Influencing discussions and use of Neuroadvancements: Perspectives of Canadian Occupational Therapists

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Abstract:

BACKGROUND: The early involvement of many actors including health professionals is identified in neuroethics and neurogovernance discussions as crucial in constructing conversations around awareness, reaction, and knowledge development pertaining to the ethical, legal, and societal consequences of neuroscientific or neurotechnological advancements (NA). Occupational Therapists (OTs) have a stake in NA; however, OTs are rarely mentioned within this context. Lifelong learning (LL) could be used to increase OTs knowledge on NA and its consequences. However, LL is rarely mentioned within neuroethics and neurogovernance discussions.

OBJECTIVE: The study’s purpose is to understand the role of OTs as professionals and citizens in neuroethics and neurogovernance discussions and to examine the utility of LL processes put in place for OTs to empower OTs to contribute in a meaningful way to NA discussions.

METHODS: 8 semi-structured interviews with OTs were conducted and analyzed using a directed content analysis.

RESULTS: Although participants believed OTs can provide a holistic perspective to neurogovernance discussions, their knowledge on NA and its consequences is limited, and LL is not used as a tool to remain informed about such consequences.

CONCLUSION: More education on NA and its consequences throughout their OT degree and through LL opportunities is warranted to facilitate their involvement.
1. Introduction:

As neuroscientific and neurotechnological advancements (from now on called NA) such as deep brain stimulation, cochlear implants, brain-computer interfaces, neurosurgery, and cognitive enhancement, continue to develop, they give rise to multiple ethical, legal, and social implications [1, 2]. NA can be used for a variety of reasons including for medical purposes, educational purposes, human enhancement, and for recreational purposes [3-6]. People with disabilities are direct recipients of NA including cochlear implants, deep brain stimulation, brain computer interfaces and virtual reality and by using neuro-linked assistive technologies [7-12]. Neuroethics and neurogovernance discourses have emerged to deal with the ethical, legal, social, and other impacts of these advancements [5, 13, 14]. One focus of neuroethics and neurogovernance discourses is to include the views of stakeholders such as researchers, health care professionals, policymakers, consumers, civil society, and funders [5, 13, 15]. Occupational therapists (OTs) are also stakeholders in how NA are governed due to their exposure to various NA [16-19], the impact of NA on occupation [20-22], the expected role of OTs as advocates for emerging NA [23], and the societal role to engage as active citizens [24]. Due to the impact of NA on occupation, their field, and their clients, they have something to contribute to these discussions. Lifelong Learning (LL) is essential for individuals to stay up to date with the changes in society, and specifically for healthcare workers to stay up to date with the changing health care field [25, 26]. Therefore, OTs can utilize LL mechanisms not only within their professional role but also within their role as citizens to obtain knowledge needed to contribute in a meaningful way to neuroethics and neurogovernance discussions. Given the role expectation of OTs and the impact of NA on OTs, the purpose of our study is to give voice to Canadian OTs on the role of OTs as professionals and citizens in NA including neuroethics and neurogovernance discussions. To fulfill the purpose, we aimed to obtain answers on the following research questions by interviewing Canadian OTs: 1) What is the familiarity of OTs with NA, their ethical, legal, and social implications, and their governance? 2) What are the views of OTs on the impact of NA on their field, occupation, and clients? 3) What are the views of OTs on using their knowledge and experiences to get involved in neuroethics and neurogovernance discussions? 4) What are the views of OTs on lifelong learning mechanisms put in place for OTs? 5) What are the views of OTs on the utility of LL to learn about NA, especially the ethical, legal, and social implications, and how and to what extent do the current LL mechanisms enable OTs to participate in neuroethics and neurogovernance discussions in a meaningful way?

1.1. OT and NA

The term occupation is used to describe the daily tasks and purposeful activities in which individuals involve themselves in due to the meanings and values they have to individuals [27]. Occupation is an essential part of human nature that is manifested by active participation in self-maintenance, work, leisure, play, and rest [27, 28]. Occupation and humans as occupational beings are impacted by the development of NA, either by outdating occupations, creating new

Keywords: neuroscience, neuroethics, neurogovernance, role expectation; occupational therapists;
occupations, or by changing current occupations [2, 20-22, 29-31]. Given that occupation is impacted by NA, and that OTs aim to enable occupation for the wellness and wellbeing of their clients [32], OTs are impacted as well by NA. OTs and their clients can be impacted by therapeutic and non-therapeutic NA, by enhancing the neuro-abilities of the person beyond the norm, and by the use of NA to fix the person to the norm [1, 5, 33, 34]. For instance, OTs use specific NA in their workplace including biofeedback [35, 36], virtual reality [23, 37], neurofeedback [16, 38], brain stimulation [17], neuroimaging [39], deep brain stimulation [18], transcranial direct current stimulation [40], and transcranial magnetic stimulation [19], and are stated to be advocates for themselves, their field, and their clients who are end users of these NA [23]. Their clients, such as people with disabilities, are impacted by NA and make use of NA including neuro-linked assistive technologies [7-9, 41]. Some examples include cochlear implants [42], virtual reality used as a tool for communication [41], brain machine interfaces, [43] and deep brain stimulation [44]. Given the impact of NA on occupation and the OT field [2, 20-22, 29-31], and their clients [7-9, 41-44], OTs are impacted by NA as consumers, users, educators, and advocates for their clients and field.

### 1.2. Neuroethics and Neurogovernance

Due to the increase in NA, the neurogovernance discourse has emerged that focuses on how to best advance these processes [5]. The association of the term governance with science and technology is used to refer to the expanded network of actors and organizations that drive the development and uptake of science and technology, as part of the process of policy-making [14]. As further supported by Garden & Winickoff (2018), “science and technology should inform policy, and policy should guide science and technology and govern responsible innovation with respect to diverse cultural domains” Garden and Winickoff (5). Neuroethics was coined as a term and developed as a field to investigate various ethical, social, and legal issues raised by the advancement of the neuro-field. This includes the advancement of neuroscience, neurotechnology's, and neuro-engineering as a whole [45-51], as well as individual neuro-applications such as brain-computer interfaces [52, 53] and deep brain stimulation [54].

With the increasing impact of NA, there is an increased need for stakeholder engagement to get a variety of perspectives [52, 55, 56]. Stakeholder engagement is one focus of discussions within neuroethics and neurogovernance discourses and consists of societal members’ opportunity to inform researchers and scientists on the development of practices and policies, including the distribution of education and awareness for society to develop an input [5, 13, 15, 57].

Concerning NA, there are a variety of stakeholder groups including researchers, health care professionals, policy-makers, patients, consumers, regulators, civil society, and funders [5]. OTs are therefore stakeholders due to: the impact of NA on occupation and their field [2, 20-22, 29-31], their exposure to NA [16-19, 23, 35-40], their expected roles as advocates and educators of technologies [23, 58], and their expected roles as active citizens [24]. Therefore, OTs have the potential to contribute to neuroethics and neurogovernance discussions, specifically pertaining to the ethical, legal, and social implications of NA, as professionals and as active citizens. Their roles can include, but are not limited to, influencer of neuroethics and neurogovernance discussions, advocates for their field and clients, and researchers on topics related to OT linked to neuroethics and neurogovernance.

### 1.3. OTs as professionals and active citizens

Occupational therapy is responsible for enabling an inclusive society for all people to participate in their daily occupations [59], and is grounded in the belief that humans are complex beings engaged in a process of dynamic interactions with the physical, social, temporal, cultural and virtual environments [58]. Specifically, according to the Canadian Association of Occupational...
Therapists (CAOT), the roles of OTs include being an expert in enabling occupation, a communicator, collaborator, practice manager, change agent, scholarly practitioner and professional [60]. Supported by CAOT, scholars have further explained the role of OT to include various competencies such as the role to (a) apply relevant knowledge of the physical, social, psychosocial, environmental, and fundamental biomedical and social sciences to practice; (b) analyze physical, cultural, social, and institution environmental impact on occupational engagement issues; (c) incorporate cultural, social, physical, and institutional options to increase inclusion and (d) balance the ethical and professional issues inherent in client advocacy, including altruism, autonomy, integrity, social justice, and idealism [61]. Furthermore, OTs are stated to be crucial in addressing the development of society and its issues of the present and future [62]. One way in which this can be achieved, is by exercising their role of being advocates for their clients and promote inclusive communities [61, 63].

Active citizenship refers to the various forms of participation that ensures to reduce the gap between citizens and governing institutions through the continuation of participatory and representative democracy [64]. It involves a range of citizen participatory actions including participatory democracy such as holding government actions accountable, and representative democracy such as voting [64]. However, being an active citizen does not only encompass being involved with political actions, yet also participating in one’s everyday social and cultural life [24]. This is interconnected with the concept of occupational rights [24]. It is argued that occupational therapy as a field must “conceptualize the occupational nature of active citizenship, located as a practice in the interconnectedness of the individual and the larger community” Fransen, Pollard (24). Furthermore, OTs have the capacity to enable and advocate for their clients, and act as active citizens by researching and influencing at the policy level [65]. This can be further understood by using the Person-Environment-Occupation (PEO) Model, a conceptualized term that is often applied by OTs in their practice [66]. Specifically, the person is defined as a dynamic individual constantly interacting with the environment, the environment is assumed to have an enabling or constraining effect on occupational performance, and occupation is defined as self-directed activities an individual partakes in [66]. Due to their unique understanding and experience of the relationship between occupation, the person, and the environment, their involvement in developing policies is warranted [65]. Additionally, health professionals are argued to be able to bring fruitful knowledge from their everyday life and in their workplace to policy networks, and get involved as active citizens [67, 68]. Therefore, falling in accordance with the democratization of science and technology [69-71], OTs can fulfill the expectation of getting involved at the policy level through their role as professionals and role as active citizens.

1.4. LL for OTs as professionals and active citizens

With the constantly evolving and changing society, it is necessary for individuals to learn new skills and stay up to date with such changes [26]. Lifelong learning (LL) is therefore a process where individuals engage in the continuous development of their knowledge, skills, and interests throughout their lives [72]. Viewing LL as a lifelong, educational commitment is essential and advocated for by various international organizations including The United Nations Educational Scientific and Cultural Organisation (UNESCO), the Organisation for Economic Cooperation and Development (OECD), and the World Bank, to name a few [73]. For health professionals, including OTs, LL is essential to stay up to date with the changes in the health field and advocate for the care of others [25]. Given that health professionals must constantly increase their knowledge and skills throughout their careers to provide safe and competent care, and with the accelerating advances in health information and technology, LL is necessary [74].
The process of LL falls in accordance with the College of Occupational Therapists’ Research and Development Strategic Vision and Action Plan, where the College emphasizes the importance of continuing personal and professional development for all members including students, associated, and professional members [75]. This reflects the continuum of competence required by practitioners, educators, managers, and researchers to provide services based upon evidence of effectiveness and best values, applying equally to all OT personnel across the range of practice settings. Furthermore, according to the OT Code of ethics, all OTs are expected to contribute to the continuing professional development of support workers in OT services [76]. In other words, not only is LL essential for OTs, yet also an educational expectation that must be provided by OTs.

With the fast-pace development of neuroscience and the direct impact on society, LL has been discussed as a tool to educate professionals on how to become competent consumers of such research, including the ethical implications [77, 78]. Given that OT personnel have a responsibility to use new technologies and new learning in order to maximize their impact for the benefit of service users, LL can be one way for OTs to increase their knowledge on the ethical, legal, and social issues of NA [75]. This knowledge can enhance the confidence of OTs to be involved in and provide meaningful input within their professional identity towards neuroethics and neurogovernance discussions.

As stated earlier, LL mechanisms are not only used by professionals to advance their practice, but also by citizens to stay up to date with their constantly changing society [26, 79, 80]. The self-motivated practice of LL not only increases individual development but also shapes individuals into active citizens [81, 82]. Several characteristics required to be an active citizen include political literacy and informed decision making [83]. Subsequently, these characteristics can be achieved and mastered through knowledge acquired in the process of LL [64, 83]. In other words, LL mechanisms can provide citizens with fruitful knowledge on how to actively get involved in society and one’s community, if it is not separated from other occupational activities [84]. Therefore, OTs can utilize LL mechanisms to increase their knowledge and identify with the role of being an active citizen within their professional and personal roles.

To conclude, we posit that OTs have a stake not only in the utility of NA and how they impact their clients medically, but also on the societal impact of NA and how they are governed. In other words, given their exposure to NA and their impact, OTs have a stake and should be involved in neuroethics and neurogovernance discussions. Therefore, our study focused on the following research questions: 1) What is the familiarity of OTs with NA, their ethical, legal, and social implications, and their governance? 2) What are the views of OTs on the impact of NA on their field, occupation, and clients? 3) What are the views of OTs on using their knowledge and experiences to get involved in neuroethics and neurogovernance discussions? 4) What are the views of OTs on the lifelong learning mechanisms put in place for OTs? 5) What are the views of OTs on the utility of LL to learn about NA especially the ethical, legal, and social implications and how and to what extent do the current LL mechanisms enable OTs to participate in neuroethics and neurogovernance discussions?

Ethical Considerations

This study was approved by the Conjoint Health Research Ethics Board (CHREB) at the University of Calgary on February 23, 2018 (REB17-0785). Participants were required to read and sign the informed consent form mandated by CHREB before participating. Participants were informed of their role in the study, what was expected of them, expected harms and benefits, and...
that their willingness to participate is completely voluntary and may be withdrawn at any time for any reason.

2. Methods:

2.1 Theoretical framework and research questions

According to role theory, the expectations of the roles one thinks one should occupy at work or in one’s social life [85-88] are influenced by the role expectations others have of oneself [89, 90]. OTs are expected to fulfill many roles such as being experts in enabling occupation, being communicators, collaborators, practice managers, change agents, scholarly practitioners, and professionals [60], being advocates for their clients, and promoters of inclusive communities [61, 63]. OTs are also seen as having an essential role in addressing the development of society and its issues of the present and future [62]. Given role theory, this role expectation of OTs should shape OTs’ own expectations of what roles they are to fill [90]. Stakeholder engagement is one focus of discussions within neuroethics and neurogovernance discourses [5, 13, 15, 57] and OTs have a stake in NA due to the impact of NA on occupation and their field [2, 20-22, 29-31] and their exposure to NA [16-19, 23, 35-40]. However, literature does not exist that looks at OTs as stakeholders in neuroethics and neurogovernance discourses. Given the role expectation of OTs and the impact of NA on OTs, the purpose of our study was to give voice to Canadian OTs on the role of OTs as professionals and citizens in NA including neuroethics and neurogovernance discussions. To fulfill the purpose, we aimed to obtain answers to the following research questions by interviewing Canadian OTs: 1) What is the familiarity of OTs with NA, their ethical, legal, and social implications, and their governance? 2) What are the views of OTs on the impact of NA on their field, occupation, and clients? 3) What are the views of OTs on using their knowledge and experiences to get involved in neuroethics and neurogovernance discussions? 4) What are the views of OTs on lifelong learning mechanisms put in place for OTs? 5) What are the views of OTs on the utility of LL to learn about NA, especially the ethical, legal, and social implications and how and to what extent do the current LL mechanisms enable OTs to participate in neuroethics and neurogovernance discussions in a meaningful way?

2.2. Study Design and Questionnaire

We chose for our study a qualitative design [91] using semi-structured interviews developed by the researchers. A qualitative design is most appropriate because the topic covered by the research questions has not been engaged with in relation to OTs so far, although one study investigated the views of OT students on the topic of OTs and science and technology governance [21], and because we want an in-depth understanding of OTs’ views and experiences [91]. This is something that cannot be done by quantitative methods. The protocol also allowed us to ask additional, unscripted probing questions as the interview progressed to clarify or further explore participant’s responses and permit participants the opportunity to discuss issues that are important to them [1, 91, 92]. A semi-structured procedure was advantageous because it allowed the researcher to control the line of questioning and probe further as necessary, and because participants were free to incorporate personal or hypothetical examples and narratives if they felt it contributes to their answering of the question [91]. Additionally, this method allowed for impromptu clarification questions, which serves to strengthen qualitative validity. To answer our
research questions, we designed a 23-question, 9 sub-question research protocol that covered demographics and our research questions and was informed by our knowledge of the literature on NA and OT, neuroethics, and governance of NA. Questions were a combination of yes and no and open-ended to encourage in-depth exploration of the research questions.

2.3 Participants and Sampling

As to inclusion criteria, participants had to be occupational therapy practitioners in Alberta, practicing for at least one year. As to exclusion criteria, any subjects not practicing within the province of Alberta were not considered. The researchers conducted semi-structured interviews with eight practicing OTs. The participants were recruited via expert purposive sampling which allowed to explore a specific group in-depth, and gather participants with particular relevant knowledge [93]. We initially contacted 11 OTs with profiles on the Autism Calgary Website after obtaining approval from the organization, out of which 2 practitioners volunteered to participate in the study. We also contacted 33 OTs listed on the Canadian Association of Occupational Therapists’ website, from which 2 OTs volunteered to participate in the study. The inclusion criteria for these two sources were that participants had to be registered OTs within Alberta, listed in Calgary, and have an email address for contact information. It was later noted that 1 participant recruited through the CAOT website listed in Calgary had moved to Edmonton for work, 2 additional OTs were introduced through personal contacts, and 2 more OTs were referred by another participant. These four also fit our inclusion criteria being registered OTs within Alberta, listed to be in Calgary, and having an email address for contact information.

2.4 Data Collection and analysis

Data were collected from July 13, 2018 (first interview) to Feb 8, 2019 (last interview) by performing 6 semi structured interviews face to face, 1 over the phone and 1 over skype (a total of 8). The interviews lasted 40 min up to 1 hr. After conducting the interviews, they were orthographically transcribed using Express Scribe® playback software into Microsoft Word®. This style of transcription emphasized what was said instead of how it was said [91]. To ensure the privacy and confidentiality of the participants, each transcription was anonymized, including any identifiable information and every participant was given a unique number, P1-P8. Once transcribed, the transcriptions were uploaded into Atlas.TI8™ [94], a qualitative analysis software, where a directed content analysis [94] of the interviews was performed. A directed content analysis [94] was performed to enlarge the scope of research on the views of OTs related to the research questions that “would benefit from further description” Hsieh and Shannon (94). We chose a directed content analysis approach because we made use of prior research [94] around OTs and NA, OTs and LL, and NA governance and neuroethics. Within a directed content analysis, codes are defined before and during data analysis which we did using prior research to develop the initial coding scheme prior to beginning to analyze the data and additional codes were developed as the analysis proceeded [94, 95]. As such, the coding is deductive in the sense that the top level themes are defined by the questions of the survey, which were generated based on the authors’ prior knowledge of the literature and to fill a gap of knowledge [96, 97] identified by the authors. However, the sub-themes that emerged under the top-level theme were not pre-set and as such could be seen as an inductive approach, as we identified in a ‘bottom-up’ way the content by identifying themes, organizing the themes into
larger categories, and then the themes were interpreted as a whole [91, 95-97]. Both authors first
familiarized themselves with the qualitative data by reading the whole PDF of a given transcript,
then re-read the content identifying potentially meaningful data whereby the unit of analysis is
the word level through performing semantic coding on the data [95]. The authors then identified
themes under each of the pre-set top themes based on meaning, repetition, and the research
question. Both authors engaged in analysis, and codes were cross-checked between the two
researchers. The interviews were re-analyzed twice after the initial coding to ensure that themes
had not been overlooked. Throughout the analysis, the investigators engaged in peer-debriefing
and personal reflection to strengthen the validity of the findings. Dependability was ensured in
the audit trail made possible by using Memo and coding functions within ATLASI-8®.

3. Results:

The findings in this study are presented in six sections. The first part will cover demographics.
The second the familiarity of OTs with n=37 NA. The third section will explore the participants’
understanding of the ethical, legal, and social implications of NA, and their views on the impact
of NA on their field, occupation, and clients. The fourth section will cover their views on using
their knowledge and experiences to get involved in neuroethics and neurogovernance discussions.
The fifth section will outline their views on the utility of LL in general, and their use of LL to learn
about NA, their implications, and how and to what extent they enable them to participate in
neuroethics and neurogovernance discussions. Finally, the sixth section discusses the limitations
to the study.

3.1 Demographics

Once our sample was established, a total of n=8 OTs participated in 1-1 interviews,
specifically seven females and 1 male, whose ages ranged from twenty-nine to sixty-four years of
age (Table 1). Specific demographic variables including their gender, age, and their focus of
practice are outlined in Table 1.

3.2 Familiarity with Neurotechnology’s (NT)

The participants interviewed expressed minimal familiarity with the term neurotechnology
and specific processes. Specifically, n= 2 were familiar with the term, n= 2 were not familiar with
the term but could guess the meaning of it, and n= 4 were not familiar with the term. In terms of
specific products and processes that we offered as examples of neurotechnology’s the results
varied (Table 2).

3.3 Perceived Implication of NA
We further asked the participants’ views on the impact that NA will have on their occupation in the future. Six of the participants expressed that NA would impact their occupation. For instance, “I think they have a huge potential to impact occupational therapy especially within the rehabilitation setting, so I think the profession as a whole absolutely it has a big opportunity to impact the way we practice and how far we are able to assist people within their recovery” (P4). Another participant expressed how OTs have to deal with the consequences of some technologies, if considering medicine and other forms of treatment. For instance: “you know a lot of pain medications cause drowsiness and sleepiness and so then it actually reduces function of the clients and that’s how it can affect impact my practice right because for example, like I get a referral that the client is is like you know leaning forward in their wheelchair, there is a risk of falling out and and then you find out they’re on lots of like medications that make them drowsy” (P8). However, n=2 participants expressed that NA will not have an impact due to barriers such as access, cost, and due to their occupational setting. For example, P3 works with children and their families in their homes and does not perceive NA as being implemented as part of home care.

All of the participants stated that NTs in particular and technologies in general will have implications on society. The ethical, legal and social implications participants indicated in relation to neurotechnology’s are listed in Table 3.

Below are some quotes that highlight the participants’ perceptions of the ethical, legal, and social implications of NA:

“One of my clients is interested in in doing the neurofeedback they can afford to go do the QEEG done so if those are the only clients that I offer it to they’re the ones that can afford than there is a social implication of accessibility” (P1)

“how much do you wanna fine tune a person or if something is being controlled like remotely or controlled by someone else like how much free will then does that person have” (P4)

“the previous approach is using these technologies to get people who are defined as lower abilities back to normal now if you have this technology, some people say why should we be normal, we want to go even higher. If you’re going to give me artificial limbs, give me limbs that are going to make me stronger than the other guy” (P7)

“there can be situations where people are deemed not to be competent to make their own decisions and I think that it in of itself brings a huge ethical concern because then despite if they did not want to participate in something or have this treatment if they’re deemed incapable of making their own decisions then they’re essentially forced to have treatment when they may not have wanted it” (P6)

“when you think about artificial intelligence for instance right and the concern about um replacing humans right and creating these other machines to do what humans do and there is a certain amount of humanness that is really important in many things we do and jobs and careers and changes a lot of things for a lot of people right those types of thoughts come to mind” (P2)
“with like the whole brain emulation um I think there’s a lot of discussion around um if you can

copy a brain if you can understand you know what the function is of each different piece of that

person’s brain and even if it’s specific to them” (P4)

We then asked their opinion on the importance of knowing about the ethical, legal, and

social implications regarding NA in their workplace, and n=7 OTs stated that it is important to

think in terms of these implications. Furthermore, n=6 OTs believe that it is important to talk about

these implications in the workplace. “I think it’s really important to talk about it because I think

when we have that conversation then it raised awareness in people and it starts to open that

different perspective and hear other people’s opinions” (P6). “I think it’s a good idea for the

public to have awareness because you know or for professionals to have awareness because you

know if it’s one of your clients who’s asking you about it you need to be able to advise them from

all kinds of standpoints” (P5).

One OT stated that OTs could be addressing the implications of NAs but they should not

necessarily be doing so, “I don’t know if they should but they can, if you consider that they should

then that would bring a lot of responsibility on the OT which they don’t have that much power, it’s

just one member of the whole treatment team but they definitively can and they contribute hugely
to this because sometimes they’re the first line of defence or the first line of care provision in these

situations. They can especially as the role of an advocate for the users and also the society, but I
don’t believe they’re the sole groups responsible it’s much much bigger than just OT” (P7).

Five participants indicated that OTs are uniquely positioned to understand the implications

of neurotechnology’s on occupation. The PEO model (person – environment – occupations)

provides a more holistic view and allows for a better exploration of the effects of certain NAs on

the multiple aspects of occupations, as explained by participant 2.

3.4 Participating in Neurogovernance Discussions

When participants were asked about whether OTs should be involved in neurogovernance

discussions, particularly around the discussions involving the ethical, legal, and social implications

of NA, n=6 reported that OTs should be involved. Below are some quotes that highlight this belief:

“I think we’re actually one of the best suited people to start these discussions because even to just
go back to that PEO model, person environment occupation, um in environment we’re looking at
the physical environment, the cultural environment, the societal, you know uh all of these
institutional environments you know person and what’s going on task and how they’re doing the
task and what are they using to do the task, all these factors right we’re looking at the big picture
we’re not looking at one we’re not looking at that muse or the neuron or that brain we’re looking
at how this affects big scale right” (P2).

“I think we should definitely be giving input you know if you’re an OT working with the deaf
culture I think you should definitely be aware of the issues and aware of the you know umm I
think in terms of making decisions that’s our specialty area” (P5).
“I think the other thing reason we’re well suited is that we do consider the whole person including the environment and their occupation and the person factor so like it really speaks well to thinking about the social implications as well and thinking about the ethical implications” (P6).

3.4.1 Barriers to Getting Involved

Although participants felt they should be involved in neurogovernance discussions, they also expressed why they believe OTs are not involved yet. More specifically, n=3 participants suggest that OTs are undervalued and not seen as credible. For instance: “despite that OT has been around like since the first world war we’re still advocating for our need in the medical profession that it’s hard then to even become a leader in something when you’re still advocating for the reason why you’re there” (P6); “I think we’ve been largely undervalued and so we don’t have a lot of confidence in other people’s perceptions of our value” (P2).

Another barrier mentioned by n=3 participants was the lack of access to platforms that engage in neurogovernance discussions. “um I think it’s probably just the access to it right so I think that most people if you’re not invited to be on the panel or to discuss this” (P4). Furthermore, the lack of access was also connected to a lack of access to NA, and therefore OTs do not have the initial exposure to those implications and possibly contribute to discussions, as expressed by n=2 participants: “we’re looking at a clinical OT right it might be working with an individual and some of these um technologies might apply to them but if they don’t have access to using that technology um they may not be able to comment on it or have an opinion about it” (P4).

Lastly, n=4 participants suggest that OTs prefer direct client care and are not interested in the politics of NA. For instance: “the other reason is that there is not that many occupational therapists in high leading um roles or policy positions um that’s not a very common space for OTs to be not that we can’t um it’s just I find that I think more OTs kind of stay in direct client care not as many OTs will move on into policy change um so I think that can be a barrier for like us as a profession to engage in and kinda become a forefront leader” (P6); “they’re focused much on their individual client and getting a positive outcome so that’s maybe an issue to that I mean yes I’ve heard of to create system somatic changes within the environment or culture maybe OTs will evolve not to work with individual clients only and work with more of the larger systems I don’t know but the funding and the service delivery model doesn’t support a lot of public relation or public education for your average OT I would say” (P3).

In regards to how to overcome the above barriers, participant 6 suggested that the provincial and national associations of OT must start to raise awareness on the impact of NA on their profession: “I think that our um like the Canadian association of OTs and all the colleges in the provinces can also have an opportunity to start to raise awareness for some of these technologies and how this impacts our profession and how it impacts our practice umm because they do like often post signs on social media or there may be um interviewed perhaps for like a news article or something so I guess there is that aspect as well” (P6). Another suggestion was to increase the knowledge through professional development practices: “umm public awareness campaigns from companies that wanna promote their products I guess and um Professional development for these people to make occupational therapists and other professionals aware of what’s out there” (P3).
3.5 Lifelong Learning and Professional Development

All (n=8) of our participants stated that LL is essential. They argued that it is necessary to provide best practice, avoid stagnation, and to learn new approaches. “It’s essential to keep up to date as much as you can even though knowledge is expanding in so many fields so you have to as an OT you can’t know everything about everything so you sort of specialize in certain areas of practice um but um you have to keep seeking opportunities” (P3); “there is no way that you can learn enough to actually be like a competent professional you have to really also continually learn and grow as a professional throughout your career so and it’s hard because no every instance is the same like not every client is the same what works in one case may not always work in the next case you have to really like be a critical thinker to re-evaluate your approaches sometimes” (P6). Our participants engaged in formal professional development opportunities such as conferences (n=6), courses (n=5), seminars (n=2) and informal opportunities such as learning through coworkers (n=7), by reading online journals (n=3) and through the media (n=1).

3.5.1 Catalysts and Barriers for doing LL

Table 4 outlines catalyst that encouraged participants to be engaged in LL and barriers that inhibited their willingness to seek it.

(Insert Table 4 here)

We further asked practitioners how they could overcome the barriers listed. One suggestion by participants 2 and 6 was to be more connected and collaborative with other professionals to share and disseminate information. Another suggestion by participant 6 was offering a variety of ways to attend conferences such as virtually. To overcome one of the most common barriers of money, participants 2 and 3 suggested that there must be more funding that is allocated for private practices to provide LL and for practitioners themselves to access LL.

3.5.2 Using LL to Learn About NA

Specifically pertaining to NA, only n=1 participant has used LL mechanisms to become more knowledgeable on NA. Participant 3 explains the lack of exposure to NA as the reason for not learning about them, “maybe if I was still working for Alberta health services I might have heard about some of them, but they don’t seem terribly relevant to what I’m doing” (P3). Furthermore, n=2 participants described different methods that OTs could increase their knowledge on NA: “they could take courses they could read articles research they could talk to people who are involved in companies that provide those products” (P2); “employers are responsible for ensuring OTs learn about NTs” (P4). Participant 1 expressed their interest in connecting with other OTs who are interested in working with NA, “this neurofeedback I would like to know if there’s OTs in Calgary in who are doing it other OTs who are thinking about doing it uh if there’s some kind of process that’s already in place that I wouldn’t have to reinvent the wheel and become the first person doing it in Calgary for instance umm.. yeah so when you are in a general way when you’re looking at doing something more efficient by using technology how to get together with other OTs to do that as a group other than in isolation would be nice” (P1).
3.6 Limitations

Given the nature of this study, social desirability bias is a possibility. Interviews were conducted face-to-face and over the phone, and though participants were guaranteed anonymity, they may not have been honest about some of their views. However, this method of data collection was chosen because it allowed for exploration and identification of a relevant issue that was identified as being a gap in the OT literature. The face-to-face and over the phone interactive format allowed participants to ask clarification questions, which was useful given that it was a novel topic to several of them. Additionally, it allowed the researcher to ask probing questions based on the responses of OTs. Moreover, we only interviewed 8 OTs whose views may not be analogous across this field. However, despite its limitations, this study provided greater insight into the topic of NA and OTs and allowed us to generate information-rich knowledge [91]. Using this insight, further research can be conducted to gauge how prevalent these practices and beliefs are.

4. Discussion

The purpose of this study was to grasp a better understanding of the views of OTs on getting involved in neuroethics and neurogovernance discussions as part of their roles as professionals and private citizens. Our findings suggest that the current knowledge on NA is limited and participants are currently not involved in neuroethics and neurogovernance discussions, particularly on the emerging ethical, legal, and social implications of NA and that LL are not used in their workplace to empower OTs to contribute in a meaningful way to NA discussions including neuroethics and neurogovernance discussions. Such findings suggest that changes might be beneficial in the education of current OT students and in the LL opportunities for OTs in order to empower these professionals to get involved in such discussions. Our findings also suggest that the neuroethics and neurogovernance field has to change how they engage with OTs if they want to fulfill their aim of involving health professionals in neuroethics and neurogovernance discussions. The remainder of this section will focus on interpreting our findings through the perception of OTs as a field and the role expectations of OTs as professionals and citizens, and literature around LL and professional development.

4.1 The Role of OTs

OTs are trained health professionals responsible for enabling an inclusive society for individuals to participate in their daily occupations [59]. Furthermore, OTs are also members of society and therefore have the role of being active citizens, advocate for their clients, and influence at the policy level [65, 98]. Below we will discuss how participants perceived their role as professionals and as active citizens involved in neuroethics and neurogovernance discussions, in comparison to the current OT literature.

4.1.1 The role of OTs as professionals

Various organizations such as CAOT and the World Federation of Occupational Therapists (WFOT) have outlined various roles warranted by OTs. Such roles include being experts in enabling occupation, communicators, practice managers, change agents, scholarly practitioners
and professionals [61]. Furthermore, WFOT emphasizes the role of OTs as advocates and promoters of health, well-being, and occupation as a human right [99], through a lens of occupational justice [100]. In other words, OTs have the responsibility to develop the knowledge needed to support the participation of all individuals, advocate for occupation as a human right, foster cultural sensitivity, identify and solve occupational justice issues, and work with groups and individuals to address such barriers [99]. However, in order to promote occupational justice for their clients, OTs must engage themselves in their community and stay aware of the societal and environmental issues that impact their clients [101].

As addressed earlier, occupation and humans as occupational beings are continually impacted by the development of NA, either by outdating occupations, creating new occupations, or by changing current occupations [2, 20-22, 29-31]. Given the therapeutic and non-therapeutic ways that their clients are impacted by NA and the societal and environmental issues that arise [1, 2, 33], OTs have a role and responsibility to develop the knowledge on how to address such issues and support their clients [99, 101]. Furthermore, with the increasing impact of NA on society, stakeholder engagement is needed to get a variety of perspectives [52, 55, 56], and is a focus of discussion within neuroethics and neurogovernance discourses [5, 13, 15, 57]. Stakeholder groups can include researchers, policy makers, consumers, civil society, and health care professionals [5]. With the impact of NA on their field [2, 20-22, 29-31], their exposure to NA [16-19, 23, 35-40], and their expected roles as advocates and educators of technologies [23, 58], OTs have the potential to contribute to neuroethics and neurogovernance discussions. Such contributions and actively participating in neuroethics and neurogovernance discussions fits with the role of OTs [61].

From our findings, 75% of participants stated that OTs are uniquely situated to be involved in neuroethics and neurogovernance discussions. Specifically, OTs have the potential to address some of the occupation-related implications of NA using the PEO model and help protect and advance occupational rights. For instance:

"the PEO model so you're looking at the person the environment the occupation so you don't just look at the occupation and there is a few different ways that you could look at that so I think that what we bring to the table right is that more holistic view of how um some of these technologies are able um or what impacts they could have within those different areas" (P4).

The PEO model is conceptualized by OT as the person, their environment, and occupations that dynamically interact [102]. Specifically, the environment includes the cultural, institutional, physical and social factors that can impact occupations and affect occupational performance [102]. Given that NA impact their clients directly as the person, impact their social, cultural, and institutional environments, and their occupations [103], OTs can provide a holistic view and exploration of the implications of NA to neuroethics and neurogovernance discussions. Furthermore, due to their unique understanding and experience of the relationship between occupation, the person, and the environment, their involvement in developing policies is warranted [65], thus fulfilling their socio-political role [104, 105].

Despite the literature on an increased need in stakeholder engagement and the potential for OTs to fulfill their role as advocates, and 75% of participants expressing that OTs can be involved
in neuroethics and neurogovernance discussions, our findings suggest OTs are not involved yet. In other words, we can assume that OTs are currently not fulfilling their professional roles as advocates for and educators of the ethical, legal, and social implications of NA on their clients. Participants did not see themselves as able to fulfill the role of being an educator, advocate, or policy influencer and partaking in neuroethics and neurogovernance discussions, a role they think OTs should fulfill. This was due to a lack of exposure and opportunities to update their knowledge and competencies on NA, and not an unwillingness on their part. Other barriers included how OTs and their voice are undervalued in the medical field, how there is a lack of access to platforms that engage in neuroethics and neurogovernance discussions, and that OTs prefer direct client care rather than policy change.

"the other reason is that there is not that many occupational therapists in high leading um roles or policy positions um that’s not a very common space for OTs to be not that we can’t um it’s just I find that I think more OTs kind of stay in direct client care not as many OTs will move on into policy change um so I think that can be a barrier for like us as a profession to engage in and kinda become a forefront leader" (P6).

These findings are problematic given the responsibility and need for OTs to actively advocate for all areas impacting their clients and their occupation [63].

As such, an increase in support and opportunities for OTs are needed in order to increase their breadth of knowledge on the ethical, legal, and social implications of NA and their impact on their field. With the increased demand for continuous and collaborative discussions on the advancement of science and technology, OTs must have access to such education beginning at the student level and expanding throughout their career [106]. Furthermore, as supported by Participant 6, the provincial and national associations must raise awareness on the impact of NA on all facets of OT. By doing so, OTs will feel empowered to actively link their role expectations of advocacy and policy development with getting involved in neuroethics and neurogovernance discussions.

4.1.2 The role of OTs as active citizens

As private citizens, individuals have the role and responsibility of being active citizens and exercising their knowledge in the public interest [98]. Being an active citizen refers to the act of engaging in participatory and representative democracy, by actively participating in society, community, and political life in accordance with human rights [64]. Engaging in this process serves as a transformative tool for social change by promoting the development of knowledgeable citizens and empowering them to take on activist roles [107]. It does not only pertain to the political actions of voting in elections, yet it extends to the everyday participation in society, while being interconnected with the concepts of human and occupational rights [24]. For instance, as an active citizen, individuals express such roles through meaningful occupation with others in a social context [24]. Furthermore, it is recognized that the fields of OT and occupational science must conceptualize the “occupational nature of active citizenship, located as a practice in the interconnectedness of the individual and the larger community” [24].
Not only is engaging in one’s right and responsibility as an active citizen directly connected with meaningful occupations and therefore impacting the field of OT [107], OTs are also members of society and therefore have the responsibility of being an active citizen and actively engaging in society [24]. It is argued that OTs have a socio-political role to fulfill including meeting with politicians to influence policy decisions that promote inclusion [107]. Furthermore, it is crucial that OTs stay aware of the societal issues that impact their clients and engage themselves in their community for the promotion of social and occupational justice for their clients [101].

As professionals, OTs have a role to meet in advocacy and policy making, which can be fulfilled by engaging in neuroethics and neurogovernance discussions. However, OTs also have a role to play in these discussions under the identity of being an active citizen. In other words, OTs can uniquely contribute to neuroethics and neurogovernance discussions as active citizens due to their professional roles that allows them to view the possible implications of NA from a different and holistic standpoint. In accordance with the democratization of science and technology, the early involvement of stakeholders including engineers, policy makers, and public citizens is warranted to construct conversations around awareness, reaction, and knowledge development and sharing [70, 108-110]. Therefore, as active citizens, OTs can share their expertise and exercise their personal and professional knowledge to contribute to neuroethics and neurogovernance discussions [69].

According to Fransen et al., (2015), one of the ways to be empowered as an active citizen is by being recognized and respected as a citizen with a contribution to make [24]. Therefore, it is noteworthy that all participants in our study did not identify with the role of being active citizens within neuroethics and neurogovernance discussions. Additionally, n=3 participants expressed that their voice as OTs felt undervalued and was a barrier to getting involved past the clinical level. Participants therefore did not feel empowered to act as active citizens in relation to the governance of NA or scientific and technological governance in general. These findings are similar to the ones by Fransen et al., (2015), where it is stated that some OTs may be challenged to fulfill their socio-political role due to role constraints [24]. Therefore, OTs must be empowered and supported in acknowledging how they can contribute with their identity as professionals and identity as active citizens to neuroethics and neurogovernance discussions. By doing so, they can increase the awareness of their thoughts and expertise on the ethical, legal, and social implications of NA they and their clients experience and foster fruitful discussions between OTs and neuroethics and neurogovernance stakeholders.

4.2 Lifelong Learning

As advocated for by international organizations including UNESCO, OECD, and the World Bank, LL should be viewed as an essential and lifelong educational commitment [73]. LL is also argued to be a cultural practice, where individuals are expected to be lifelong and self-directed learners provisioned by goals, means, and evaluation in curriculum development [111]. With the constant changes in the health field, OTs are expected to use LL mechanisms to stay up to date with such changes in order to efficiently advocate for the care of their clients [25]. Such mechanisms are one of the strategies that are most recommended by professional associations to enable OTs to stay up to date with new knowledge and evidence, and apply it to their work [112].
and Action Plan, the continuation of personal and professional development is necessary for all students and professionals, reflecting the continuum of competence required by practitioners [75].

The need for OTs to continuously engage as lifelong learners is further reflected in our results, where all (n=8) participants stated that LL is essential to stay up to date, grow as a professional, and provide best practice. To give one quote:

“While especially in my profession I do think it’s important for professional growth and development just because in this area there’s even though you went to school there’s so much you don’t know” (P8).

Despite the need for LL as a practitioner, participants outlined various barriers from getting involved in more LL opportunities. Such barriers include lack of time (n=8), accessibility (n=7), and lack of money (n=7). For instance:

“time I think is a huge one because there could be so many different opportunities that we could take advantage of like I know there is tons of different workshops that are offered within the city and yet like we aren’t able to take that time off work even if it could benefit our clients and it could benefit ourselves us therapists” (P6).

Furthermore, only n=1 participant has used LL mechanisms to increase their knowledge on NA. However, the advancement and implementation of NA in the health field will only continue, and it’s the practitioner’s role to continually become lifelong learners and increase their knowledge on NA and their implications [113]. In order to get involved in neuroethics and neurogovernance discussions, individuals must first have fruitful knowledge on the implications and topics at hand [83]. Furthermore, given the impact of NA on all facets of OT, it is argued that OTs would be more inclined to further engage in learning these implications and participate as advocates, as is expected [114]. However, we suggest that the current formal LL mechanisms are not providing OTs with meaningful information to guide them with getting involved in neuroethics and neurogovernance discussions. Given that OTs are stakeholders of NA as health professionals and are expected to take part in neuroethics and neurogovernance discussions, these findings are problematic.

Without a formal exposure to the ethical, legal, and social implications of NA, OTs will not have the background tool and purpose for further learning about such implications on their own time. As stated by Garden & Winickoff (2018):

“ It is crucial to build a recognition of the importance of social and ethical issues into the training of all those involved in developing and utilising novel neurotechnologies, thus principles of responsible innovation and public engagement should be incorporated into education curricula to foster a better understanding of benefits and risks. Strengthening of ‘neuro-literacy’ in the wider public, including, for example, patient groups, practitioners, and lawyers would help responsible use” [5].

Therefore, we posit that provincial and national organizations must expose OTs to the various societal and non-clinical consequences of NA. This will increase their knowledge and encourage their involvement in neuroethics and neurogovernance discussions. A change in the
current LL mechanisms is also warranted in order to provide OTs sufficient information to be comfortable with educating others on the implications of NA. Lastly, OT students have to be exposed to the topic to be sensitized so that they actively seek out LL as professionals.

4.2.1 Engaging in LL as an active citizen

In the same way that OTs can formally use LL mechanisms to update their professional competencies, LL mechanisms can also be used to empower OTs to identify with their role as active citizens. It is essential for all individuals to become active lifelong learners, in order to be able to actively deal with the changes in society and their consequences [79], including the consequences of NA.

In order to fulfill the identity of an active citizen where civic participation and social cohesion is promoted, an educational process and responsibility must be taken [24]. LL mechanisms can therefore be utilized as tools for individuals to identify as active citizens by constantly learning and remaining engaged [79, 80, 82, 84, 115]. Such mechanisms must also provide OTs with citizen education including moral and social responsibility, community involvement, and political literacy, in order to achieve social, moral, and political outcomes [83]. With the efficient use of LL mechanisms, OTs can feel empowered to fulfill their role as active citizens by contributing to neuroethics and neurogovernance discussions.

While LL mechanisms are necessary for individuals to gain new knowledge, OTs must also be provided with appropriate learning environments, provided with opportunities to integrate new knowledge to work, and provided with the right conditions to understand new situations encountered, in order to build their skills and capabilities to be active and global citizens [116-118]. As argued by researchers, adjustments will therefore need to be made to the early education and training of OTs so that such professionals are better equipped to act as active citizens and health promoters [65]. In other words, the current OT curricula should be reviewed and adapted as it evolves with global needs, in order to train prospective OTs as responsible active and global citizens [119]. Therefore, these findings posit an impact on the current education, occupational learning environment, and LL mechanisms for OTs. We suggest such areas must be adapted in order to provide OTs with knowledge and empower them to engage as active citizens. OTs would be encouraged to utilize new knowledge learned about the implications of NA and how to create profound change in the community from the University curricula and LL mechanisms, as well as their expertise from working in the field. Such changes would empower OTs to merge their roles as health professionals and roles as active citizens, and actively contribute to neuroethics and neurogovernance discussions.

5. Conclusion:

Our findings suggest that the knowledge of NA is limited among our participants, and participants are currently not involved in the discussions surrounding the ethical, legal, and social implications of NA. Participants saw OTs as individuals who can uniquely contribute to discussions due to their holistic way of thinking as a field and their use of the PEO model, allowing them to view the impacts of NA in a different way. However, due to limiting factors such as access to discussions and a lack of knowledge, participants did not see themselves and other OTs as
Currently being involved in neuroethics and neurogovernance discussions. Furthermore, all (n=8) participants view LL mechanisms are essential in order to stay up to date, provide best practice and grow as a professional. However, these mechanisms are currently not providing OTs with knowledge on NA past the clinical level and on the ethical, legal, and social implications of NA. These findings are problematic given the role understanding of OTs [23, 61, 63], the impact of NA on OTs [18, 19], their clients [7-9, 41], the OT field [16, 17], and occupation [20-22], and the focus of neuroethics and neurogovernance on stakeholder engagement [52, 55, 56].

Our findings fit with a similar study that outline the limited role of OT students in the involvement of science, technology, and innovation (STI) governance [21]. The students in this study emphasized the importance of learning about STI developments early in their educational career, starting at the undergraduate level [21]. It was also emphasized how they view OTs as being uniquely and well positioned to support the governance and development of STI yet are not involved due to a lack of access and lack of knowledge provided throughout their undergraduate and Master’s degrees [21]. Therefore, the barriers to getting involved in governance that were reported in our study were already seen as problems by OT students. Such similarities imply that a change of curricula at the undergraduate level and in OT schools is warranted so that students can gain insight into the developments of NA and their implications and encourage future OTs to further learn about them through LL mechanisms. Our findings also fit with other studies that outline the limited role of OTs as portrayed in Canadian newspapers, the lack of engagement from OT with ethics and ethical theories, and the limited role narrative of OTs in the artificial intelligence and machine learning discourse.

Given the gap outlined by our study on how the OT field and neuroethics and neurogovernance discourses interact, we suggest more must be done to facilitate the involvement of OTs in such discussions. For example, the current undergraduate and OT graduate curricula must change, to introduce prospective OTs to the constantly emerging consequences of NA and the impact NA will have on their personal and professional lives. LL mechanisms must also be modified to empower current OTs to bring forth new knowledge acquired through such mechanisms as well as knowledge gained while working directly in the field to engage in neuroethics and neurogovernance discussions.

As to future directions, a study can be done that focuses on evaluating the current OT curricula to grasp a better understanding of how it can be adapted to better provide knowledge on NA and its implications at the student level, while still falling in accordance with current OT learning outcomes. Future studies can also focus on how to properly implement LL mechanisms involving the implications of NA and analyzing the outcomes of such implementation. Such studies will provide researchers the extent that OTs would get involved with such changes and more fruitful information on how to better get OTs involved in neuroethics and neurogovernance discussions. Lastly, it would be fruitful to grasp a better understanding of why there is a disconnect between OT curricula and scholars and neuroethics and neurogovernance curricula and scholars. This would include an investigation of what current stakeholders in neuroethics and neurogovernance discussions think of the involvement of OTs in such discussions in order to brainstorm how OTs can better contribute.

Conflict of Interest
No conflict to declare.

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6. References:


98. Stivers C. The public agency as polis: Active citizenship in the administrative state.


Table 1: Participant demographics

<table>
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<tr>
<th>Variables</th>
<th>N (n=8)</th>
<th>%</th>
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Table 2: Familiarity of n=8 OTs with the following NAs.

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<tr>
<td>Brain imaging</td>
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Virtual reality  
Whole brain emulation  

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