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The Canadian Alouette women: reclaiming their space

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Introduction

The starting block for the race to space is often recognized as the launch of the Union of Soviet Socialist Republics’ (U.S.S.R) Sputnik satellite in 1957, and the response by the United States (U.S.) with their Mercury and Apollo programs that sent White men into space and then to the moon (Launius, 2007). The White men involved in this Cold War race have been accorded an almost exclusive voice in space organizational histories and in the popular media (e.g. De Groot, 2006; Launius, 2007, 2005). We contend, along with others (e.g. Ruel et al., 2018, 2019; Shetterly, 2016), that these histories cannot and must not be solely about and by these White men, that there had to be many complex individuals involved in the global Cold War space race. Notably, the Canadian Cold War experience made important contributions to space and its exploration. The Canadian military and eventually privately Canadian-owned companies were responsible through the phases of design, manufacturing, testing, launch and operations for the successful Alouette I and II satellite missions. These Canadian scientific satellites marked Canada as the third space-faring nation during this Cold War space race (Godefroy, 2011).
Just as in the U.S., Canadian men were at the center of this space race also. The Canadian focus has been on the ‘100’ men who contributed to the Alouette program as put into evidence via historical artefacts and archival evidence. Silence surrounding the women involved in these Alouette missions appears to maintain their “work sleep[ing] in the forgotten” (Olsen, 1978, p. 11). We argue in this chapter that these Alouette women and their work must be raised out of this sleep and that they be incorporated within the “social circulation […] connections among past, present and future” (Jones Royster & Kirsch, 2012, p. 23). Our attempts to establish these connections are in line with the notion of pluralistic understanding advocated by Maclean, Harvey and Clegg (2016). To this end, we ask how are Canadian Alouette women remembered? And, what are some of the discursive processes involved in this gendered remembering?

The notion of gendered remembering includes men’s recollection of institutional traditions (Hobsbawm & Ranger, 1983) along with women’s “fingerprints upon the handles of history” (Jones Royster & Kirsch, 2012, p. 10). With gendered remembering, we move beyond the past, as “a realistic record of every event and experience in time” (Suddaby et al., 2010, p. 152), refocusing our lens on everyday Alouette complex individuals and their use of organizational histories in the present. With respect to discursive processes, we are concerned specifically with antenarratives (Boje et al., 2016) circulating around Alouette women. Antenarratives are “not yet fully-formed narratives, but rather pieces of organizational discourse that help to construct identities and interests” (Boje et al., 2016, p. 391). Antenarratives and their subjective interests are not fictional tales; they are reflective of processes that embrace critical imagination, in the sense that antenarratives provide us with an avenue to “making connections and seeing possibility […] in remaking interpretive frameworks” (Royster, 2000, p. 83). Some of the literature on collective memory tells us that histories are focused on “what is remembered, not on
what is never acknowledged” (Anteby & Molnár, 2012, p. 531) and that archival silences with respect to women ensure “not simply invisibility but erasure” (Hunter, 2017, p. 203). With our work, we are interested in elevating antenarratives that appear to be ‘never acknowledged’, in particular those surrounding Alouette women, such that these women can be part of gendered remembering in organizational space histories.

We collected stories, narratives, media reports, and photographic images from both Canadian and American-based archival sites to be able to reconstruct this Alouette gendered remembering. We embraced a postmodern approach to these archives (Mills & Helms Mills, 2018), noting that “narratives form in strategic context” (Boje et al., 2016, p. 392). We also interviewed surviving team members transposing their recollections with archival data. We have to date found over 120 Canadian women who were involved in the Alouette I and II satellites. It is beyond the scope of this chapter, however, to reproduce how each of these women are remembered and the discursive processes surrounding them. We focus rather on some of these Alouette women, notably Doris Jelly, Elinor Bachand, Beverly Fulton, Phyllis Timleck, Pat Butler, Ethel Moore and Audrey Scott, and on the discursive processes that surround them. We applied a subset of elements from the generative moments heuristic to these collected data, reproducing antenarratives centered around gendered identities, seeking to see these anew, feeling despair and movement, and playing with artifacts (Dutton & Carlsen, 2011). By doing so, we are contributing to the development of feminist historiography and to the undoing of silences.

We begin by presenting the theoretical framing for this study, looking at silences, antenarratives and gendered remembering. We then consider our methodology, built on the generative moments
heuristic applied to archival documents and semi-structured interviews. We then present our findings and analysis. We close with a brief word on our study’s contributions.

**Theoretical Framework: silences, antenarratives, gendered remembering**

We acknowledge that there are important gendered subtexts in organizational histories that need to be surfaced in line with Allen’s (1986) views on feminist histories and the silencing of the marginalized. This acknowledgement is achieved by looking at the concepts of silences, antenarratives as discursive processes, and gendered remembering as an antithesis to collective memories, which we examine in turn below.

*Silences*

Organizational silence is more than the absence of voice, where voice is understood to be “members of an organization express[ing] their views in an attempt to change organizational circumstances” (Knoll et al., 2016, p. 162). Voice has achieved conceptual maturity in various fields, including human resources management, organizational behavior and psychology. Some (e.g. Knoll et al., 2016) argue that silence has not achieved such conceptual maturity while those focused on power and power-relations in institutions, such as Clegg, Courpasson and Phillips (2006) and their “sounds of silence” (p. 180), dispute this characterization.

There are different aspects to consider in a study focused on silence that need to be teased apart, including who is practicing such silence and where silence occurs; that is, an employee or an employer, and their respective genders and other intersectional identities (Collins & Bilge, 2016) along with contexts. Foucault (1984) explains silence as being things that are not said, declined to be said, or forbidden to be said. He calls on the discretion of the speaker to know the
boundaries “that function alongside the things said […] There is not one but many silences” (Foucault, 1984, location 343-348). Embracing this notion of plural silences, we acknowledge that they can exist across different contexts, where these contexts can be organizational, ethical, behavioral, writing, or archival, to name just a few. Silences in organizations can be defined as the suppression or withholding of genuine expression (Knoll et al., 2016). Harlos (2016) considered employee silences within the context of ethical concerns as “a person’s withholding of genuine expression about behavioral, cognitive and/or affective evaluations of organizational circumstances to persons perceived capable of effecting change or redress” (p. 346). Foucault (1984), within the context of sex, likens silences as “[…] an affirmation of nonexistence, and, by implication, an admission that there was nothing to say about such things, nothing to see, and nothing to know” (Kindle location 59). Olsen (1978), in the context of writing, builds her understanding of unnatural silences along hidden silences “as work aborted, deferred, denied – hidden by the work which does come to fruition” (Olsen, 1978, p. 8). She also talks to censorship silences where the censurer can be the government, publishers, religion or even the self where “deletions, omissions, abandonment of the medium; […] paralyzing of capacity” (p. 9). These hidden and censorship silences in particular are imbued with power, where the marginalized writer remains in the void between creativity and life. Finally, within the context of histories, Carter (2006) states that archival “silence is equated with oblivion” (p. 220). Hunter (2017), drawing from Michel-Rolph Trouillot, likens historical silences to “the power of historians to silence during the moment of creating retrospective significance” (p. 208).

The practice of silences in the context of organizations can be categorized as a behavior inviting us to look at the role of emotions and practices of resistance. Psychologists and sociologists have argued that the practice of silences can come at a considerable physiological and psychological
cost when one actively inhibits the expression of one’s thoughts, emotions and behaviors (John & Gross, 2004; Pennebaker, 1989; Winnicott, 1960). Some have also argued that the practice of silences is indicative of a passive coping strategy (e.g. Tankirk & Richters, 2007). When researchers look to employees as a collective practicing silences, they refer to collective silences coalescing into organizational silence (Knoll et al., 2016). For example, Knoll et al. (2016) looked at collective sexual objectification in the historical airline industry where women are asked to practice caring activities and be glamorous sex objects as a collective while hiding behind a veneer of appropriate service industry standards (see also Mills, 1997; Mills & Helms Mills, 2006). Others question the overall negative framing of employee silences and archival silences in particular. They emphasize that such practices of silences can be influenced by and within power-relations, being used as forms of resistance (e.g. Bies, 2009; Carter, 2006; Donaghey et al., 2011; Foucault, 1988) or as defensive workplace practices (e.g. Bowen & Blackmon, 2003).

There are various typologies and taxonomies for these ‘many silences’. Harlos (1998) and Harlos and Pinder (1999) suggested two types of organizational silence in ethical practices: quiescent silence, which is fear or anger-based; acquiescent silence, which is futility or resignation-based. Kurzon (2007), considering silences in social interaction or in interpersonal communication practices, builds on previous work on silences to present conversation silences where one does not speak and allows the other person in the conversation to speak. There is also thematic silences which relate to women not being given a voice until the 1960s. Kurzon (2007) includes textual silences, where one reads in silence or says a silent prayer. He closes his taxonomy with situational silences where, in a large group of people, one practices rhetorical control (Kurzon, 2007). He underscores the importance of understanding influences from intentional silences and
unintentional silences, psychological presence or non-presence where one withdraws from interactions, social norms and rules from the social code, and a need to consider the amount of people involved in social interactions (Kurzon, 2007).

Such “rule[s] of silence” (Foucault, 1983, p. 128) and the state of research into silences underline a need to consider individuals, power-relations and the contexts in which silences are practiced. We also need to move beyond organizational boundaries towards historical, creative, and cultural influences (Allen, 1986; Harlos, 2016; Hunter, 2017; Knoll et al., 2016). Our understanding of silences, as Harlos (2016) points out, within ontological and epistemological concerns of ‘knowing’ silences is a reflection of the complexities of the self and of the self interacting with others. Harlos (2016) also invites researchers to move away from what she calls traditional work into areas that incorporate researcher and researched. Hunter (2017) underlines that as historians “we are forced […] to narrate and imagine the worlds and feelings of our subjects.” (p.208). We are then less concerned with paradigmatic boundaries, looking more to the complexity of individuals as they interact with others, the power-relations that are embedded in these social interactions and cultural influences as well as the reflexivity of researchers.

We build our understanding of silences in this study as one that embraces Olsen’s (1978) hidden and censorship silences. These hidden and censorship silences are influenced by life happening (Olsen, 1978) - in the sense of time and lack thereof - along with various life experiences, such as the cultural domination of, and systemic discrimination against North American women during the Cold War era (Ruel et al., 2019; Runté & Mills, 2006), are involved. These individuals who “struggle for existence” (Olsen, 1978, p. 11) can and do leave traces via tales
and myths, or antenarratives. We turn to these discursive processes next as part of our theoretical framework.

**Antenarratives**

Antenarratives are not necessarily linear with a beginning, a middle and an end (Boje, 2014). They are rather indicative of “dynamic processes of negotiating inter-relationships” (Boje et al., 2016, p. 393). Antenarratives are not fully formed stories, in the sense that they are fragmented, sometimes incoherent and may be speculations. Boje et al. (2016) present four specific antenarrative processes: they (i) emerge before grand narratives take form; (ii) represent a deeper structure beneath these grand narratives; (iii) reoccur, in a cycle of sorts, in events through time; and, (iv) are the ‘between’ of individual’s stories and the organization’s long-lived grand narratives. Boje et al. (2016), we believe, focused on the spoken or textual word in these fragmented, nonlinear stories and tales, and did not consider photographic images and their influence as possible storytelling vehicles. In this work, we incorporate photographs as part of the dynamic processes involved in social interactions and as part of these ‘in-between’ narratives.

Given these characteristics of antenarratives, we acknowledge that they can reflect critical imagination on the part of the researched and of the researcher in the sense that they can be influenced by an individual’s critical sensemaking processes (Helms Mills et al., 2010; Weick et al., 2005). Sensemaking “unfolds as a sequence in which people concerned with identity in the social reality of other actors engage [in] ongoing circumstances from which they extract cues and make plausible sense retrospectively, while enacting more or less order into those ongoing circumstances” (Weick et al., 2005, p. 409). We come to understand “how different meanings are
assigned to the same event” (Helms Mills et al., 2010, p. 183) by our sensemaking and its seven socio-psychological properties. Critical sensemaking, building on this notion of Weickian sensemaking, addresses some key areas of sensemaking that can be overlooked. Mills and Helms Mills (2004) notably folded power and gender into Weickian sensemaking. Critical sensemaking, a theoretical and analytical method, embraces power-relations and context, along with identities. Furthermore, critical sensemaking looks to plausibility, rather than accuracy, in line with Weick’s sensemaking (Helms Mills et al., 2010). An example of critical sensemaking includes, interestingly for this study on Alouette women, Hartt, Helms Mills and Mills’ (2012) dual ANTi-History and critical sensemaking framework applied to archival materials. The interpretation of these materials support the notion that history is socially constructed storytelling with respect to gender relations.

One premise of critical sensemaking is that social realities and interactions cannot be understood without looking at discursive practices such as antenarratives. Focusing on antenarratives and critical sensemaking leads us to reveal constraints the individual may face, and incites them to “seek out familiar solutions that have worked in the past […] [that] maintain the social status quo” (Helms Mills & Mills, 2009, p. 175). These familiar solutions can be influenced, in part, by institutional and cultural rules and meta-rules (Mills & Murgatroyd, 1991), such as women leaving work to marry and raise children (e.g. Ruel et al., 2019), and by social values (Unger, 1987b, 1987a), such as the historical belief that women were not technically/scientifically inclined (e.g. Hacker, 1989). These rules and social values are an integral part of the influences on the complex individual within organizations and in their storytelling (Boje et al., 2016).
These antenarratives and critical sensemaking that surrounds such discursive processes guide us also to think “about the silent in that time of the twelve-hour-a-day, six-day work week” (Olsen, 1978, p. 11). We must then consider the guiding hand of critical imagination in the sense that we build on these fragments of tales and stories, recognizing the cultural and social boundaries erected by larger systems of exclusion and domination. In this effort to recognize this guiding hand, we turn now to the notion of gender and gendered remembering.

*Gendered remembering*

‘Doing gender’, according to West and Zimmerman (1987), is a “complex of socially guided perceptual, interactional, and micropolitical activities that cast particular pursuits as expressions of masculine and feminine ‘natures’” (p. 126). By embracing this notion, we are focusing on both interactional and institutional contexts where we ‘do gender’, as representing “the most fundamental divisions of society” (West & Zimmerman, 1987, p. 126). ‘Doing gender’ provides such an “interactional scaffolding of social structure, along with a built-in mechanism of social control” (West & Zimmerman, 1987, p. 147). Such mechanisms of social control and, we would add, performance are “fundamental in forming the social nature and ideals of individuals” (Anderson, 2016, p. 175).

We acknowledge this gendered scaffolding and social control, and that we ‘do gender’ in an ongoing fashion in a particular context. Knowing ‘your gendered place’, within such scaffolding and social control, is reflective of ongoing power-relations. For example, a woman who chooses to work in a masculine-dominated context, such as the space industry, might find herself walking a tight-rope between ‘doing’ her feminine gender while also at times being accepted as an ‘honorary man’ in social interactions (Ruel, 2019). American and Russian space Cold War
histories – along with the few Canadian space Cold War histories – perpetuate another aspect of this ‘doing gender’ spectrum beyond the feminine; that is, these histories talk extensively to the masculine hero rhetoric (e.g. Launius, 2005; Ruel et al., 2019). Such hero rhetorics are indicative of masculine/masculinities norms (Connell, 2005; Hearn, 2000; Knights, 2019) that are performed as both a meta-rule and as a social value. These norms are not only experienced and performed by the men in this industry but also by the women who are embedded in such a context.

The various complex aspects, including meta-rules and social values, involved in ‘knowing your gendered place’ we argue can also be practiced and reflected in acts of organizational remembering. The problem to date, however, is that organizational remembering or collective memory is focused on representing linear and, in some cases, factual accounts of past events by homogeneous individuals that form a collective. Notably, one definition of collective memory is the “reconstruction of the past that adapts images of ancient facts to present beliefs” (Anteby & Molnár, 2012, p. 517). These collective memories are process-based and dynamic, where events are chosen that reflect the homogeneous collective (Casey & Olivera, 2011). Organizational mnemonics (Zerubavel, 1996), a branch of collective memories, are concerned with how organizational collectives establish a collective identity such that this identity provides boundaries that define the social institution (Coraiola et al., 2018). These social institutions are represented by social actors who collectively remember and share their memories of successes, practices, and collective meaning-making along with collectively forgetting the past (Coraiola et al., 2018). Organizational mnemonics rely, in part, on collective memories of “the specific social and historical contexts of organizational memory” (Rowlinson et al., 2010, p. 69) that aren’t necessarily ‘true’ or objectively accurate. What is troublesome here is that while organizational
mnemonics acknowledge that memories can be influenced “by the relations actors establish with other field-level actors” (Coraiola et al., 2018, p. 52), where these social actors can be the state, professions or social movements (Coraiola et al., 2018), the underlying assumption is that these actors are homogeneous and are a collective that share a similar identity. In other words, in these constructions of remembering, management and organizational studies tend to embrace homogeneous, neutral concepts, such as “collective”, “actors”, “community”, etc. Such neutral treatments remove questions and influences of ‘doing gender’ and of intersectional identities, such as ethnicity, race, sexuality, etc., as well as the exclusionary order that these intersecting identities can (re)create (Crenshaw, 1989, 1991).

Over forty years of research has shown that the organization is not neutral or homogeneous when it comes to embedded complex individuals. ‘Doing gender’ is a social reality that needs to be addressed in organizational studies and, in particular, historical organizational studies. Case in point, Kanter (1977) underlines with respect to the concept of managers that:

“a ‘masculine ethic’ of rationality and reason can be identified in the early image of managers. This ‘masculine ethic’ elevates the traits assumed to belong to men with educational advantages to necessities for effective organizations: a tough-minded approach to problems […] to set aside personal, emotional considerations in the interests of task accomplishment” (p.43).

Furthermore, we see that in certain organizational contexts, such as in science, technology, engineering and mathematics (STEM) contexts, collective memories are imbued with masculine/masculinities notions (e.g. Ruel, 2019; Watts, 2010). In contrast, when we talk of a collective and collective memories that are predominantly women, this is historically linked to
and gains legitimacy with feminist movements and the universal experience of subordination, as Joan Wallach Scott (2011) points out. Research on collectives and collective memories in contexts where there are token women (Kanter, 1977) underscore for us that these women have difficult choices to make with respect to the (re)creation of collective memories: they must either take gendered steps to assimilate into this collective, or walk a fine-gendered line, or recognize that they can be isolated from this collective (Bowen & Blackmon, 2003; Ruel, 2019; Watts, 2010).

Given our focus on organizational histories and archives, we must also acknowledge Harris (2001), who moves away from Derrida’s binary opposition of remembering and forgetting in archives. Harris (2001) embraces rather ‘imagining’ and the intertwined nature of remembering and forgetting:

“there is no remembering without forgetting. There is no remembering which cannot become forgetting. Forgetting can become a deferred remembering. Forgetting can be a way of remembering. They open out of each other, light becoming darkness, darkness becoming light. And dancing between remembering and forgetting, at once spanning them and within each, is imagining.” (p. 6)

With respect to this archival dance in the ‘imagining’ and applying it to space organizational histories, Miller and Olivera (2006) looked at the National Aeronautics and Space Administration (NASA) and their difficulties in keeping track of incident reports (i.e. some misfiled, no indexes, etc.). They offered two interpretations for this collective forgetting: intentional or unintentional processes that were influenced by a politics of forgetting (Nissley & Casey, 2002); or intentional, organized forgetting – that is, strategic forgetting (Casey & Olivera,
These purposeful actions, we argue, are more layered than a question of intent or non-intent. This is similar to the notion of silences, as we discussed previously, that is beyond such questions of intent. Reaching into the Harris archival dance as a cue, the first author recalls having to do these NASA incident reports, without having any training on how to complete them, along with juggling two missions, multiple international stakeholders, and managing home responsibilities (that is, four children). There was no strategic or political intent in forgetting, that she can recall; it was, anecdotally for her, an experience in lack of training and of time, and of being spread too thin across multiple responsibilities. Importantly, she also now retrospectively recognizes that she embraced hidden and self-censorship silences for fear of gendered reprisals from her masculine/masculinities-dominated context. Her silences with respect to NASA incident reports for her missions include her embracing critical sensemaking – identities including gender, power-relations, retrospective, plausibility, etc. - and imagining. By doing so, she moves across a spectrum of productive and oppressive power-relations as opposed to binary representations.

In light of these insights and what we know of ‘doing gender’, we believe we need to re-contextualize and re-claim nuanced understanding of power-relations in such gendered space contexts, and the influences on remembering and forgetting in organizational space histories. In Anteby and Molnár’s (2012) work within the aerospace industry, they underlined that shared beliefs of what should be remembered and what is forgotten are two sides of the same coin, in line with Harris’ (2001) work. Importantly, Anteby and Molnár (2012) define this relationship across remembering and forgetting as “who we were not…[and]…who we are” (p. 532). In our re-contextualized understandings of women in the space industry and the stories that surround them, we note that they face important challenges of being either assimilated, walking a fine-
gendered line, or being left on the fringes. In other words, women and antenarratives that surround them may appear for a time to be part of ‘who we are’ while also residing in ‘who we were not’. These women might also embrace hidden and censorship silences, inviting this dance between gendered remembering and forgetting to continue via antenarratives that bubble to the surface. These marginal, fragmented tales may be reproduced by others, men included. It is left to those in the present and the future to shape and reshape these tales and stories. Some throw out those stories and antenarratives that do not reflect a homogenous collective in organizational histories. We are advocating with our work to move the fragmented stories and tales surrounding women in the space industry into productive power-relations such that we can embrace pluralistic understandings of ‘who we were not’ and ‘who we are’ in organizational space histories.

Methodology

We present in our methodology the nature and the method of data collection that we used. We then move to our data analysis framework, with the goal of answering our research questions: how are Canadian Alouette women remembered? What are some of the discursive processes involved in this gendered remembering?

Nature of Data and Method of Data Collection

The body of evidence in this study relies on four sources: Library and Archives Canada’s Alouette I and II collection of documents; NASA’s National Headquarters archives on Alouette I and II documents; the Friends of Communications Research Centre (CRC) organization; and, semi-structured interviews with individuals who worked on these Alouette missions.
The Library and Archives Canada hold an extensive number of documents, well over 1500, focused on Alouette I and II. Within these documents, we found three major fonds created and housed under the following individuals: John H. Chapman, Colin Franklin, and Curtis Yool. The first two individuals were senior executives and managers for these two missions, while Mr. Yool was responsible for taking and collecting photographs of various events in and around Alouette I and II. These archival documents include annual reports, summary and full reports of events, meeting minutes, media reports, celebration and commemorative notes, technical mission specific documents, etc. Importantly, we found extensive formal organizational charts dating from 1958 until the end of the 1960s, outlining positions, roles and responsibilities of key personnel involved in these missions. We also found a number of personal notes and letters between various individuals, providing a view into social interactions at the time.

As for the NASA Headquarters archives, there were no significant individuals attributed to the files that housed the Alouette I and II mission information. In fact, the first author found an interesting contrast between the Canadian archives and the U.S. archives: the personal touches, such as correspondence and notes to secretaries or personal letters, pictures of local events, etc., were present throughout the Canadian archive while the U.S. archives were sanitized to such an extent that it was difficult to find any one individual within these archives.

The Friends of CRC have both a web-based presence along with monthly meetings where former employees and those interested in the work of CRC are invited to support various activities. Through their web presence and through a presentation made by the first author at one of these monthly meetings, we were able to connect with a number of individuals who worked on Alouette I and II.
We conducted interviews with some of the Alouette members of the “farm team” (transcript, James Mondo⁴), and uncovered additional personal photographic images and stories that individuals consented to share. The semi-structured interviews consisted of collecting various fragments of historical narratives along with pictures and notes taken at the time. These interviews were audio recorded and transcribed. In one instance, the first and second authors took copious notes instead of recording the interview, given the participant’s request. These notes were later transcribed into a combined narrative.

We did face a dilemma about anonymizing our various informants. Our research intent is to write these Alouette women back into space histories. It is interesting that we promised confidentiality to the men we interviewed, such that their identities are concealed here by using pseudonyms but we do not conceal the identities of the women named in their reminiscences. The woman whom we have been able to interview thus far, notably Doris Jelly, gave her written consent to reveal her identity. As this research continues, we will continue to seek consent from the Alouette women to reveal their identities.

*Data Analysis Framework*

The generative moments heuristic (Dutton & Carlsen, 2011) permitted us to focus on the Canadian Alouette women and antenarratives, while also melding in the dominant class of men who contributed to these missions. Critical imagination, an important influence on the generative moments heuristic, guided us in the gendered remembering surrounding these Alouette individuals. We were able to acknowledge the ‘contentious’ nature of history, which is not as well-defined as others would have us believe (Clark & Rowlinson, 2004), and focused our analysis on historical silences surrounding the women’s contributions to the Alouette missions.
We evoked Dutton and Carlsen’s (2011) five themes in the generative moments heuristic: seeing anew, feeling despair and movement, daring to engage, interrelating, and playing with artifacts. We chose to focus on seeing anew, feeling despair and movement, and playing with artifacts, as we explain below. Seeing anew pulls on critical imagination and enables the creation of new questions and conversations. For example, the organizational charts we found in archives clearly identified women as ‘Miss’ or ‘Mrs’, even when some of these women had PhD’s. We showed these organizational charts to some of the individuals we interviewed, along with some pictures found in archives that had no names associated to them. Some of these images included a ‘space princess’, where a woman was crowned at a monthly beauty pageant event, and what one of our interviewees (emphatically) called ‘a wife’ accompanying her husband to a scientific conference. Looking back at these organizational charts and at these images, the interviewees and the interviewers were challenged to see these artifacts anew, reflecting social values and organizational rules of the 1960s and transposing them to contemporary values and rules in such a way to assess anew.

Feeling despair and movement incorporates feelings into embodied knowing, acknowledging emotions in gendered remembering. Returning to our example, the first author was initially surprised at the use of ‘Miss’ or ‘Mrs’, and the vehemence of our interviewee calling the woman pictured ‘a wife’. This surprise led to her reflecting on her embodied experiences of the space industry in the 20th and 21st centuries, notably how she had been positioned and affectionally named a ‘space princess’ by her colleagues and then feeling despair at how this had positioned her below her counterparts who were all men. The importance of this aspect of the generative moments speaks to not only the interviewee’s feelings but also the interviewer’s movement through her own emotions and her embodied experiences of knowing.
Finally, *playing with artifacts* materializes data as “symbols that store insights…propel[ing] understanding and growth” (Dutton & Carlsen, 2011, p. 216). Photographic images and antenarratives became our site of play, where we offered counter claims to refute the masculine-centric collective Alouette stories. Our goal, to be clear, was not to diminish the role the men played in these missions; our goal was to propel Alouette women into the present and the future. Playing with artifacts became a possible source of inspirational gendered remembering in which these Alouette women and their roles were no longer ‘sleeping in the forgotten’, and no longer lost to the hidden and censorship silences.

We focused on these three aspects of generative moments to re-create possibilities of knowing and of learning. These possibilities reside for us in liminal spaces, pushing idea change through relational stories. For example, in one interview, Doris Jelly talked about her start as a student in the Alouette program. She also shared more recent (1970s) space responsibilities, including her work on the Hermes satellite (an experimental communications satellite). The ultimate goal of Hermes was to set up telemedicine services to the Canadian North. Ms. Jelly spent considerable time explaining the mission and sharing pictures of herself interacting with various stakeholders on this mission. During her fragmented storytelling, the first author had moments of knowing and learning with respect to her own work on communications satellites for the North. The first author went so far as to state to Ms. Jelly that she would have loved to have met her 20 years ago, and that if she had, the first author might have navigated her job and role in the contemporary space industry in a different fashion. This social interaction and the web of power-relations pushed gendered remembering to an unexpected, liminal space of knowing, not only for the first author but also for the second author who was present for this interview. We three embraced this web of plausibility, bringing forward this experience to the present. In other
words, we acknowledge that we were influenced with and by our interactions with the various Alouette individuals.

Findings and Analysis

The surfacing of antenarratives surrounding the Canadian Alouette I and II satellite missions and the women involved in these missions reflects a multitude of complex organizations and gendered individuals. Notably, these two satellites were designed, constructed and operated via the Defence and Research Telecommunications Establishment (DRTE), reporting to the Canadian Minister of Defence (DRTE, 1960a). A mix of public companies, including the Cosmic Ray Section of the National Research Council (Chapman, 1964), private companies, including De Havilland Aircraft Co., RCA Victor Co. Ltd, Sinclair Radio Laboratories, and Spar Aerospace (DRTE, 1972), and international companies, including the NASA-provided launch and Goddard Space Flight Center (NASA, 1962), all contributed to these missions. These organizations are important to recognize here given the fragmented stories surrounding who were involved in these missions (e.g. Godefroy, 2011) and the many antenarratives that took form in these different contexts.

Focusing in on DRTE, through our archival search we uncovered men and women who worked in various capacities on Alouette I including 35 engineers, 17 physicists and over one hundred support staff (Chapman, 1964; DRTE, 1960b, 1972). While enumerating these types of quantitative data reflects more of a modernist approach to archival research (Mills & Helms Mills, 2018), we approach archival data as postmodernists. This implies that we are concerned with the ‘how’ of the collection of artefacts, including judging and imagining the discourses in those collections (Mills & Helms Mills, 2018).
To this end, from the first and third authors’ previous work on the U.S. space industry (e.g. Ruel et al., 2019), they learned that there was a proliferation of ‘space princesses’ across U.S. space organizations. These space princesses were representative of what women were ‘supposed’ to be like in the context of this industry, as representatives of the feminine ideal. Drawing on this knowledge, we did find one Canadian media report, reproduced in figure 1, that is similar to antenarratives surrounding the U.S.-based space princesses.

We acknowledge that this Canadian space princess, an unnamed secretary working at DRTE, symbolizes one ‘how’ of the gendered remembering around Alouette. It is also important to underline that this is the only image of an Alouette woman available in the public domain. Through our interviews, we found that space princesses were indeed more prevalent than what was initially found in archival boxes from Library and Archives Canada. From the Chairman of the Friends of CRC John Brebner’s private photographic collection and subsequent conversations, we learned that as a way to keep “things interesting” for the people working on these missions, the DRTE held beauty pageants regularly (see figure 2). Brebner also shared with us that images of women would also appear in slide carousels, as a way to break the monotony of calculations and technical drawings.

These particular antenarratives are but one example of how Canadian Alouette women are remembered. Drawing inspiration for seeing anew and feeling despair for this way of remembering these women and their mission contributions, we looked to instances of gendered
remembering focused on men, hoping to achieve some movement away from these representations of the feminine in space. Canadian men were indeed reproduced extensively through images and media reports that we found in archives, and through various images shared by our interviewees. These Canadian men were often portrayed as being serious, hardworking, and interacting with space hardware as reflected in Figure 3.

Imagine for a moment what the following Alouette antenarratives surrounding women, in Figure 4 and 5, from Brebner’s personal collection could tell us about women working on these missions.

We learned recently through *Hidden Figures* (Shetterly, 2016) that Black women played an integral role in getting U.S. White men to the moon. These Black women acted as human computers, or mathematical wizards, taking on complex and detailed orbital calculations. In the case of Alouette women, we learned of the presence of such human computers working on these Canadian Alouette missions (Figure 4). We also learned of women’s responsibilities as scalers (Figure 5). At the time, we were not certain what the archival documents were telling us with respect to these scalers. One of our interviewees (Dean Lorie’) helped us decipher what was being said and shown in photographic images about these women scalers. Lorie shared his own antenarratives surrounding these women scalers, reconstituted here as a flowing story:
**Dean Lorie:** The scalers weren't hired to do research. They were hired to pick parameters off the ionograms. For example, they might pick several points along the X trace on an ionogram. These would be fed into a computer by a scientist and the electron density from the satellite height down to the height of the maximum density of the F2 layer calculated.

There were about 4 or 5 ladies working on contract to "scale" (i.e. get information from) the ionograms. If she were scaling ionograms, there should also be a projector containing a roll of film with the ionograms on it. This was 40 to 50 years ago so, except for Elinor [Bachand], I can't even remember their names. The lady I referred to, Elinor Bachand, was special. Elinor was special because she was fast and accurate. She investigated large numbers of ionograms looking for a particular feature. I wanted to make her a co-author on some papers but was told that because she was a contract employee she couldn't be an author or even acknowledged.

**Interviewer:** When you say pass on the information so that a scientist can feed it into a computer, do you mean these scalers would use punch cards to capture the data and then give the punch cards to the scientist (like you)?

**Dean Lorie:** You are correct. The ionograms were projected onto a screen and cross hairs were clicked on the point of interest and the coordinates transferred to punch cards.

The presence of these women scalers and their work appears to lie in the hidden and censorship silences, supported by their employment status as temporary, contractual employees. We recognized, upon analyzing these antenarratives and Dean Lorie’s expression of surprise that we
were interested in these scalers, that these women scalers were more than what the objective past was telling us. Today, notably, these women scalers would be recognized as technologists or technicians fulfilling key satellite data mission responsibilities. By seeing anew and holding onto a movement forward, we are breaking these historical silences in such a way to bring at least Elinor Bachand into the present, to celebrate her contributions on these missions and to inspire current women data mission specialists.

We were excited about the possibilities with this movement forward, and once again we turned to Dean Lorie to help us understand what some other fragments were telling us, reproduced here again as a story that lives in the antenarratives’ ‘in between’:

"Mr. Petri and Miss Fulton asked for the latest roll-off curves on the low band sounder aerial. The most recent figure from the Sinclair Radio Lab is approx. 36db attenuation at 0.5MC/sec […] Dr. Warren's group would study the present antenna characteristics."

(Barry, 1960)

**Dean Lorie:** I don't know why Len [Petri] and Bev [Fulton] wanted the roll-off curves; possibly because of some research Len wanted to do. The Alouette and ISIS satellites had two crossed dipoles, a short one for the lower frequencies and a long one for the higher frequencies. I think this quote must be before the launch of Alouette 1 because I think the crossover frequency was higher than 0.5 MHz (this is an old quote because we don't use MC/sec anymore.) Eldon Warren was our group leader. I guess he was involved in designing the best antenna for ionospheric studies.
There weren't that many women that worked on the science [side]. Phyllis Timleck and I and a summer student [Doris Jelly] did some statistics on ground reflected echoes from Alouette 1 and 2. Bev [Fulton] must have been an engineer but I don’t know where she is or what happened to her.

We found other instances of Beverly Fulton’s presence in technical meetings, working on the science side of the Alouette mission, given the scientific quotes we can attribute to her. What is surprising in some of these documents is that she was part of technical discussions which must have been meetings full of men, yet another individual (James Mando) could not remember if there were any women involved in any of the technical meetings: “there were probably secretaries in the meetings but not sure”. We probed further with Mando, asking about one particular scientist who was a mentor for Doris Jelly (see figure 6).

We attempted to recreate relational stories for Mando, to instigate idea change, by asking if the name Moira Dunbar meant something to him: “Moira Dunbar was quite well known. Notable scientist in Arctic research but not on Alouette. I used to hear about Moira but I don’t think I ever met her”. This movement away from Alouette meetings and further discussions about the first author’s experience in the Canadian space industry appeared to help Mando make important links with respect to women’s roles on Alouette missions. Three such Mando antenarratives, including Figure 7, are shared here:
James Mando: [In 1957, there were] lots of women in various functions but not yet secretaries. There was Pat Butler, photography, and Ethel Moore produced illustrations and engineering drawings. [The] photography and drafting was really important; Ethel [Moore] had all the schematics produced for Alouette 1 […] If we didn’t have the photographs and illustrations, don’t know what we would have done!

While preparing to go to Vandenberg [Airforce Base] [for launch in 1962], Frank Davies’ secretary [Audrey] Scott had been watching the goings on and absolutely wanted to go with them. Davies said no – he got very nervous about this group of young men (20 somethings) letting loose. A male secretary was sent instead which raised eyebrows by NASA (couldn’t believe that a man was a secretary!)

Why was Mando initially steadfast in his gendered remembering that there must have been women but he couldn’t recall their presence in meetings? Perhaps he experienced “introspective certainty” (Nisbett & Wilson, 1977, p. 255) about the absence of women since the Alouette technical events were salient in his perceptions and memories. In other words, women scientists might run counter to a plausible cultural rule in this man’s recollection of institutional traditions (Hobsbawm & Ranger, 1983). Mando did have “direct access to a storehouse of private knowledge” (Nisbett & Wilson, 1977, p. 255) and personal facts about the Alouette missions, hence his confidence that no women could be recalled as being present. When we directly asked about the Alouette women, his a priori rules and meta-rules in his particular context made him confident that there would have been none present.

It is also plausible that at the time of the missions, the gender of team members was not seen as relevant to Mando’s tasks and plans, so attributions of gender to work done did not occur. When
asked to recall the presence of team members, he simply relied on the perceived likelihood that there would have been women present. Furthermore, because we were asking about events that occurred over 50 years ago, it is also likely that Mando would have been relying on representativeness as opposed to actual memories. Representativeness is used here in the sense that if an individual is, say, a librarian, one would compare his information about the individual with the contents of his stereotype concerning librarians (Tversky & Kahneman, 1974). Cues that we provided through our relational stories, such as talking about Doris Jelly and Moira Dunbar, about the relevance of gender allowed him to re-classify his memories of the team members as men or women. Thus his gendered remembering and the accompanying silences were not cases of intentional vs unintentional practices, as Miller and Olivera (2006) would have us believe. Rather, it is plausible that Mando did not know about the women because they were not encoded in terms of gender in his memories of Alouette events.

**Conclusion**

There is a need, as Godfrey *et al.* (2016) state, for there to be an “entwining of history with morality and social impact” (p. 599). The need to recognize ‘doing gender’ in space organizations, as one such morality and social impact study, guided our investigation into the Alouette I and II satellite missions and the hidden and censorship silences that have been carried through time. The grand narratives of the ‘100’ men are central to the rhetoric of a “teleology of success” (Suddaby *et al.*, 2010, p. 161) for these Alouette missions. These meta-narratives propelled us forward to see these missions anew, to seek movement forward and to play with cultural artefacts to re-imagine what the gendered historical heritage could be with respect to Alouette.
In this study we do not wish to undo the work of these ‘100’ men. We are looking to unravel the institutional traditions around focusing only on these ‘100’ and to consider various discursive processes, grounded in Boje et al.’s (2016) antenarratives and in the addition of photographic images to our understanding of antenarratives. Through a framework of silences, antenarratives and gendered remembering, we presented how Canadian Alouette women’s ‘sleeping in the forgotten’ can be undone such that a broader understanding of who they were and what their contributions were can be part of space organizational histories. With this gendered remembering study, we are making a contribution to the development of feminist historiography by subverting normative, masculine/masculinities-centric collective understandings of stories and embracing partial tales to bring some of these Alouette women to the fore.

References


Library and Archives Canada.


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i We recognize the socio-political characterizations of race, gender, class, etc., that are produced through discourses. To this end, we capitalize the ‘White’ and ‘Black’ races but leave ‘woman’ and ‘men’ un-capitalized.

ii The terms ‘women’ and ‘men’ encompass the feminine and masculine normative cisgender-experiences that are attributable to these social positions, and how gender is ‘done’ (West & Zimmerman, 1987). In other words, women and men are created and recreated through social interactions (West & Zimmerman, 1987).

iii We use ‘complex’ to reflect a lens of “mutual construction […] [across] people’s lives and identities [that] are generally shaped by many factors in diverse and mutually influencing ways” (Collins & Bilge, 2016, p. 26).

iv This is a pseudonym to protect the participant’s identity.
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Figure X.1: Canadian space princess (The Ottawa Citizen, 1961)
Figure X.2: More Canadian space princesses (Brebner, 2014)
Figure X.3: DRTE men interacting with Alouette artifact (Brebner, 2014)
Figure X.4: Human Computer (Brebner, 2014)
Figure X.5: Two DRTE scalers (Brebner, 2014)
Figure X.6: Doris Jelly (center) pictured with co-workers at DRTE (Jelly, 2019)
Figure X.7: Pat Butler, Photographer (Brebner, 2014)