became more marked in the late 1910s and thereafter. This may have been due in part to the population of male adopters already being saturated or men beginning to lack time and money to take pictures of birds due to the economic recession and then war. From a gender perspective, however, taking still shots of birds became more controversial among men as it became tinged

with feminine qualities, such as domesticity. In fact, male participants shifted to creating and publishing motion pictures of wild birds as motion picture cameras became available, beginning in 1915, and were considered more state-of-the-art than roll film or plate cameras (The National Association of Audubon Societies 1915). Because maleness was defined in terms of the rejection of femaleness (Bittman et al. 2003, 193; Brines 1994), male participants were less likely to espouse bird photography (-.266 at the 0.10 level in Model 6). Instead, the adoption of an alternative technology became accounted masculine.

Discussion and Conclusion

Despite the broad interest in and the vast body of literature on innovation adoption, the wide acceptance of non-adoption of technological innovations remains relatively under-examined. This study takes the first steps in theorizing the non-adoption of innovations from a gender perspective to understand the diffusion of bird photography. Empirical investigation shows that individual non-adoption of technological innovations could display the way others expect an individual to behave according to gender. Innovation non-adoption does not arise from lack of interest or information about the innovation. Instead, the adoption of a new technology and the innovation itself convey expectations related to gender. The more innovations diffuse, the more likely it is that innovation adoption is modulated by gendered expectations.

By demonstrating how gendered expectations shaped the individual likelihood of adoption of a certain innovation, this study advances organization studies on innovation adoption. A growing stream of non-adoption studies considers the

heterogeneity of potential adopters and the way that within-organization diversity can help erode (Greenwood, Suddaby, and Hinings 2002) or maintain organization-level adoption resistance (Ferlie et al. 2005; Jonsson 2009; Marquis and Lounsbury 2007). However, such studies pay little attention to the fact that the heterogeneity in individual characteristics, such as entrepreneurial traits, could reflect shared social beliefs about differences in men's and women's entrepreneurial abilities (Bruni, Gherardi, and Poggio 2004; Correll and Ridgeway 2003; Fiske et al. 2002; Foschi 2000; Thébaud 2015b). For instance, when female managers introduce new ideas, test new methods, and evaluate new products, their entrepreneurial traits appear to deviate from generally expected feminine qualities. This deviation from gendered expectations often results in fewer rewards and a stricter standard of performance for female entrepreneurs (Foschi 2000; Heilman, Block, and Martell 1995; Thébaud 2015b). To complement the current literature, this study observes gender disparity in entrepreneurial qualities and demonstrates its effects on innovation adoption. It introduces new questions to advance theoretical pursuits, as it charts new territory in work that weds innovation adoption to considerations of the symbolic display of behavior expected of men and women.

The theoretical development in this study also has practical implications. There have been a variety of subsidized programs and corporate initiatives targeting female pioneers in STEM (science, technology, engineering, and mathematics) fields. Although these programs (e.g., GNOME's Outreach Program for Women) are designed to assist women in developing, using, and disseminating innovations, very few of them are successful (e.g., only 5.5% of holders of commercialized patents are female) (Hunt et al. 2012). Some may cite physical differences between male and female brains as the

reason why women remain unmotivated by these programs. This study does not deny that there are biological differences between men and women. Instead, it emphasizes that not all differences are natural; instead, real differences are used to reinforce the masculine or feminine account of every social behavior (Lorber and Farrell 1991). Unless women-oriented initiatives and programs fundamentally challenge gendered expectations, testing and using cutting-edge technologies and introducing new scientific methods will continue to be activities considered more appropriate for men (Katila and Meriläinen 1999). Hence, this study asserts that women's lack of enthusiasm for and participation in these programs should be understood as a result of gendered expectations. Any solutions should address the possibility of more widespread loosening of such expectations in general.

In addition, this study makes an important contribution to our understanding of the non-adoption of innovations in keeping with the social construction tradition of institutional theory (Berger and Luckmann 1967). It clarifies the ways in which the meanings of a technological innovation and its adoption are gendered. Contrary to the legitimacy argument found in institutional literature, innovation adoption everywhere cannot be taken for granted. Innovations make sense to audiences in a gendered way, and adopters' displays of their gender continuously reproduce gendered meanings in innovation adoption. On the one hand, the public discourse on technological innovations undermines female autonomy and agency to adopt new technologies, and masculinity conveyed in innovations limits the amount of legitimacy female adopters can accrue. On the other hand, innovations that are slowly adopted by women are invoked to legitimize their female qualities, as female adopters present a socially scripted dramatization of

their feminine natures for an audience that is well schooled in the presentational idiom (Goffman 1976; cf. Deutsch 2007). In either case, non-adoption is more appropriate and socially accepted for one gender or the other. In this regard, this study calls for a reassessment of the non-adoption of popular innovations by focusing on the equally important but neglected process of how women and men are expected to behave with respect to innovation adoption.

Any generalization from this study might apply best to the technological innovations, and require modification to apply to a universe of individual cases within that class (Abbott 1992), society's gendered expectations (e.g., "would the gendered nature of innovation adoption be more (or less) pronounced if we study innovation adoption these days?" and "would female CEOs forgo new technology because of gendered expectations?"). In this regard, this study suggests that reconceptualizing innovation adoption as an integral dynamic of gendered expectations is applicable to technology dissemination in the 21st century. Of course, very few female participants in the Audubon movement in the early 20th century could be called independent, either financially or socially. Even if they were (e.g., Mrs. Russell Sage), there was little support for them to fully explore alternatives and justify their behaving like men. It is reasonable to question the extent to which the non-adoption of innovations is socially accepted according to one's gender, as society has apparently become less gender-biased and gender has become less static. Although the empirical case presented in this study recognizes the need to take into account the social context of the acceptance or non-acceptance of innovation adoption, implicit in my thesis is that the adoption of bird photography represents a common phenomenon that is not often studied (Walton 1992).

Given societal changes, such as the feminist movement and the agitation surrounding the proposed Equal Rights Amendment, which provided the ideology and impetus to question existing social arrangements, one may argue that the gendered adoption of bird photography clearly reflects a particular social milieu. Despite all these changes, however, gendered expectations continue to constrain individuals today to act in an expected way by adopting or avoiding innovations, especially in science and technology. In this respect, my study provides avenues for future research, not only with respect to generalizing this thesis to other contexts but also to enhancing our understanding of gendered expectations and the social construction of innovation adoption.

Although the insights of this study have broader theoretical and practical implications for understanding innovation diffusion, more work is needed to clarify the effects of the existence of alternative innovations on the adoption of bird photography. Literature on the adoption of innovations suggests that social actors select different innovations when two or more alternative or similar innovations are available and all other external conditions are held constant (Arbena 1988; Wejnert 2002). As discussed in the findings, taking motion pictures of birds became an alternative to taking still photos (i.e., bird photography, which is the focus of this study). In addition to alternative technological innovations, species conservation involved non-technological innovations, such as the education of children regarding the importance of the protection of birds (e.g., the Junior Audubon Class [The National Association of Audubon Societies 1910]). Given that these alternatives were not available during the first 15 years of the research period, it is safe to assume that bird photography was the

only innovative practice that movement participants chose to adopt (or not). More importantly, both the alternative technological innovation (taking motion pictures) and non-technological innovations (teaching children) were strongly tinged with one gender. Male and female participants chose each innovation as they presented themselves in consideration of others' expectations. Nevertheless, further work is required to verify how the availability of alternative varieties of innovation facilitates or hinders the individual likelihood of adopting a certain innovation according to gender.

Future research could extend the focus of this study by examining social contagion through interpersonal networks, cultural similarity through network positions and the socio-economic status of individuals. The existing diffusion literature underscores innovation adoption through cohesive networks (Abrahamson and Rosenkopf 1997; Burt 1987; Coleman, Menzel, and Katz 1966; Strang and Meyer 1993; Strang and Tuma 1993). It is difficult for individuals who are in well-connected interpersonal networks to ignore innovation adoption, either because they quickly receive information about others' adoption or because the innovation adoption is considered legitimate for members of the network. From this perspective, the non-adoption of innovations by a certain group of individuals may be understood as a result of their sparse networks relative to adopters' networks (Robertson, Swan, and Newell 1996; Wong and Boh 2014). In addition, prior studies stress that an actor's perception of behavioral similarity with others, such as structural equivalence or socio-economic characteristics (e.g., education level and income), affects his or her likelihood of adoption (Wejnert 2002). Regrettably, this study was unable to map interpersonal networks or operationalize socio-economic characteristics because these data were not

available; if they had been, further incorporation of interpersonal networks and socio-economic variables would be useful. The future development of the above areas would shed light on scholarly issues relating to the assessment of the rate and pattern of the adoption of innovations by gender.

About the Author

Eun Young Song is a research associate at the Bartlett School of Construction & Project Management, University College London. She investigates public conformity to social norms and its unintended consequences. Her current research projects examine the ritualism of compliance, the legalization of animal-human relations, and the role of bystanders in undoing social change. Her most recent publication is “Protect to damage? Institutional work, unintended consequences and institutional dynamics" in Organization Studies (forthcoming).

References

Abbott, Andrew. 1992. "What Do Cases Do? Some Notes on Activity in Sociological Analysis." In *What is a Case? Exploring the Foundations of Social Inquiry*, edited by Charles C. Ragin and Howard S. Becker, 53-82. NY: Cambridge University Press.

Abrahamson, Eric., and Lori Rosenkopf. 1997. "Social Network Effects on the Extent of Innovation Diffusion: A Computer Simulation." *Organization Science* 8 (3):289-309.

Aldrich, Howard E., and C. Marlene Fiol. 1994. "Fools Rush in - The Institutional Context of Industry Creation." *Academy of Management Review* 19 (4):645-670.

Arbena, Joseph L. 1988. *Sport and Society in Latin America: Diffusion, Dependency and Rise of Mass Culture*. Westport, CT: Greenwood.

Aronson, Sidney H. 1952. "The Sociology of the Bicycle." *Social Forces* 30 (3):305-312.

Bailey, Jane, Valerie Steeves, Jacquelyn Burkell, and Priscilla Regan. 2013. "Negotiating with Gender Stereotypes on Social Networking Sites: From "Bicycle Face" to Facebook." *Journal of Communication Inquiry* 37 (2):91-112.

Becker, Marshall H. 1970. "Sociometric Location and Innovativeness: Reformulation and Extension of the Diffusion Model." *Annual Review of Sociology* 35:267-282.

Beer, William R. 1983. *Househusbands: Men and Housework in American Families*. New York: Praeger.

Berger, Peter L., and Thomas Luckmann. 1967. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Garden City, NY: Anchor Doubleday.

Bittman, Michael, Paula England, Liana Sayer, Nancy Folbre, and George Matheson. 2003. "When Does Gender Trump Money? Bargaining and Time in Household Work." *American Journal of Sociology* 109 (1):186-214.

Brescoll, Victoria L. 2011. "Who Takes the Floor and Why: Gender, Power, and Volubility in Organizations." *Administrative Science Quarterly* 56 (4):622-641.

Brines, Julie. 1994. "Economic Dependency, Gender, and the Division of Labor at Home." *American Journal of Sociology* 100 (3):652-688.

Bruni, Attila, Silvia Gherardi, and Barbara Poggio. 2004. "Doing Gender, Doing Entrepreneurship: An Ethnographic Account of Intertwined Practices." *Gender, Work & Organization* 11 (4):406-429.

Burt, Ronald S. 1987. "Social Contagion and Innovation: Cohesion Versus Structural Equivalence." *American journal of Sociology* 92 (6):1287-1335.

Butler, Judith. 1990. *Gender Trouble: Feminism and the Subversion of Identity*. New York: Routledge.

Castilla, Emilio J. 2007. *Dynamic Analysis in the Social Sciences*. CA: Academic Press.

Coleman, James S., Herbert Menzel, and Elihu Katz. 1966. *Medical Innovations: A Diffusion Study*. New York: Bobbs-Merrill.

Correll, Shelley J., and Cecilia L. Ridgeway. 2003. "Expectation States Theory." In *The Handbook of Social Psychology*, edited by John D. DeLamater, 29-51. New York: Kluwer Academic Press.

Cott, Nancy F. 1997. *The Bonds of Womanhood : "Woman's Sphere" in New England, 1780-1835*. 2nd ed. New Haven: Yale University Press.

Deutsch, Francine M. 2007. "Undoing Gender." *Gender & Society* 21 (1):106-127.

Dewar, Robert D., and Jane E. Dutton. 1986. "The Adoption of Radical and Incremental

Innovations: An Empirical Analysis." *Management Science* 32 (11):1422-1433.
DiMaggio, Paul J., and Walter W. Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48 (2):147-160.
Eastman Kodak Company. 1999. *History of KODAK Cameras*. http://wwwuk.kodak.com/global/en/consumer/products/techInfo/aa13/aa13.pdf.
Fenstermaker, Sarah, and Candace West. 2002. *Doing Gender, Doing Difference: Inequality, Power, and Institutional Change*. New York: Routledge.
Fenton, W. H. 1896. "A Medical View of Cycling for Ladies." *The Nineteenth Century* 39:799-800.
Ferlie, Ewan, Louise Fitzgerald, Martin Wood, and Chris Hawkins. 2005. "The Nonspread of Innovations: The Mediating Role of Professionals " *Academy of Management Journal* 48 (1):117-134.
Fischer, Claude S. 1988. "Gender and the Residential Telephone, 1890-1940: Technologies of Sociability." *Sociological Forum* 3 (2):211-233.
Fiske, Susan T., Amy J. Cuddy, Peter Glick, and Jun Xu. 2002. "A Model of (often mixed) Stereotype Content: Competence and Warmth Respectively Follow from Perceived Status and Competence." *Journal of Personality and Social Psychology* 82 (6):878-902.
Foschi, Martha. 2000. "Double Standards for Competence: Theory and Research." *Annual Review of Sociology* 26:21-42.
Goffman, Erving. 1976. “Gender Display.” Studies in the Anthropology of Visual Communication 3(2):69-77.
Greenwood, Royston, Roy Suddaby, and Christopher R. Hinings. 2002. "Theorizing Change: The Role of Professional Associations in the Transformation of Institutionalized Fields." *Academy of Management Journal* 45 (1):58-80.
Greve, Henrich R. 2011. "Fast and Expensive: The Diffusion of a Disappointing Innovation." *Strategic Management Journal* 32 (9):949-968.
Greve, Henrich R., and Alva Taylor. 2000. "Innovations as Catalysts for Organizational Change: Shifts in Organizational Cognition and Search." *Administrative Science Quarterly* 45:54-80.
Grinnell, George Bird. 1892. "Hunting with a Camera." *Forest and Stream*, May 5, 417.
Griswold, Robert L. 1988. "Anglo Women and Domestic Ideology in the American West in the Nineteenth and Early Twentieth Centuries." In *Western Women: Their Land, Their Lives*, edited by Lillian Schlissel, Vicki L. Ruiz and Janice Monk, 15-34. Albuquerque, NM: University of New Mexico Press.
Hall, Elaine J. 1993. "Smiling, Deferring, and Flirting: Doing Gender by Giving “Good Service”." *Work and Occupations* 20 (4):452-471.
Harper's Bazaar. 1888-1900. http://hearth.library.cornell.edu/h/hearth/browse/title/4732809.html.
Heilman, Madeline E., Caryn J. Block, and Richard F. Martell. 1995. "Sex Stereotypes: Do they Influence Perceptions of Managers?" *Journal of Social behavior and Personality* 10 (4):237-252.
Hughes, Everett Cherrington. 1945. "Dilemmas and Contradictions of Status." *American Journal of Sociology* 50 (5):353-359.
Hunt, Jennifer., Jean-Philippe. Garant, Hannah. Herman, and David J. Munroe. 2012.

Why Don't Women Patent? edited by National Bureau of Economic Research. Cambridge, MA: National Bureau of Economic Research.
Jonsson, Stefan. 2009. "Refraining from Imitation: Professional Resistance and Limited Diffusion in a Financial Market." *Organization Science* 20 (1):172-186.
Kao, Patricia, and Susan Tien. 2003. *Vault Guide to Conquering Corporate America for Women and Minorities*. New York: Vault, Inc.
Katila, Saija, and Susan Meriläinen. 1999. "A Serious Researcher or Just Another Nice Girl?: Doing Gender in a Male-dominated Scientific Community." *Gender, Work & Organization* 6 (3):163-173.
Lee, Brandon H. 2009. "The Infrastructure of Collective Action and Policy Content Diffusion in the Organic Food Industry." *Academy of Management Journal* 52 (6):1247-1269.
Lorber, Judith, and Susan A. Farrell. 1991. *The Social Construction of Gender*. Newbury Park, CA: Sage.
Marquis, Christopher, and Michael Lounsbury. 2007. "Vive la Résistance: Competing Logics and the Consolidation of US Community Banking." *Academy of Management Journal* 50 (4):799-820.
Martin, Patricia Yancey. 2004. "Gender as Social Institution." *Social Forces* 82 (4):1249-1273.
McKendrick, David G. 2001. "Global Strategy and Population-level Learning: The Case of Hard Disk Drives." *Strategic Management Journal* 22 (4):307-334.
National Audubon Society. 1887-1889. *Audubon*. New York: Forest and Stream Publishing Company.
Roberts, Thomas S. 1899. "The Camera as an Aid in the Study of Birds." *Bird lore*, 6-13.
Robertson, Maxine, Jacky Swan, and Sue Newell. 1996. "The Role of Networks in the Diffusion of Technological Innovation." *Journal of Management Studies* 33 (3):333-359.
Rogers, Everett M. 1995. *Diffusion of Innovations*. 4th ed. New York: Free Press.
Rogers, Everett M., and Lynne Svenning. 1969. *Modernization among Peasants: The Impact of Communications*. New York: Holt, Rinehart, and Winston.
Schmutz, Vaughn, and Alison Faupel. 2010. "Gender and Cultural Consecration in Popular Music." *Social Forces* 89 (2):685-707.
Sheth, Jagdish N. 1981. "Psychology of Innovation Resistance: The Less Developed Concept (LDC) in Diffusion Research." *Research in Marketing* 4:273-282.
Shiras, George. 1895. "Hunting with a Camera." *New York Sun*, August 25, 12.
——. 1900. "Hunting with a Camera." *The Independent*, June 7, 1364-1368.
Smith-Rosenberg, Carroll. 1986. *Disorderly Conduct: Visions of Gender in Victorian America*. New York: Oxford University Press.
Souder, William. 2013. How Two Women Ended the Deadly Feather Trade. Smithsonian Magazine. http://www.smithsonianmag.com/science-nature/How-Two-Women-Ended-the-Deadly-Feather-Trade-192135981.html#ixzz2R6C7jqsa.
Strang, David, and John W. Meyer. 1993. "Institutional Conditions for Diffusion." *Theory and Society* 22 (4):487-511.
Strang, David, and Nancy Brandon Tuma. 1993. "Spatial and Temporal Heterogeneity in Diffusion." *American Journal of Sociology* 99 (3):614-639.
Thébaud, Sarah. 2015a. "Business as Plan B: Institutional Foundations of Gender

Inequality in Entrepreneurship across 24 Industrialized Countries." *Administrative Science Quarterly* 60 (4):671-711.
——. 2015b. "Status Beliefs and the Spirit of Capitalism: Accounting for Gender Biases in Entrepreneurship and Innovation." *Social Forces* 94 (1):61-86.
The National Association of Audubon Societies. 1899-1920. *Bird Lore*. New York: D. Appleton & Company.
The New York Times. 1865-1920. http://www.nytimes.com/ref/membercenter/nytarchive.html.
U.S. Census Bureau. *Statistical Abstracts of the United States, 1878-1994*. https://www.census.gov/library/publications/time-series/statistical_abstracts.html.
Walton, John. 1992. "Making the Theoretical Case." In *What is a Case? Exploring the Foundations of Social Inquiry*, edited by Charles C. Ragin and Howard S. Becker, 121-138. New York: Cambridge University Press.
Wejnert, Barbara. 2002. "Integrating Models of Diffusion of Innovations: A Conceptual Framework." *Annual Review of Sociology* 28:297-326.
West, Candace. 1984. "When the Doctor is a "Lady": Power, Status and Gender in Physician-Patient Encounters." *Symbolic Interaction* 7 (1):87-106.
West, Candace, and Don H. Zimmerman. 1987. "Doing Gender." *Gender & Society* 1 (2):125-151.
——. 2009. "Accounting for Doing Gender." *Gender & Society* 23 (1):112-122.
Wong, Sze-Sze, and Wai Fong Boh. 2014. "The Contingent Effects of Social Network Sparseness and Centrality on Managerial Innovativeness." *Journal of Management Studies* 51 (7):1180-1203.
Yamaguchi, Kazuo. 1991. *Event History Analysis*. Newbury Park, CA: Sage.
Yapa, Lakshman S., and Robert C. Mayfield. 1978. "Non-adoption of Innovations: Evidence from Discriminant Analysis." *Economic Geography* 54 (2):145-156.

Notes

1. I thank an anonymous reviewer for pointing this out.

2. I chose 1920 as the final year of observation for two main reasons. First, the Migratory Bird Treaty Act (MBTA), which was considered the ultimate success of the Audubon movement, came into effect on July 1, 1919. The MBTA alleviated the urgency of bird protection; thus, after the MBTA, the adoption of bird photography was less important than it had been for conservation purposes. Second, there was no significant leadership change until William Dutcher, the president of the NAS, died on July 1, 1920 (The National Association of Audubon Societies 1920, 252). Under his presidency, there was no dramatic change in the promotion of bird photography. Thus, I assume that the practice (taking photos of wild birds) was framed in a fairly consistent way until his death.

3. With regard to coding photos, issues of intercoder reliability are important to consider when the coded messages are latent rather than manifest (Lee 2009). However, the presence of an outdoorsman (a man in a forest, at the seashore, or on a mountain) and hunted birds in photos are relatively unambiguous. Therefore, I coded all data independently. I repeated the coding process after a month without looking at the previous coding results and compared the results. I then went back to the photos once again to check for any miscoding.

4. Appendix 1 provides the results of the supplementary analysis and a detailed description of the variables used in the supplementary analysis.

Figure 1. Bird Photography Adoption, 1887-1920

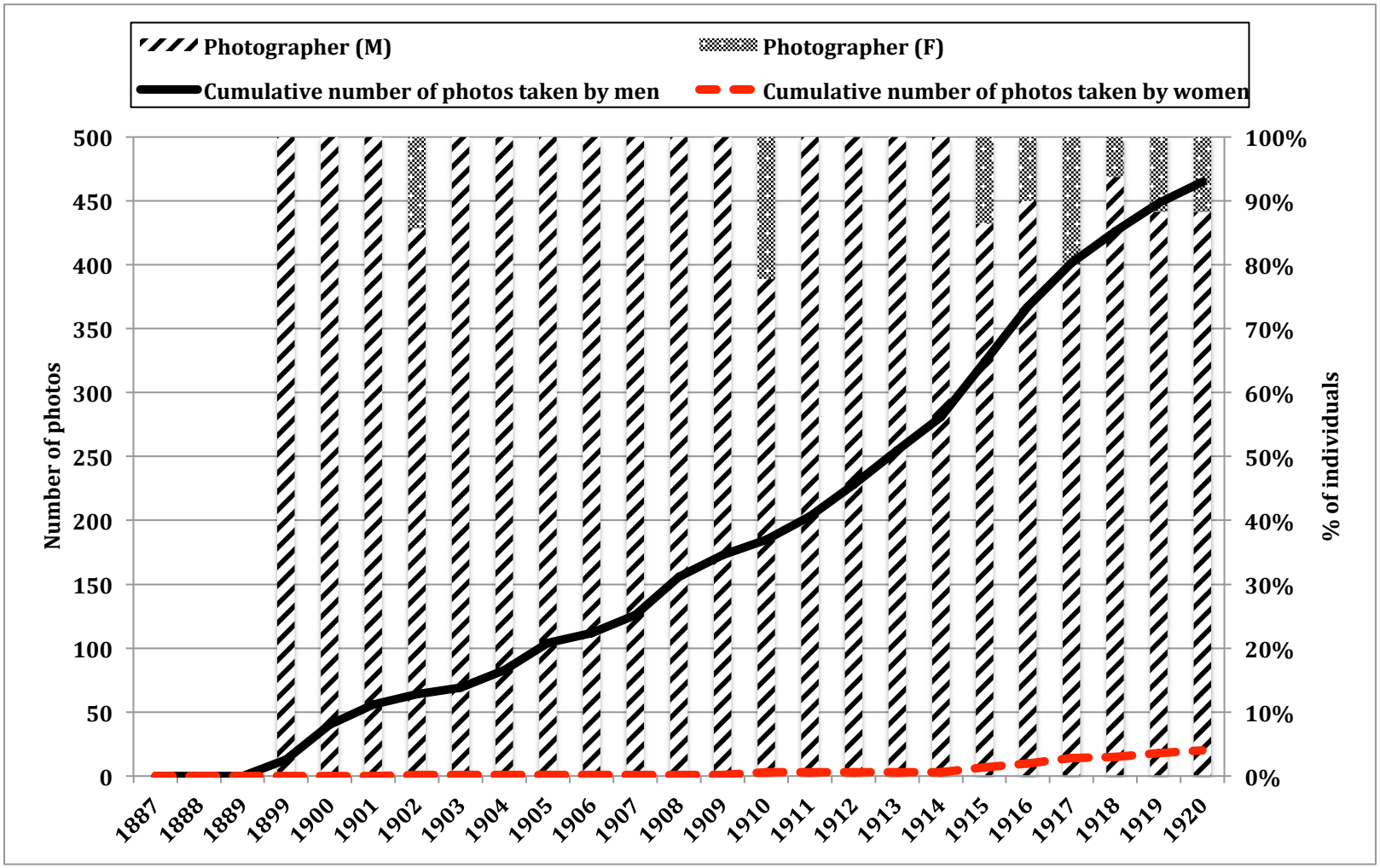


Figure 2. An Article about a New Camera

which works upon the smaller cogwheel, which is fast to the end of the lower roller, D. If the key were freed, the lower roller would at once revolve and pull down the curtain from the upper roller and the curtain would then be wound upon the lower roller again.

The upper roller is furnished with a cog attachment, and a small lever (Fig. 1, F) catches into each cog as the roller is wound up and keeps the roller from turning back. In this way the curtain is wound up on the upper roller and held there.

The small lever or catch (Fig. 1, F) is attached to a longer lever (Fig. 1, G). When the distant end (H) of the long lever is raised a little the end of the small lever at E is forced upwards and releases the roller, and the tension of the spring below winds the curtain back upon the lower roller.

A mirror (I, I) set in a light wooden frame is hinged at the upper end and rests upon a bed of felt-covered strips of wood all around (J, J, J). The mirror is hung at an angle of 45 degrees to the plate, and is placed so that the distance from the lens to the surface of the mirror and up again to a ground glass (Fig. 1, K K) set into the top of the box, is the same distance in a straight line from the lens to the plate. The image comes through the lens upon the mirror and is reflected upwards upon the ground glass, where it is properly focused by means of the ordinary rack and pinion attachment (Fig. 1, Q).

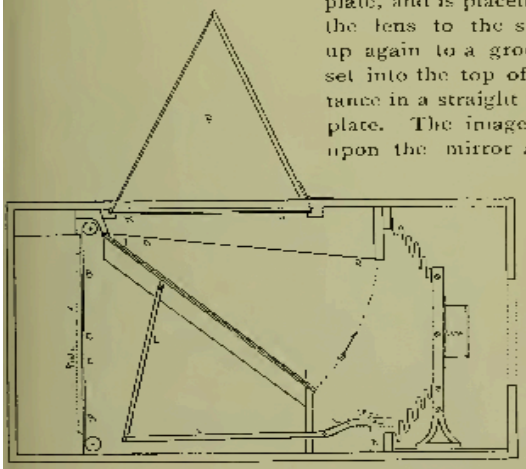


FIG. 2. INTERIOR OF LEFT SIDE OF MIRROR CAMERA (HOOD RAISED)

The mirror is raised by means of the combination of levers (Fig. 2, L, L, L). A spur attached to this lever at M projects through the side of the box and works up and down in a slot (N) cut there for its reception. When the spur of the lever is pressed downwards the mirror (Fig. 2, I, I) is raised and closes tightly upon a felt-lined and light-proof bed (O, O) upon the inside of the top of the box and surrounding the ground glass.

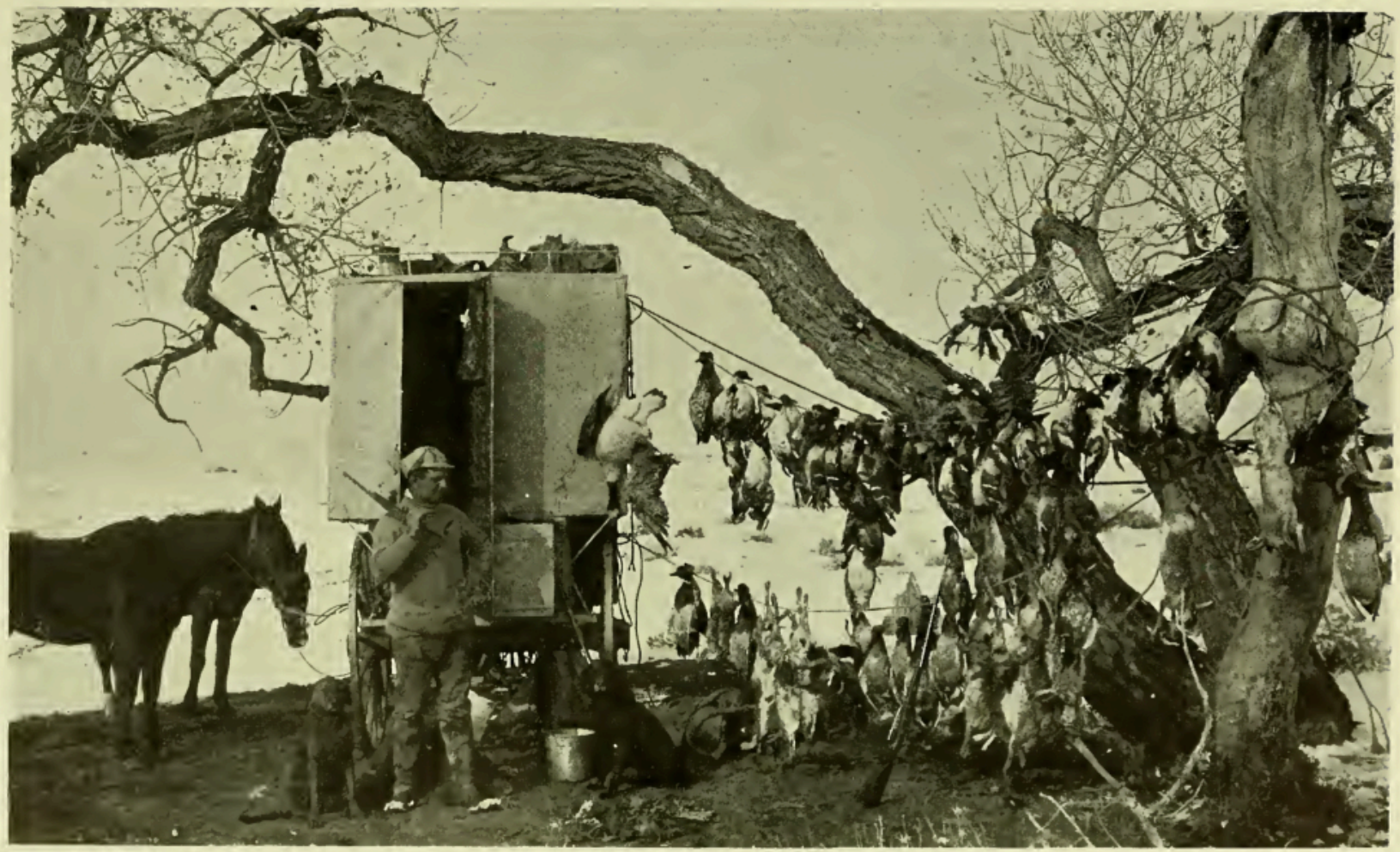
Source: The National Association of Audubon Societies (1900, 39).

Figure 3. A Photo of an Outdoorsman

WILLIAM L. FINLEY,
The National Association's agent for the Pacific Coast, taking moving pictures on the verge of Crater Lake.

Source: The National Association of Audubon Societies (1917, 416).

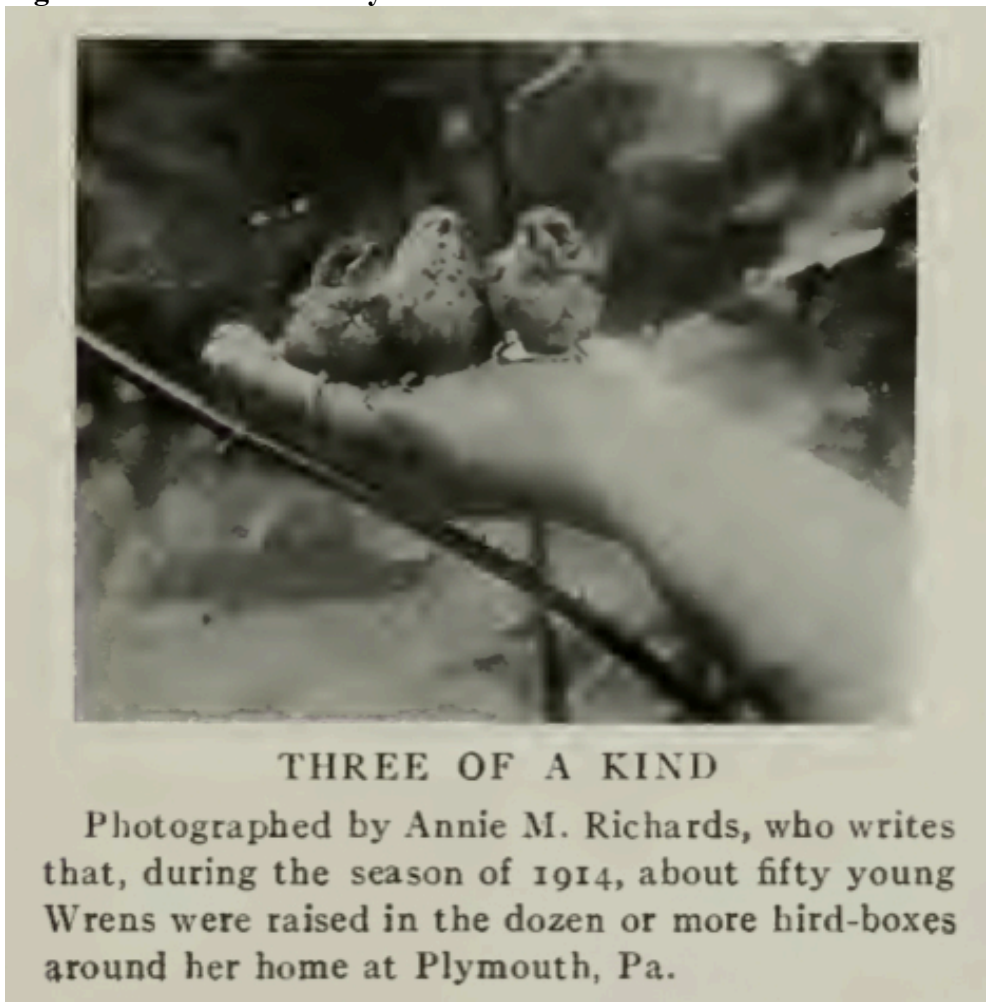
Figure 4. A Photo of a Hunter



ONE REASON FOR THE PASSAGE OF THE McLEAN BILL IN CONGRESS
(Photograph taken in Colorado)

Source: The National Association of Audubon Societies (1913, 69).

Figure 5. A Photo Taken by a Woman



THREE OF A KIND

Photographed by Annie M. Richards, who writes that, during the season of 1914, about fifty young Wrens were raised in the dozen or more bird-boxes around her home at Plymouth, Pa.

Source: The National Association of Audubon Societies (1915, 213).

Table 1. Summary of Variables and Correlations

	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9
1. X-mas census	.043	.203	0	1	1								
2. Official position	.016	.125	0	1	.026*	1							
3. Woman	.302	.459	0	1	-.049*	.039*	1						
4. % of articles written by $men_{(t-1)}$	78.0	5.92	63.2	87.5	-.021*	-.023*	0	1					
5. % of masculine $photos_{(t-1)}$	26.5	17.7	0	70	-.006	-.022*	0	.236*	1				
6. Photos taken by $women_{(t-1)}$	.590	1.33	0	5	.038*	.020*	-.000	-.545*	-.197*	1			
7. % of articles written by $men_{(t-1)}$×Woman	23.6	35.9	0	87.5	-.050*	.037*	.995*	.049*	.011*	-.027*	1		
8. % of masculine $photos_{(t-1)}$×Woman	8.02	15.6	0	70	-.037*	.020*	.780*	.081*	.344*	-.068*	.790*	1	
9. Photos taken by $women_{(t-1)}$×Woman	.178	.783	0	5	-.004	.022*	.346*	-.281*	-.102*	.516*	.298*	.154*	1

N=56703, VIF = 1.2824193

*P<.05

Table 2. Cox Regression Predicting the Adoption of Bird Photography

	Baseline	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
X-mas census	-.402(.344)	-.391(.344)	-.384(.344)	-.391(.344)	-.386(.345)	-.392(.344)	-.389(.344)
Official position	2.43(.330)***	2.44(.330)***	2.44(.330)***	2.45(.331)***	2.46(.331)***	2.43(.330)***	2.43(.330)***
Woman	-1.65(.307)***	-1.65(.307)***	6.77(3.68)†	-1.65(.307)***	-.195(.569)	-1.65(.308)***	-1.99(.374)***
Articles written by men$_{(t-1)}$		.031(.015)*	.041(.015)**				
H1. Articles written by men$_{(t-1)}$×Woman			**-.112(.049)***				
Masculine photos$_{(t-1)}$				.013(.004)***	.017(.004)***		
H2. Masculine photos$_{(t-1)}$ ×Woman					**-.073(.032)***		
Photos taken by women$_{(t-1)}$						-.086(.043)*	-.117(.046)*
H3. Photos taken by women$_{(t-1)}$×Woman							**.266(.139)**†
Number of adopters	210	210	210	210	210	210	210
Number of events	486	486	486	486	486	486	486
Number of individuals	2578	2578	2578	2578	2578	2578	2578
Wald chi2	67.3***	69.6***	76.5***	78.4***	89.7***	71.0***	79.2***
Log pseudolikelihood	-2068.4668	-2066.1656	-2063.3404	-2065.0886	-2061.0048	-2066.5079	-2064.4054

N=56703

†P < 0.1, *P < .05, **P < .01, ***P < .001, Robust standard errors are adjusted for clustering on each individual.

Appendix 1. Supplementary Analysis

I conducted a supplementary analysis to examine whether the results from the main analysis changed with model specifications. I used a Weibull hazard model with an ancillary parameter (the NAS membership) using robust standard errors. Using a Wald test, I chose the Weibull because I found that the shape of the baseline hazard progressively increased over time. I then added an ancillary because the shape of the hazard changed according to the overall growth of the Audubon movement, measured by the membership (Castilla 2007).

In the supplementary analysis, I added four society-level and two organization-level control variables. Of the social control variables, first, I included a year dummy of the war between 1914 and 1918 to control for the effects of the First World War on the diffusion of bird photography, especially among male participants. Second, I controlled for female labor force as a proxy for the gradual change in gender norms. The female labor force data were obtained from the United States manufacturer census of 1860, 1905, and 1923 (U.S. Census Bureau). Third, I included the percentage of New York Times (NYT) articles against bird hunting. The NYT had a broad male readership at the time. When male participants read NYT articles about the brutality of hunting accompanying photos of slaughtered birds in rookeries and colonies, they were likely to be motivated to take photos of birds as the NYT reporters did. I collected NYT articles that contained at least one of these keywords—"bird(s)," "cruelty," "hunting," and "milliner(s)"—from 1865 to 1920. On average, 10.4 (or 0.5%) of NYT articles per year were about bird hunting and millinery between 1886 (the founding year of the NAS) and 1920. The last society-level control variable was the average price of Kodak cameras. The availability of inexpensive cameras was likely to favorably affect potential adopters' decisions to buy cameras and take photos. I calculated the annual average camera price based on data on all Kodak models and prices since 1888 from *History of KODAK Cameras* (1999) and commercials (1900 to 1920) published by Eastman Kodak Company.

In addition to the membership variable, I included another organization-level variable to control for the effect of anti-plumage rhetoric on the production of photos of plume-worthy birds taken by men. The main goal of the Audubon movement was to stop bird hunting for non-food usage, especially for millinery purposes (National Audubon Society, 1887). Movement organizers wrote extensive articles blaming milliners and their customers for the near extinction of American birds (e.g., The National Association of Audubon Societies 1916, 60-62). The anti-plumage articles were published alongside photos of piles of plumes and bird carcasses once bird photography was introduced. The anti-plumage rhetoric was likely to appeal to male readers and motivate them to travel and take photos of crime scenes where plume-worthy birds were killed. To control for the effects of the anti-plumage articles on the adoption of bird photography, I counted the total number of specific vocabularies describing plume hunting in the NAS magazine (i.e., "plume(s)," "hunting," "egret(s)," "milliner(s/ry/ries)"). In the analysis, I used the annual percentage of these words. With the exception of the war dummy, all control variables were lagged by one year to capture causality.

Non-proportional Weibull Model Predicting the Adoption of Bird Photography

			Baseline	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control variables	Social	War	.467(.225)*	.609(.229)**	.592(.228)**	.864(.292)**	.860(.290)**	.481(.232)*	.480(.231)*
		Female labor force$_{(t-1)}$	-3.86(1.92)*	-5.22(2.39)*	-5.09(2.38)*	-4.60(2.13)*	-4.98(2.13)*	-3.90(1.96)*	-3.91(1.97)*
		NYT articles$_{(t-1)}$	-1.71(.995)†	-1.91(1.03)†	-1.84(1.02)†	-2.91(1.19)*	-3.24(1.24)**	-1.66(1.00)†	-1.69(1.00)†
		Camera price$_{(t-1)}$	.003(.005)	.003(.005)	.003(.005)	.006(.004)	.007(.004)	.003(.005)	.003(.005)
	Organizational	Membership$_{(t-1)}$	.000(.000)**	.000(.000)**	.000(.000)**	.000(.000)**	.000(.000)**	.000(.000)**	.000(.000)**
		Anti-plumage words$_{(t-1)}$	.252(.224)	.318(.260)	.308(.259)	.358(.253)	.390(.251)	.250(.225)	.253(.225)
	Individual	X-mas census	-.449(.344)	-.453(.345)	-.448(.345)	-.452(.343)	-.448(.343)	-.449(.344)	-.447(.344)
		Official position	2.28(.323)***	2.28(.324)***	2.29(2.29)***	2.26(.322)***	2.26(.321)***	2.28(.323)***	2.29(.322)***
		Woman	-1.63(.305)***	-1.63(.305)***	6.59(3.27)*	-1.63(.304)***	.853(.957)	-1.63(.305)***	-1.95(.362)***
Articles written by men$_{(t-1)}$				-.042(.018)*	-.031(.018)†				
H1. Articles written by men$_{(t-1)}$×woman					**-.109(.043)***				
Masculine photos$_{(t-1)}$						.026(.007)***	.033(.007)***		
H2. Masculine photos$_{(t-1)}$× woman							**-.125(.056)***		
Photos taken by women$_{(t-1)}$								.012(.045)	-.016(.046)
H3. Photos taken by women$_{(t-1)}$×woman									**.250(.126)***
Constant			29.7(19.4)	47.0(25.1)†	44.8(25.0)†	36.6(21.4)†	40.3(21.4)†	30.1(19.8)	30.3(19.9)
Number of adopters			210	210	210	210	210	210	210
Number of individuals			2578	2578	2578	2578	2578	2578	2578
Wald chi2			81.7***	91.5***	85.7***	93.2***	105.1***	81.9***	85.7***
Log pseudolikelihood			-1408.0267	-1405.3822	-1402.4117	-1402.8768	-1395.864	-1407.9971	-1405.9379

N=36102.

†P < 0.1, *P < .05, **P < .01, ***P < .001, Robust standard errors are adjusted for clustering on each individual.