The “silent killers” of a STEM-professional woman’s career

Stefanie Ruel
Department of Business, Athabasca University, Edmonton, Canada

Abstract

Purpose – The purpose of this paper was to provide a plausible answer to how there are so few science, technology, engineering and mathematics (STEM)-professional women managers in the Canadian space industry.

Design/methodology/approach – The author showcased one such individual and her experiences of the exclusionary order in this industry, by focusing on her discourses and those of her former supervisor. The author applied the critical sensemaking (CSM) framework to unstructured interview data and to various collected written documentation. To guide the author’s application of this CSM framework, the author asked and answered the following questions: what is the range of identity anchor points associated with, and available to, a STEM-professional woman within the Canadian space industry? What is the relationship between these anchor points and organizational rules and social values? And, how do these anchor points and their relationship with rules and social values influence the exclusion of STEM-professional women from management positions within this industry?

Findings – The author surfaced a STEM-professional woman’s range of ephemeral identities, captured within her range of attributed anchor points. The author also revealed some of the rules and social values of the organizational context she worked in. The author then analyzed the how of her exclusionary social order, by studying the relationship between these anchor points and these rules and social values.

Social implications – In addition to addressing the lack of STEM-professional women in management and to filling a gap in the literature, this study made a contribution to our understanding of social-identities, represented by anchor points, and to their discursive reproduction within organizational contexts. The author also suggested micro-political resistances to undo this social order for one particular individual.

Originality/value – This study’s value can be measured by its contribution to the postpositivist cisgender and diversity literature focused on intersectionality scholarship, specifically in the area of identity anchor points and their (re)creation within social interactions.

Keywords STEM, Intersectionality, Discourses, Anchor points, Critical sensemaking framework

Paper type Research paper

Humans have been fascinated with the idea of space and its exploration since we first looked up at the stars and wondered about them. The space industry, as we know it today, grew from this curiosity to attempts to control the heavens via the Cold War between the USA and the Union of Soviet Socialist Republics (USSR) (Hartt et al., 2009). During these military attempts to control space, the Canadian space industry was brought to the attention of the global space community with the USA-provided launch of the Canadian-designed and built Alouette satellite in 1962 (CSA, 2012b), marking Canada as the third spacefaring nation after the USA and the USSR. These global space military efforts would eventually lead to global capitalist concerns with respect to space. To this end, the contemporary Canadian space industry is now recognized for its strengths in such areas as satellite-based communications, earth observation and space robotics (AIAC, 2015). The Canadian arm of the global capitalist space industry generated, in 2012, revenues totaling $3.32B (CSA, 2013). A diversity[1] of individuals work together to achieve these capitalist goals, holding various professional[2] occupational positions including scientific/technical/engineering and administrative/corporate roles. Specifically, 7,993 individuals worked in the Canadian space industry in 2012, where 2,932 were engineers/scientists/technicians and 671 were managers (CSA, 2013).
The problem that I set out to study was hidden in these statistics, and was reflected in my experiences in this industry, as the only Canadian woman in her late career to fulfill the role of Life Sciences Mission Manager. As I was completing my graduate degree, while working full time in this industry, I began to look around me to find that I was often the lone woman at the table in technical/operational meetings. I was surrounded by White, military-trained and/or engineering-trained men who predominantly occupied science, technology, engineering and mathematics (STEM)-management positions. Delving into these statistics, I found that STEM-professional women represented less than 20 percent of managers in 2012 across this industry (CSA, 2012a; Catalyst, 2013). I also found that Canadian STEM-professional women were, and continue to be, relegated into supporting technical and/or administrative, corporate roles in spite of their ongoing efforts to try to climb the corporate ladder into STEM-management/executive positions. This social order, where White military-trained men were in senior management positions while women, White or ethnic/raced, were excluded and marginalized into supporting roles was, simply stated, unacceptable. Stating something as unacceptable does not address the problem, however, nor does it reveal the social order and its systemic exclusionary reproduction.

To surface what it means to work in such an exclusionary social order, I decided to look into the day-to-day interactions among individuals in this industry. Specifically, I looked at mundane discourses among cisgender men and women, who were STEM-professionals, in such a way to undo these marginalizations. Discourses, in this study, encompassed “everyday attitudes and behaviour, along with our perceptions of what we believe to be reality” (Grant et al., 1998, p. 2). They can be constructed as sets of statements and practices that bring an object/individual, or a set of objects/individuals, into being within a larger context of meanings (Parker, 1992). This notion of larger meanings, represented via stories and narratives, can play an important role in exposing limits and boundaries of day-to-day social interactions (Saleebey, 1994). Space exploration stories are extensive and reach back to the early Cold War efforts to conquer space, such as in Wolfe’s (1979) The Right Stuff, or more recently in Shetterly’s (2016) Hidden Figures. These stories, and others by industry insiders, endure within the global space industry; they are also hallmarks of discriminatory practices that can be surfaced in order to address social orders that limit and bind (Sage, 2009).

Capturing a space story or narrative, and then reproducing it, does not necessarily convey the lived reality of an exclusionary order, however. There needs to be some object that captures the creation and recreation of that order. Stories and narratives that were centered on an individual’s intersecting identities (Crenshaw, 1989, 1991) can be that object, showcasing the limits and boundaries that were (re)created in discourses. I set out to capture these intersecting identities within a reconstructed Glenn (2004) anchor point concept. I found that the binary relationality concept, which underpinned this anchor point concept, had to be undone given our poststructural understandings of power and meaning making. In other words, the reconstructed anchor points concept embraced flowing power-relations (Foucault, 1980) and the making of sense processes that an individual experiences (Helms Mills et al., 2010) in her social order. I then set out to surface one late career STEM-professional woman’s, Vigrine’s complexity and her lived exclusionary social reality by considering her stories and narratives, and her former supervisor’s, Ormyr, discourses. Applying Helms Mills et al.’s (2010) critical sensemaking (CSM) framework, I was able to surface Vigrine’s attributed anchor points, their relationship with organizational rules and social values as representative of her context, and the how of her exclusion in my attempt to address the unacceptable social order.

Before I consider the anchor point theoretical framework and the findings of this research study, I turn to the literature to present an overview on the engineering/science professions and the space industry. In this way, I showcase the epistemological
contribution I am making with this study. The theoretical framework follows this literature review. The research methodology is then presented. The findings from Vigrine’s and Ormýr’s stories and narratives are then considered. The results of the CSM framework analysis, revealing the exclusionary order, are then presented. I close with a discussion on anchor points, addressing the theoretical contribution of this study, and on a brief consideration of micro-political resistance initiatives (Davies and Thomas, 2004) to address Vigrine’s exclusionary order.

The engineering/science professions and space literatures

There were, and continue to be, important influences from the military in Canada’s efforts to explore space (Godefroy, 2011). To better understand these influences, I turned to the literature on engineering/science professions. These professions have historical roots in male-dominated military institutions (Hacker, 1989; Royal Military College, n.d.). Notably, West Point, the first US military and engineering school established in 1802, was based on the French military system of the École Militaire/École Polytechnique (Fox, 2006). Rigid military discipline along with the goal of creating the best engineers, mathematicians and officers were central concerns of these military-based systems (Hacker, 1989). The Military College of Canada, founded in 1874, was based on these US and French military systems. The Canadian military college system was, and continues to be, focused on military tactics, fortification, engineering and objective/positivist scientific knowledge acquisition (Hacker, 1989; Royal Military College, n.d.).

This Canadian military college system, at arm’s length from the Canadian Government’s Department of National Defense and the Canadian Armed Forces, specifically excluded women from entering its halls until 1979. The military engineering field was constructed as a masculine-hierarchical structure, which demanded unquestioning obedience and loyalty to the few at the top (Acker, 1990; Hacker, 1981; Jorgenson, 2002). Hacker (1989), in particular, argued that the military provided the first instance of a structured, masculine-ideal hierarchy to those learning the engineering and science professions. During periods of rapid change, such as in times of war, she similarly argued that military engineering served to maintain occupational stratification along cisgender lines. The unfortunate outcome of such practices was ongoing gender occupational stratification, which were the subject of a number of studies (Cardador, 2017; Cardador and Hill, 2018; Faulkner, 2000, 2007; Fox, 2006; Hewlett et al., 2008; Johnson, 2011).

Professional engineering and science continue to be male-dominated fields in spite of extensive legislation and policy initiatives (Evetts, 1998; Hacker, 1989; Hanappi-Egger, 2013; Jorgenson, 2002; Vetter, 1981; Wulfe and Gail de Planque, 1999). What does it mean then to work in such male-dominated professions when you are not a man? Etzkowitz et al. (2000) found that women who did not have a sense of belonging within a male-dominated field experienced low self-confidence, questioning repeatedly why they were there, and what they were doing. Jorgenson (2002), looking at discourses of women engineers in a male-dominated profession, found that these women adopted a variety of positions to support their qualified professional identities. These professional women, for example, would talk to their credentials and professional awards as a way to establish their acceptable status within this context. Miller (2004) suggested in her study of women engineers, in the Canadian oil industry, that masculine organizational values specific to engineering reinforced these cisgender masculine divisions. Furthermore, she found that women in her study “conformed to the dominant culture in order to survive and, over time, incorporated the values of the industry [...] walking(ing) a very fine line between being ‘like’ the valued-masculine prototype and avoiding any implication that they were not ‘real women’” (Miller, 2004, p. 68). Similarly, Powell et al. (2009) found that within engineering professions, women would undo their cisgender feminine-ideal notions, acting like one of the boys. Specifically, these women would accept the gendered jokes, making sense of
them by looking at the advantages over the disadvantages of their daily work life, and eventually they would adopt an anti-woman approach.

As for working in the space industry, STEM-professionals encountered, on a daily basis, high-risk situations and pressures to perform (Messerschmidt, 1996). Space personnel were recognized as being resilient, able to weather the amount of canceled programs that outnumber the amount of completed ones, and they were able to work extremely long hours (Allan, 2004; Lang et al., 1999). Sandal and Manzey’s (2009) study, focused on STEM personnel across the global space operational world, found that STEM-professionals experienced significant challenges and risks to working interdependently. Some of those challenges included, as Kanas et al. (2000) and Kanas (2006) supported, cross-cultural impacts among national groups of astronauts and international space agency personnel, where discursive practices were identified as key challenges in multinational space crews. Cisgender was briefly highlighted as affecting interdependence aspects in one study (Lozano and Wond, 2000). Lozano and Wond (2000) also suggested that decision-making processes could be influenced by gender where invariably a White man with a military background would make a decision when consensus could not be reached.

The vast majority of the positivist and postpositivist empirical literature on engineering and science, I found, was focused on areas such as student and faculty experiences in university in engineering/technology/science fields (e.g. Hanappi-Egger, 2013), or on engineering occupational segregation (e.g. Cardador, 2017) or, interestingly, identities and gender (e.g. Faulkner, 2007). Many studies (Chu, 2006; Faulkner, 2007; Hanappi-Egger, 2013; Jorgenson, 2002; Maier, 1997; Messerschmidt, 1996) were centered on the most vulnerable or on the wives of space employees/astronauts (Sage, 2009). The epistemological vacuum created by focusing on the most vulnerable, such as students or temporary contractual workers, implied that STEM-professional women in their late career were left to stare into the abyss, alone and unaided. The danger, as Nietzsche (1998) pointed out, was that the abyss would stare back into them. Furthermore, while many studies talk to cisgender as an identity, there were few studies that looked at relationships among social interactions, inputs into identities and rules and social values within organizations. This study bridges that gap, filling an epistemological vacuum for late career STEM-professional women within the organizational context of the Canadian space industry.

**Anchor points theoretical framework**

How to fill this epistemological vacuum required a theoretical framework that could address the complexities of revealing an individual and her lived experiences. As I introduced earlier, I turned to the notion of identities, embracing a poststructural/sociological perspective focused on social interactions and social constructions. Social interactions were considered as relationships among individuals that created the self and the mind (Anderson, 2016). The social world and the individual interacted together, mutually constituting each other in the processes of these everyday social interactions. This social-interactionist perspective, which would later become symbolic interactionism (Anderson, 2016), embraced a social world that was always evolving and how individuals were shaped by that social world. This implied that the social individual was evolving, and being reshaped and, importantly, doing the reshaping in the social world. This perspective, in contrast to Erikson’s (1963, 1964, 1968) work on who I am, did not define the identity concept as having a centrality to it. The Eriksonian identity concept relied on sameness or selfsameness, within an individual, and on the identity’s constant, stable continuity that was independent from the dynamics of social interaction. Symbolic interactionists, such as Mead (1932, 1934), were more interested in “social interaction, mediated through shared symbolic systems” (Gleason, 1983, p. 917), and of how the self can be shaped, and influenced, into being.
The self, according to Mead (1932, 1934), was constructed around a sense of identity that we each possess as a result of social activities and events. This self arose via our capacity to use language, to assign meaning to the narratives of the everyday and then to reconstruct an image of ourselves in light of these interactions (Anderson, 2016). Mead went further, breaking out the self into the I and the Me: the I represented the “response of the organism to the attitudes of the others, representing a direct line of action taken by an individual” (Anderson, 2016, p. 178); and, the Me was “the organized set of attitudes of others which one himself [sic.] assumes” (Mead, 1934, p. 173). The I then represented a sense of becoming, while the Me represented a sense of the past, and of making sense of that past. The self, constructed from this I and this Me, was created and recreated from this continuous search for “adjustment and adaptation” (Anderson, 2016, p. 179).

The concept of identity, influenced from Mead’s work, was constructed here along self-identity, social-identity and identity work (Anderson, 2016). Self-identity was defined as the “notion of who he/she is becoming” (Corlett and Mavin, 2014, p. 262), or her sense of self, as she defines who I am. Self-identities permitted me to look at self-perception with respect to who I am as Me sees this state of being. Social-identity, on the other hand, consisted of inputs into this self-identity (Watson, 2008). These inputs were socially constructed, and manifested, in stories and narratives. These inputs can be found within ideologies; that is, an experience, history and position in society that was external to and coercive to the individual (Anderson, 2016). Stories, such as narratives of a particular social categorization, and attachments, such as emotional involvements, can also be considered inputs (Ashmore et al., 2004). Social-identities can be manifested in discourses and this, just as with self-identities, via interactions with others. Social-identity has been hinted at in empirical studies, such as in Chu (2006), or directly addressed under other theoretical umbrellas, such as in social-identity threat by Castro et al. (2013). Finally, identity work acted at the nexus of self-identity and social-identity, where “people [...] are both making connections ‘outwards’ to social others as well as ‘inwards’ towards the self” (Watson, 2008, p. 140). Identity work was essentially critical meaning making, which Mead (1934) captured within his construction of the self.

Glenn’s (2004) original identity anchor points concept was constructed based on identity category lines such as gender, race, ethnicity, etc., that intersect (Collins and Bilge, 2016; Crenshaw, 1989, 1991). There was one particular concept, relationality, which took this intersectionality further than a simple listing of identity categories. For example, Black and woman identities gained meaning in relation to each other, working in concert to give meaning to who I am (Bowleg, 2008). The White identity was defined to be the dominant category over the Black identity, creating an order along raced/ethnic lines (Glenn, 2004), by embracing this relationality. Anchor points also included the intersection of occupational identities, such as housekeeper responsibilities. Creating an anchor point, a Black woman housekeeper, secured meaning in such a way to shine a light on the discriminatory order that resulted. In other words, this anchor point positioned the individual below someone else, in this example a White woman who may have hired a Black woman housekeeper.

The relationality concept and Glenn’s (2004) binary construction of this concept unfortunately did not embrace the poststructural application of power-relations that flow through the social. Power-relations in this study were recognized as existing locally in day-to-day interactions, and were continuous, productive and “capillary” (Fraser, 1989, p. 22). The relationality concept did not also recognize that the making of sense of social interactions could play a role in the individual’s understanding and their reproduction of that social order. In other words, the making of sense of discourses and power-relations in the everyday social interactions played an integral part in how an individual experiences a particular social order (Helms Mills and Mills, 2009; Weick et al., 2005) but the relationality concept did not consider this. CSM of the social (Helms Mills et al., 2010), in particular,
needed to be melded into the construction of anchor points. CSM, built on Weickian sensemaking, addressed some key weaknesses of Weick’s construction of sensemaking. Mills and Helms Mills (2004) folded “such issues as structure, power, [cis]gender, class, and race” (Kindle location 3302) into our understanding, and application, of socio-psychological processes when studying social interactions within a specific context. I reworked the Glenn anchor point concept in such a way that it embraced these flowing power-relations, undoing the relationality concept’s binary representations of Black vs White, woman vs man. I also melded the individual’s CSM of their everyday discourses in such a way to reflect social constructionism and social interactions in this study on exclusionary social orders.

The reworked identity anchor points concept, based on an intersectionality scholarship and the sociological/poststructural treatment of identities, did not pre-define an Eriksonian self-sameness of identity. The reconstructed anchor points concept was premised on intersecting social-identities that were shared in stories and narratives reflecting daily social interactions. These anchor points, which could be attributed by others to a particular individual, included then the act of their creation, via stories and narratives, the power-relations among individuals in those social interactions and the CSM processes of those individuals. They were not built based on “accusation and confession” (Friedman, 1995, p. 7), as a relic of the concept of relationality, but were based on a spectrum of productive and oppressive forces that flowed through the social (Foucault, 1978, 1980). Finally, an attributed anchor point secured meaning, for a brief period of time, so that someone studying these meanings may consider the order that was created and recreated in these meanings.

Research methodology
How does one find anchor points? The CSM framework (Helms Mills et al., 2010) was one possible approach that could be used to find them. To guide my application of this CSM framework, I asked the following research questions:

RQ1. What is the range of identity anchor points associated with, and available to, a STEM-professional woman within the Canadian space industry?

RQ2. What is the relationship between these anchor points and organizational rules and social values?

RQ3. How do these anchor points and their relationship with rules and social values influence the exclusion of STEM-professional women from management positions within this industry?

To be able to answer these questions, I present the participants and the data collection method used, and Helms Mills et al.’s (2010) CSM heuristics. I also show how to apply the CSM heuristics to one particular story, as a precursor to presenting the findings and analysis focused on Vigrine’s and Ormyr’s collected stories and narratives.

Participants and data collection
I began data collection by drawing on McCall’s (2005) intersectionality work. I recognized that I needed a primary identity category, such as woman, to be able to identify possible participants. I followed this primary category identification by letting the participants identify who they are, via the recruitment protocol; in other words, the participant’s identity intersection(s) that they felt best reflected their self-identity and social-identities were left up to the individual to surface. These identity intersections included race, sexual orientation, STEM-class and experience and whether they occupied employee or manager positions across the Canadian space industry, to name just a few possibilities.

The recruitment of these participants was done via a snowball referral technique, in order to avoid the introduction of any inherent biases I may have had as an insider within
the industry (Kvale, 1996). A total of ten participants were recruited, six women and four men. From this larger sample, I specifically focused on Vigrine’s case given the high emotionality of her interview, and her similarities to me as a late career STEM-professional. I felt her case, and her “injunction to silence” (Foucault, 1984, p. 293), had to be brought forth on its own. By focusing on Vigrine, I had to bring Ormyr into the analysis work, as he was her former supervisor, and his stories and narratives added a richness to Vigrine’s case. A summary of these two participants’ intersecting identities are reproduced in Table I.

Data collected included Vigrine’s and Ormyr’s narratives and stories, and a variety of documents including participant e-mails and publicly available corporate reports. Unstructured interview data were tape recorded during the conversations we had away from our respective organizational units. This avenue of unstructured interviews was specifically chosen given the quantitative and qualitative findings that stress that identity categories are best left to the participants to name in their own voice (Ashmore et al., 2004). The tape-recorded interviews, along with the other collected documents, were translated (French to English), transcribed and subsequently analyzed using the CSM framework.

As this was a qualitative, poststructural work, the number of stories and narratives collected were not the focus. The stories and narratives were a showcase with respect to the nature of the anchor points and not that they occurred frequently or infrequently. Furthermore, issues of generalizability, validity, reliability, quantitative and positivist notions also did not figure in a poststructural work of this nature.

Critical sensemaking framework
The CSM framework was shaped from the interaction of Foucault’s (1978, 1980) technology of discourses, Weick’s (1995) sensemaking, Mills and Murgatroyd’s (1991) rules and Unger’s (1987a, b) formative contexts. Interaction was the key consideration in using CSM as a strategy. In other words, there was no structural or procedural step-function among discourses, CSM, rules and formative contexts. I consider each individual heuristic in turn below and then I bring them together to demonstrate how to apply them.

Discourses, represented by stories and narratives, provided an avenue for seeing what was happening in an organizational context. These discourses reflected power-relations that flowed through the social, and the order that could be created and recreated. Discourse, identities and power-relations worked together, in other words. The CSM framework acknowledged these interactions; it also acknowledged that social realities were best understood by focusing on and investigating discourses (Phillips and Hardy, 2002). Stories and narratives provided an individual a way to receive, organize, rationalize, make sense of and understand social practices (Boje, 1989; Foucault, 1978).

CSM showcased that an individual was constrained “to seek out familiar solutions that have worked in the past […] and [that] maintain the social status quo” (Helms Mills and Mills, 2009, p. 175). CSM ebbs and flows throughout the individual’s shared stories and narratives. These stories and narratives, and the CSM of them, were fragments of their historical past. These stories and narratives were also plausible in the moment they occurred frequently or infrequently.

<table>
<thead>
<tr>
<th>Name</th>
<th>Cisgender/ethnicity/cultural/sexual preference</th>
<th>Profession/career stage</th>
<th>Marital status/family status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigrine</td>
<td>Woman/White/French/Canadian/heterosexual</td>
<td>Employee/STEMF/late career/MSc</td>
<td>Married, three grown children, grandmother</td>
</tr>
<tr>
<td>Ormyr</td>
<td>Man/ethnic identity/bilingual/dual citizen/homosexual</td>
<td>Executive/STEMF/mid-career/PhD</td>
<td>Married, two children</td>
</tr>
</tbody>
</table>

Table I. Participants and their intersecting identities, as they named them

Note: *To protect participants, I must hide her/his specific cultural, academic identities
were told, and my interpretation of those stories was also plausible in the moment that I interpreted them. This plausibility did not imply, though, that the stories and narratives and, importantly, identities will not/cannot change in the future.

Mills and Murgatroyd (1991) rules were defined as a pre-existing framework that determined how things get done. Rules were essentially social constructions that imposed order in organizations. Rules were broken into different categories such as formal and informal rules, written and unwritten rules, policy-driven and ethically-driven rules (Helms Mills and Mills, 2000). Rules whether informal or formal, written or unwritten, were influenced by discourses and power-relations. They were also influenced by an individual's CSM processes. Rules can evolve from their initial creation and established practice (Helms Mills and Mills, 2000). They can be, in other words, reproduced, enforced, misunderstood and/or resisted by individuals within their social interactions. As Thurlow (2007) found, rules evolution can be studied in discourses, and the CSM processes of those discourses can reveal the individual's understanding and approach to rules. Rules then were a window into a particular organizational context.

Finally, formative contexts brought together dominant social values with individual action (Helms Mills et al., 2010). Specifically, Unger (1987b) stated that formative contexts “consist in imaginative assumptions about the possible and desirable forms of human association as well as in institutional arrangements or non-institutionalized social practices” (p. 89). Formative contexts, or the more commonly used terms social values and social practices, limit an individual and what they can imagine, and what can be done, within a social reality. Social values reflected shared beliefs; they provided continuity and coherence, and they set boundaries (Blackler, 1992; Crawford and Mills, 2011). Importantly, formative contexts on their own have “little to say about agency” (Mills and Helms Mills, 2004, Kindle Location 3239). Hanappi-Egger (2013) went as far to state that value systems “reveal the existing organizational culture with respect to masculinity and femininity” (p. 281). However, formative contexts do not tell us that an individual will necessarily move in any specific cultural/social direction.

**Bringing CSM heuristics together**

Identities, as Thurlow (2007) found in her application of the CSM framework, can be teased out from discourses to reveal the complex individual. In addition, the power-relations reflected in these discourses and the ongoing nature of CSM implied that identities were not fixed or stable. The CSM processes shared in these discourses, along with rules and social values, can be found and extracted in order to showcase who I am and who I am becoming, along with contextual limits and boundaries to the self. To showcase how to find and extract identities, rules and social values, I share a brief story of one of my experiences in the space industry.

I was a participant in a meeting that was rather contentious, where we could not reach consensus on a particular important technical point. A White military-trained, engineering male colleague challenged me to an arm wrestle in order to resolve this work-related disagreement. I obliged my colleague, agreeing to this masculine-ideal show of force to resolve the issue. This arm-wrestling activity was not an organizational formal rule that my male colleague was enacting; it was an informal, masculine-imbued social values practice which assigned physical strength as a norm. While the outcome of the arm-wrestling activity ultimately cooperated with an organizational formal rule (i.e. we could reach a decision to meet an organizational objective), the spontaneous use of this informal rule established a social value and a social practice (i.e. a White military-trained STEM-professional man who is physically stronger than a White STEM-professional woman, and therefore this man’s decision will win) that colored our social interactions in this meeting. In other words, the informal rule became congruent with a formal organizational rule, whereby they mutually reinforced each other (Chavance, 2008). The informal rule, however, did nothing to establish an equitable relationship between us. The social interaction with this colleague was co-created following practices that were
gendered along masculine-ideal values. The resulting order, reflective of White military-trained man being physically superior to a STEM-professional woman, placed me in an ordered existence below him. Furthermore, my retrospective CSM of this story showcased an important aspect: I was accepted, on some level, as one of the guys, one possible anchor point framed within this social context.

The interesting aspect of this story, and the application of these four heuristics working together, was that I was able to reveal an imposed sense of repression, my own “injunction to silence” (Foucault, 1984, p. 293), within this context. In other words, an individual can apply a host of disciplinary processes in order to remain silent, such as I did. My injunction to silence, in the face of shared rules and social values, can be linked to particular historical processes – such as the military/engineering/masculine hierarchy – which constrained an individual from thinking otherwise (McHoul and Grace, 2007). This injunction to silence, supported by historical occupational roles for women in the space industry (Ruel et al., 2017), becomes part of the disciplinary processes at work in an individual’s every day, mundane social interactions. The creation and recreation of an exclusionary order was then not an either/or type of relationship, but was complex, requiring a look at the four heuristics interacting together to be able to surface such an ordering.

Findings: anchor points, rules and formative contexts
The first question that guided this investigation was centered on finding the range of attributed anchor points for one STEM-professional woman working in the Canadian space industry. By focusing on finding this range of anchor points, via the application of the CSM framework to Vigrine’s discourses, the reader was invited to discover the individual and her experiences, before delving into the rules and social values that were at work in her context.

Vigrine’s range of anchor points
I found five attributed anchor points in her collected data. I chose to focus here on the following three anchor points due to their provocative nature: On Probation, You’re like a dog […] you need to be kept on a leash and You don’t have a PhD and you’re an ‘old’ woman, you are worthless. With respect to the On Probation anchor point, this one surfaced in Vigrine’s stories focused on her STEM-work experiences:

At that point, we were about [number of employees] at [specific company] and then the cuts started. There were things happening on a financial level, things were going horribly. We went from [number of employees] to [60% of original number of employees] to [40% of original number of employees]. When we got to [30% of original employees], things got uncomfortable […] Upon my arrival in [specific location for a business trip], the boss who sent me there was fired. So that signified that it was my final three weeks.

I go into public service and I know nothing. I do my job to the best of my capacity. I’m told I am on probation and that stresses me out because I’m always worried they will fire me. This was after at least two years at [another company] where everyone was being fired, one after the other. So, I can’t believe that the public service doesn’t fire people when their jobs are abolished. That doesn’t make sense to me. So I’m very nervous, and then there’s no manager [for my unit] […] It was such an unstable time. I still don’t understand how I made it through.

I was, in a way, prepared to find the previous anchor point given my previous experiences in this industry and the findings in the empirical literature (e.g. Allan, 2004). I was not, however, in the least prepared to find the next anchor point, You’re like a dog […] you need to be kept on a leash. This anchor point was closely related to the You don’t have a PhD and you’re an ‘old’ woman, you are worthless anchor point as showcased in the following three-story fragments:

I went back to [a specific location] – I had been in the US – I went back [a specific location] to report to new [manager] […] another hard phase, where I found it sickening. I am told: “You don’t have a
PhD, you are worthless [...]”. I'm told “you’re like a dog, don't take [this] wrong, it's just that you need to be kept on a leash otherwise you'll screw up”.

I considered doing a PhD because I was belittled for not having one. I talk[ed] to [my manager] about it who says: “You wouldn’t want to go work in a different sector? In a company? You know, you worked in [specific area]. The industrial/aerospace sector wouldn’t interest you? Doing a PhD at your age, [Vigrine], I'm not sure you’d be able to integrate yourself. You’d have to continue working at [specific company] anyways, and it’s really not a good idea to study part time”. I was [...] I knew then that my dog had died [...]

I never ended up doing a PhD. I think I'll always regret it, but that’s what it is. I'm the one who thinks: “Crap, I’ve screwed this up, I should have [...]”. I should have. It’s sure that at [specific Company], it’s an environment in which [...] I’ve been criticized for not having a PhD and I find that this fact was frequently used to belittle me, rather than focusing on “here’s what you bring”. No, it was always “Well, you don’t have a PhD”. I was sort of stuck, in my group, between “You don't have a PhD” and “You are only a woman”.

Vigrine’s map of identities, presented in Figure 1, graphically represent these findings, along with her complexity as an individual. The map also highlighted Vigrine’s CSM processes, via some of her shared stories and narratives.

I now turn to some of the rules and social values found in Vigrine’s and Ormyr’s respective collected data.

**Vigrine’s and Ormyr’s rules and formative contexts**

The canceled project/program rule, namely that canceled programs overshadowed the conduct of business in this industry, was showcased in Vigrine’s first attributed anchor point, On Probation, in the previous section. This finding gave voice to Allan’s (2004) work, foregrounding the social values of uncertainties and frustrations in this industry. As for the question of resilience in the face of these canceled programs and missions, brought to bear in Lang et al.’s (1999) findings, I could not ignore the emotional toll that Vigrine shared with me during her interview; she was in tears during much of the interview, requiring me to turn off the tape recorder a number of times so she could compose herself. She recounted the constant uncertainties, through the ever-changing positions and projects, she held. It is noteworthy that both Vigrine and Ormyr experienced canceled programs, and they managed to be resilient in the face of this uncertainty.

Vigrine’s early career experiences showcased taking jobs that no one wanted, as a rule. This taking unwanted jobs rule, according to her, would ensure she kept learning and kept moving through her STEM-professional career. Her stories focused on the production floor highlighted this particular finding:

So, I go and nobody ever bit me, they never even swore at me. So, I learned a lot and there were project opportunities. So, then I learned about finance. Then I went to strategic planning and that’s where I wanted to go. Strategic planning was always interesting to me, how to manage a company.

[My boss] invited me to the cafeteria one day and she says to me “[Vigrine], would you like to take the [specific technology area] [...]”. And I told her: “Look, honestly, if I said no you would be really stuck”, and she said: “Yes”. So, I took it. In my career, I often took projects nobody else wanted. The whole [specific location project] thing, when I volunteered to take it, I was one of the only ones. Very few wanted it. It was seen as a pile of crap [...] We were shutting it down and now we were bringing it back. People were so demoralized, so I had a motivational problem for the team and once again. [...] It’s a group of people who don’t quite behave [...] They are so vulgar, very direct, so I get used to it. It’s no big deal, I got used to it.

These stories focused on taking unwanted jobs rule also showcased a social value of wanting to help someone get out of a difficult situation. Vigrine had to take on motivational issues, in addition, to nurturing everyone back into a team. She also had to navigate the social values of
the “vulgar”, the “very direct” comments/teasing by the men who surrounded her on the shop floor. In contrast to the literature, I found no evidence in Vigrine's early career of her taking on the masculine-ideal of passionately fighting against these “very direct comments”, such as in Jorgenson’s (2002) or Faulkner’s (2007) respective studies.

In Vigrine's late career, I found that she faced the daunting and contradictory occupational position rules:

[Manager #1] had promised me a position, when I started as [a specific position]. He said “It's not complicated. We will draft a job description and stick you in it”. So, silly me, I write many descriptions that are never good: “No, that's not it, start over”. I don’t know how many times I drafted the description, and one day, his secretary tells me: “[Vigrine], that's not how it works. The job you have belongs to someone else [masculine]. We can't remove that person, you can't have the job”. [To which I responded]: “Are you serious?! “She was very serious.

Figure 1.
Vigrine's map of identities

Note: These self- and social-identities are reproduced here in Vigrine’s map of identities to give the reader a view into her complexities as an individual.
At the reorg[anization], [Ormyr] asks me to his office and says: “You don’t report to me anymore. They will reorg you. Thank you”. Where am I going? He had warned me that there would be fairly significant changes and he said: “Listen, go take a look at the other managers, I don’t have anything for you”. And as naively as I just said, I did it. I went to see [Manager #2] who said to me: “[Vigrine], what you are telling me is fun, but are you really meant to be in space […]” [Manager #3] then tells me: “What good news, we have created a position for you!”

I also found that Vigrine began challenging these contradictory occupational position rules, in contrast to her early career experiences. She moved to forcefully and persistently challenging the contradictory rules, embracing masculine-ideal values:

I get closer to that [mentor] committee, close enough to go talk to them about: “Come on, what’s the deal at the [specific company]? There are only men here?” And a colleague [female] tells me: “You’ll have to understand that the women here are a joke, they are [treated like] idiots. All women at the [specific company] are considered glorified secretaries by all men at the [specific company], whether you are a secretary or not.”

[Manager #2] sent an email saying: “Hey people, if you are interested [in a position], here’s what it takes, put your hands up”. I wasn’t allowed to compete, so I went to see [Manager #2] with the email and I said “[Manager #2], I don’t see how I do not fulfill this, I don’t see what is typically engineer about this.” He said: “I follow what HR tells me. This is how HR classified it, and I do not have a choice. There used to be a time when a job could have more than one classification, but that is no longer the case”. Perfect, your hands are tied […] I said: “Would you mind if I go see the two other Managers?” And I talked to them in the same manner, telling them that I don’t see why one would have to be an engineer to do this […] He said: “Fine by me, go ahead”. I went to see [Manager #3] who reacted with fear: “Oh my God, what am I going to say to this woman?”

Ormyr’s narratives showcased a dismissive attitude, mixed with an appreciation for the lack of women in management, in relation to these contradictory occupational position rules:

Ormyr: If we think about women in the space sector, which is really it, what we need is new leadership, whether it’s male or female, that probably doesn’t matter. And that recognizes kinds of things I was telling you about in terms of the role of women, but who also has the balls, whether they are male or female, to fire people, to get rid of the old guard, to realize that at some point your experience, the incremental advantages that your experience brings don’t outweigh the organizational benefits, the quality of decision-making, that kind of stuff. And you have to have the balls to say “it’s time, old, white men […]”

Interviewer: [There is] new leadership […]

Ormyr: Yeah, but he doesn’t realize that. Well, I don’t know, I never have met him, but from what I understand, he’s not the visionary-type of person that we need, and although [specific organization] is a very small organization in the […] sense of things, it has a big impact nationally and I think we can set the tone for how space is done in Canada. And until we start, and that is a role for government in whatever sector is setting the example, so at some point we have to make the conscious decision, that [the Executives] at [specific organization] needs to have at least half of them needs to be women, and [that] they are there because they are women and are good, and that’s when things are going to start to change. It has to be that way.

These stories also surfaced the social value of “having the balls” as what was expected and needed, in order to effect change with respect to women holding STEM-management positions. In other words, “it has to be that way” that we must embrace the masculine-hierarchical value that someone at the top must do something to get rid of the “old, white men.”

Ormyr’s reference to a “cultural blockage,” in the following story, was another important rule that I found which was in line with the previous rule and social values of “having the balls”:

Ormyr: I don’t think it [lack of women] was that big an issue. Where it became an issue was in management, right? And it’s still stagnant in terms of management. So, if the old white guys don’t get out of the way first of all, and there’s an issue for La Relève, and then there, I think there’s just a cultural blockage […]
The ability to move beyond a “culture blockage” involved, according to Ormyr’s sensemaking of rules and social values, the need to win in the hierarchical game of women in management. This was also surfaced in the following story:

Ormyr: Did she win [a management competition] because she’s a woman? Maybe. But there wasn’t room for both of them. They both wanted the same thing, both very competent, intelligent, strong people, but they both wanted the same thing and she won. And, it’s probably a good thing that I would consider them both equally competent and she was the one that was retained. You have to do that kind of thing, it’s a good example of somebody who is, I think, extremely competent and we had the choice, and chose the woman. I think it’s a great thing. We lost somebody great, [male colleague], really great, I loved the guy, but he realized that it was her, and it was her. And now she’s just like, it doesn’t matter what her gender is in her current job in the way that she’s in this impossible position and all the craziness that goes on, and all the changes in leadership and problems in leadership, and I guess she was acting [senior management] for a while, but until she’s actually [senior management], you are not going to get that women’s perspective.

This notion of winning in the hierarchical game was, I found, a call again to masculine-military hierarchical values; that is, of competition and of winning in the military game that overshadowed how work was done in this context. This masculine-military hierarchical value was contradictory for this woman in this story: perhaps a woman won a competition because she was a woman, who happened to also be competent and knowledgeable; then, her gender did not matter anymore; and, then a “women’s perspective” was indeed needed. This gender spectrum oscillation between having a gender, to not, to again needing gender, mirrored the contradictory occupational position rules in this context.

Analysis: revealing the exclusionary order
I now move to the analysis of the relationship between anchor points and the rules and social values presented in the previous section, and how the exclusion of STEM-professional women in management positions in the Canadian space industry can plausibly be explained. I summarize, in Table II, the range of anchor points, the rules and social values found in Vigrine and Ormyr’s data. I also summarize the relationship between this range of anchor points and the rules and social values in this table.

Vigrine’s two anchor points, On Probation and You don’t have a PhD, and their relationship with the taking unwanted jobs rule, contradictory occupational position rule, the “cultural blockage” rule, and the masculine-military hierarchical values, surfaced the unstable nature of the social interactions of this industry. While the empirical literature presented previously highlighted the ever-changing nature of this industry, the On Probation anchor point reflected Vigrine’s unstable, fragmented state of becoming. She acknowledged that while she had been attributed the On Probation anchor point, she also learned to embrace the need to be resilient in the face of such uncertainty while also acknowledging her emotions in the face of these challenges, to enact taking on unwanted jobs, to first accept and then to challenge contradictory occupational rules.

These two anchor points and their relationship with these rules and social values also spoke to the notion of how a STEM-professional woman could pull on merit in order to navigate these rules and social values. Vigrine believed that as long as she kept learning, via taking unwanted jobs and perhaps doing a PhD, she would naturally keep moving up the hierarchical structure. She assigned merit to sacrificing, whether it be putting up with “vulgar” and “very direct” comments from her male colleagues or of being resilient in the face of being repeatedly On Probation. However, as seen in her lack of movement up the hierarchical ladder, Vigrine jumped horizontally from one On Probation to another On Probation position. No organizational value appeared to be awarded to her ability to navigate unwanted jobs, or the ability to navigate cisgender masculine-ideal values. I showcased that Vigrine’s understanding of how to navigate these anchor points, these
rules and social values was imbued with power-relations where she chose to navigate by first embracing a nurturing/caring approach and then moved to a more confrontational approach. The spectrum of gendered power-relations, best exemplified by Ormyr’s last story focused on winning the hierarchical game and of “having the balls,” underscored the challenges for anyone to know what they should do in the face of such a spectrum of power-relations. From embracing a masculine-ideals, to having no gender, and then needing to embrace feminine-ideals may plausibly play a part in Vigrine’s Othering (Butler, 1985) experiences and in her attempts to climb the corporate ladder. This organizational context, as represented in Vigrine’s and Ormyr’s stories also appeared to have a tangled understanding of gender spectrum, reverting to masculine-ideals, to leash with attributed You’re like a dog anchor point.

The lack of awareness of what this STEM-professional woman had to do in order to climb the hierarchical ladder was perhaps best exemplified in Vigrine’s You don’t have a PhD attributed anchor point. Vigrine wanted to do a PhD, but this passion for higher education was pushed down as a function of her gender and her age. Her experiences and knowledge capabilities did not figure as the stumbling block in her wish to seek out higher education. This moved beyond obfuscation, to keep Vigrine on a leash; this is discrimination. In addition,

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Table II. Summary of rules and formative contexts, and relationship with anchor points
reaching into the literature, Jorgenson (2002) found that women can adopt a variety of positions to support their qualified professional identities, where having a certification of some kind was one of those adopted positions. Vigrine believed that if she achieved this PhD status, her merit to the organization would be undeniable and her age and gender would not be relevant. However, given the lack of awareness to what Vigrine had to do to be recognized and this blatant discriminatory power-relation, I doubt whether Vigrine would have achieved the recognition that she was searching for.

Finally, the attributed You’re like a dog [...] You need to be kept on a leash anchor point and its relationship with the contradictory occupational position, “it has to be that way,” and “cultural blockage” rules Vigrine had to navigate, reflected the attempts by others to keep her on a leash. Vigrine’s stories and narratives were peppered with repeated defeat, calling upon her You are a Dog anchor point throughout. Etzkowitz et al.’s (2000) work suggested that women were constantly questioned as to whether they should be in their field. Vigrine’s experiences go beyond this level of questioning; this was obfuscation done by so many individuals in this organization, on so many different occasions. Vigrine’s “dog had died” sensemaking, reproduced in Figure 1, left me with the sense that she no longer had a will to continue, that her who I am becoming was no longer possible. By constantly changing the target, Vigrine lost hope to move forward in her career, in spite of adhering to the resilient values that she embraced.

**Discussion: anchor points and social justice initiatives**

I now turn to a discussion on anchor points as the chosen theoretical framework to showcase the complex individual and her Othering experiences. I then consider micro-political resistance initiatives (Davies and Thomas, 2004) to begin to undo Vigrine’s Othering experiences.

I was able to reveal a suite of Vigrine’s intersecting social-identities, the power-relations and her CSM processes that were at work in her daily social interactions, by surfacing discourses in a particular organizational context. These silent killers, Vigrine’s attributed anchor points across the spectrum of power-relations and her CSM processes, were an unstable branch of social-identity. There can be many different silent killers, and each one in this range can be attributed by many different individuals, whether they were a man or a woman or transgender individual. Case in point, the You’re like a dog anchor point was attributed by a woman to Vigrine, while being On Probation was attributed by a variety of gendered individuals. I presented in the Methodology section the participants’ intersecting identities, as they identified them in their own words during their recruitment, to showcase one possible application of intersectionality scholarship. The anchor points that were surfaced in the stories and narratives also reflected Vigrine’s identity intersections, in a way that moved us away from just gender/race/ethnicity/etc. considerations: being a dog, for example, was not solely a gender-based identity category. It is rather reflective of discriminatory, derogatory social interactions that meld power-relations, CSM and social-identities together into potential silent killers of Vigrine’s career.

The complex individual can be reconstructed via these unstable anchor points, along with their self- and social-identities, from stories and narratives that showcase the larger meanings in a particular context. Anchor points were not just linked to the individual “by a conscience or self-knowledge” (Foucault, 1982, p. 781); anchor points were in a relationship with organizational rules and social values, along with the experiences of discourses, CSM and exclusion. Furthermore, the On Probation, You don’t have a PhD and You’re like a dog anchor points, found in a particular social reality, and subject to an individual’s CSM processes, reflected and revealed the experience of exclusion/discrimination for everyone to see. Anchor points offered a momentary snapshot of time and space, and thus brought forth an understanding of power-relations within a specific social reality, and the power effects of such complex silent killers.

Feminist standpoint functionalist approaches would have a difficult time considering these varied and extensive power-relations, along with the CSM processes, with their search for
objective and unitary truth (Hawkesworth, 1989). Feminist standpoint-based research would valorize a woman’s (class, race, cisgender, etc.) difference, for instance, and use these differences as a mode of resistance (Hekman, 1999). However, with this work I was not striving for economic determinism as a form of resistance. With this work framed within theoretical anchor points, an individual was no longer considered as a unitary woman, representative of all women. My construction of Vigrine was fractured and fragmented, as a subject of the power-relations and discourses that were at play in her daily work life. She was, in other words, both in a state of being and of becoming. There was no longer a universal truth that was woman, and so there was no longer a universal victim to power and hierarchies.

This construction of a fractured, complex individual opened up an important area with respect to micro-political resistances (Davies and Thomas, 2004; Hutton, 1988). While resistance academic research is extensive and beyond the scope of this work, this form of resistance can be used to showcase how each individual STEM-professional woman can choose to address dominant discourses and power-relations. The possibility for micro-political forms of resistance was important to consider, here especially when we recall the theoretical framing within intersectionality scholarship that required I address social justice initiatives (Collins and Bilge, 2016). This characterization of resistance, for an individual, was one that moves away from economic and environmental concerns of the organization, toward the nuances of individual’s, and their enactments of resistance (Thomas and Davies, 2005). Micro-political resistances, inspired by Foucauldian philosophies, were defined by Weedon (1999) as: “winning individuals over to these discourses and gradually increasing their social power” (p. 111). This production of micro-political resistances was not a cause-and-effect type of resistance, as in you are denied an employee position because you are woman, and you call this out as discrimination, and launch legal action. Micro-political resistances were reflexively constructed, and allowed for subversive places to exist in such a way to challenge hegemonic discourses (Thomas and Davies, 2005).

In this nuanced treatment, you may begin by acknowledging that you have been denied a management position because you are woman, internalizing and blending this experience into your fragmented identity constructions retrospectively. You may also find cues from rules, to make sense of this social event, and the social environment, in question. You could go in any number of directions then, plausibly pulling from extracted cues, identities and enacting the environment in an ongoing fashion (Weick, 1995). Such a treatment of resistance, within this understanding and practice of informal and formal rules, opens the door to a spectrum of possibilities with respect to social constructions, and reconstructions, of everyday interactions. As to specific micro-political resistances that Vigrine could embrace, she could choose to resist the oppressive attribution of anchor points in a variety of ways. She could choose to use a mix of gendered responses, for example, depending on how she perceives the interactions. That is, she could ask questions in order to enlighten the individual with respect to their practice of identity attributions. She could confront the individual, highlighting that being named in such a way, such as a dog, is not appropriate or acceptable. She could also choose to reflect on the attributed anchor point, and the context she finds herself in, to determine if this is indeed what she wishes to become.

The important message in these options was that Vigrine does not have to be a victim to the anchor points, and to the rules and social values of the context in question. She can choose along a spectrum of power-relations and CSM processes. An injunction to silence (Foucault, 1984) was no longer the only option open to Vigrine.

**Conclusion**

This work showcased a social constructionist theoretical framework, focused on anchor points. By untangling identities along with organizational contexts in this poststructural/sociological study, the self moved beyond our own self-perception of who I am. The complex individual and
her lived experiences, as I demonstrated, can include social interactions and their influences on who I am becoming. The empirical evidence and its analysis reflected one possible how with respect to the exclusion of a STEM-professional woman from management within the Canadian space industry. Vigrine’s stories and narratives, coupled with her former supervisor’s discourses, showcased a spectrum of power-relations and CSM processes related to her Othering experiences. These power-relations were not broken down into a binary man vs woman type of treatment. Vigrine’s state of being and of becoming as the other was a complex dance across fractured and fragmented identities. This complex dance foregrounded that the silent killers of this STEM-professional woman’s career are no longer hidden; they become an opportunity for micro-political resistances to be enacted in order to undo attributed anchor points.

Notes
1. In line with Nkomo and Cox (1999), diversity was used within the notion of identities, and the resultant recreation of many intersecting, ephemeral identities.
2. Profession was treated in this study not just from an accreditation and university-trained perspective but also from a historical and cisgender perspective. This was in line with Witz’s (1992) definitions of occupational positions.
3. I needed to recognize the socio-political characterizations of race, gender, class, etc., that were produced through discourses in spite of Lykke’s (2014) “passionate disidentification” (p. 30) efforts. To this end, I capitalized the White race but I left woman un-capitalized.
4. As a poststructuralist/postmodern work, I was concerned with bringing to light an event, or an experience, not as truth or fact but as a plausible window into a social reality that was, up until now, best characterized as a wall. I chose to refer to this plausible window as revealing. The act of revealing was not premised on seeking out and believing in one truth; it was about having a look inside, at a particular moment in time and in space, to see what was happening.
5. The poststructuralist perspective I embraced was founded on the notion of difference. Difference was a difficult term to control given the misappropriation in meaning that has historically occurred with this concept. The reader is cautioned to not confuse poststructural difference with implying that the opposite of difference is sameness. Difference was used here in the sense that we reproduce uncertainties, and a range of beliefs/meanings, that we do not necessarily aim to resolve (Belsey, 2002). As such, a poststructuralist examination of a social reality compels the researcher to no longer think about binary oppositions such as men vs women, White vs Black, as these collectivities invoke sameness and difference arguments that were not appropriate within this perspective.
6. Names have been changed to protect participants’ identities.
7. As a poststructuralist work, I caution the reader to not fall into either/or binaries. These particular academic references could be misunderstood to mean that the masculine-ideals of obedience and loyalty implied that women were disobedient, etc., if framed in binaries. As will become clearer in the theoretical framework, power-relations were problematized and not the either/or of man vs woman.

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**Corresponding author**
Stefanie Ruel can be contacted at: stefanie.ruel@videotron.ca

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