



Neuro-Enhancement Practices across the Lifecourse: Exploring the Roles of Relationality and Individualism

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Specialty section:

This article was submitted to
ELSI in Science and Genetics,
a section of the journal
Frontiers in Sociology

Received: 14 November 2016

Accepted: 13 February 2017

Published: 02 March 2017

Citation:

O'Connor C and Nagel SK (2017)
Neuro-Enhancement Practices
across the Lifecourse: Exploring the
Roles of Relationality and
Individualism.
Front. Sociol. 2:1.
doi: 10.3389/fsoc.2017.00001

One key theme in sociological analysis of neuro-enhancement has been the question of whether the drive for enhancement promotes the cultural value of individualism. It has been argued that neuro-enhancement discourses implicitly propagate new responsibilities that oblige individuals to continually “work on” their brain to ensure its health and productivity. However, much of this critique relies on rather abstract analyses of discursive trends, with relatively little consideration of empirical evidence illuminating the role played by more “micro” social dynamics, such as interpersonal relationships, in the logics and practices of neuro-enhancement. This article proposes a novel perspective on neuro-enhancement by reviewing existing empirical literature enlightening everyday engagements with neuro-enhancement, and suggesting that relationality, rather than pure individualism, may be a better framework for conceptualizing these findings. The article advances this argument through a particular focus on two major preoccupations of neuro-enhancement discourses, namely, enhancing children’s brains and preventing age-related cognitive deterioration. The article synthesizes the empirical evidence showing that these two concerns are essentially relational in experience and considers how familial relationships and conceptualizations of caregiving shape the ways neuro-enhancement concepts and technologies unfold in everyday life. The article offers insights from the philosophical literature on relationality as a conceptual framework to steer further investigation of neuro-enhancement’s impact on contemporary society. A more holistic understanding of the relational dynamics that characterize everyday engagement with neuro-enhancement practices will enable better anticipation of the risks and benefits such practices may entail, due to greater insight into how they are likely to be enacted in context.

Keywords: neuro-enhancement, relationality, pediatric neuro-enhancement, aging, individualization, responsibility

INTRODUCTION

The meaning of neuro-enhancement, its prevalence and use, and its justification and critiques have evolved over recent decades. Typically, neuro-enhancement refers to the use of technologies such as prescription medication and brain stimulation for the purpose of augmenting normal cognitive or affective function (Parens, 1998; Farah, 2005; Nagel, 2010a, 2014; Lucke and Partridge, 2013). In a wider sense, other interventions such as nutrition and cognitive training can also be

understood as neuro-enhancement (Dresler et al., 2013; George and Whitehouse, 2011; Lumma and Nagel, 2016). While many of the relevant techniques were originally developed for use in clinical populations, they are increasingly proposed as options for persons who are healthy and “normal” across the lifespan. Notably, neuro-enhancement is not only suggested to have the potential to influence cognitive faculties (e.g., memory and attention), but also physical capacities (e.g., muscle strength and sleep), affective states (e.g., moods and emotions) and even social and moral competencies (e.g., moral decision-making) (Nagel, 2010a). There is mixed data on the veracity of these claimed effects (de Jongh et al., 2008; Repantis et al., 2009, 2010; Battleday and Brem, 2015). However, it is important to note that while the effectiveness and scientific validity of many neuro-enhancement applications remain uncertain, their popularity and cultural prominence mean that they merit ethical scrutiny irrespective of whether they actually are effective. This need not contribute to the “hype” (Hasler, 2012) that often surrounds discussion of neuroscientific advances, but instead can help avoid a “phantom debate” (Quednow, 2010) by grounding ethical analysis in reasoned, empirically informed discussion of actual social practice.

The notion that we can affect our neurocognitive performance through deliberate action has many appealing dimensions. It promises a greater degree of control over our futures, and a route to promoting health, happiness, autonomy, and economic success (Harris, 2007; Greely et al., 2008; Bostrom and Sandberg, 2009; Savulescu et al., 2011). However, the topic of neuro-enhancement also raises numerous ethical issues. Neuro-enhancement’s implications in relation to standard bioethical principles, such as users’ safety and autonomy, have received necessary consideration in the literature (Parens, 1998; Farah et al., 2004; Nagel, 2010a). Yet, neuro-enhancement raises more complex ethical issues than direct threats to the safety and autonomy of the individuals who avail of enhancement technologies. Neuro-enhancement is extensively discussed in the media and increasingly absorbed into public policy (Broer and Pickersgill, 2015; O’Connor and Joffe, 2015). As a cultural phenomenon, neuro-enhancement has potential repercussions for broad societal issues such as justice, equality, markets, and health policies (Singh and Kelleher, 2010; Nagel, 2015; Ray, 2016). Thus, further ethical considerations relate to the type of society that neuro-enhancement reflects and reinforces. As a result, the popularity of new neuro-enhancement technologies has sparked extensive sociological scrutiny. One of the most frequent themes in this analysis has been the question of whether the drive for neurocognitive enhancement promotes the cultural value of individualism (Pitts-Taylor, 2010; Biebricher, 2011; Ortega, 2011; Thornton, 2011; Joldersma, 2016). The current paper seeks to advance understanding of these ideological dynamics by bringing into focus the micro-social dimension of how people engage with neuro-enhancement ideas in real-world social contexts. It reviews empirical research enlightening everyday engagements with neuro-enhancement and argues that relationality, rather than pure individualism, may be a better framework for conceptualizing these findings. It offers insights from the philosophical literature on relationality as a conceptual framework to steer further investigation of neuro-enhancement’s impact on contemporary society.

A concern with investigating how neuro-enhancement resonates in ordinary social life requires consideration of how “neuro-enhancement” is to be defined. The extant empirical and conceptual literature on the topic has primarily concentrated its discussion on technological means of enhancement, with a particular focus on psychotropic medication. Such practices are indeed increasingly salient in society at large (Farah, 2015). Yet, sociological research shows that concern with enhancing brains manifests at a much broader level of practice, such as the adoption of daily nutritional and cognitive training regimes specifically oriented toward improving neurocognitive function (Pitts-Taylor, 2010; Thornton, 2011; O’Connor and Joffe, 2015). Again, whether these actually do affect neurocognitive performance is uncertain, yet inconsequential for studying neuro-enhancement as a cultural phenomenon: when the aim is to understand how neuro-enhancement is being configured as a cultural ideal, the key condition for analytic attention is that a particular practice is *experienced* as an act of enhancement. In the current paper, we adopt an inclusive definition of neuro-enhancement, which incorporates any behavior that the actor undertakes with the specific aim of enhancing neurocognitive function. While this is somewhat imprecise, inclusivity is an advantage in an exploratory analysis, as it reduces the chances that some important phenomenon will be overlooked. This is especially pertinent since technological means of neuro-enhancement remain in use by only a minority of the population, who have often been prompted to adopt these technologies by a specific neurological or psychological diagnosis. If logics of neuro-enhancement also manifest in more prosaic everyday behaviors, such as nutrition and leisure regimes, this may be where their impact is most pervasive (Lumma and Nagel, 2016). While such practices are not intrinsically or necessarily enhancements, they can be experienced as such if they are performed with the aim of affording the user a competitive advantage in the culture in which they are operating. Adopting a broad definition of what “counts” as neuro-enhancement thus affords the best chance of capturing the multifarious ways people are engaging with this ideal in their day-to-day lives.

Considering neuro-enhancement in its social context makes clear that the extent and nature of engagement with neuro-enhancement deviates across important social categories such as culture, gender, and class. The current paper seeks to enlighten the micro-social dynamics of neuro-enhancement through a particular focus on the generational dimension of neuro-enhancement experiences. The ethical questions neuro-enhancement raises may vary according to the developmental stage of the population at which it is targeted (Forlini and Racine, 2011). This is reflected, for instance, in the American Academy of Neurology’s differing guidelines for use of neuro-enhancement for children and adults, which recommend more conservative practice for children (Graf et al., 2013) than for adults (Larriviere et al., 2009). Children are frequently positioned as vulnerable consumers (Graf et al., 2013). While enhancement in adolescents is often justified with reference to the principle of personal autonomy, enhancement for young children is more difficult to evaluate because their underdeveloped cognitive and legal competence establishes a special vulnerability to any risks

neuro-enhancement technologies might incur (Graf et al., 2013). Just as children need distinct consideration, the group of the elderly is often also positioned as requiring caution in relation to enhancement endeavors. Given that enhancement is usually most relevant to elderly people experiencing or anticipating cognitive decline, questions about personal autonomy and risk again arise when neuro-enhancement is targeted at this population.

In an exploration of the micro-social dynamics of neuro-enhancement, focusing on children and the elderly adds particular analytic value due to the unique social positioning of these populations. Members of both groups have a heightened level of dependence on others, generally within a family context. As such, data enlightening engagement with neuro-enhancement within these populations should offer a particularly direct glimpse of how neuro-enhancement is mediated by personal relationships. The current paper reviews the existing empirical research that illuminates how the ideas and practices of neuro-enhancement manifest in the lives of children and elderly people and considers how these findings resonate with philosophical reasoning on individualism and relationality. With this structure, the paper does not claim to capture the full spectrum of relationships that may mediate neuro-enhancement's social effects. Firstly, it concentrates mostly on familial relationships: relationships rooted in non-domestic contexts, such as educational and medical settings, are undoubtedly also important. Furthermore, in focusing on children and older people, the paper omits direct consideration of the young and middle-aged adults who, in many cases, are those providing the care that children and older individuals require. While these groups doubtlessly also merit attention, they lie outside the scope of the current paper. Here, childhood and aging are adopted as case studies on which to base a preliminary conceptual investigation of the micro-social context of neuro-enhancement ideas and practices.

NEURO-ENHANCEMENT AND INDIVIDUALIZATION

Individualism is an ethos deeply rooted in Western civilization. Many cultural theorists have observed that processes of individualization gathered pace in European and American societies throughout the twentieth century (Lukes, 1973; Sampson, 1988). Beck and Beck-Gernsheim (2002) define individualization as the instantiation of:

a compulsion, albeit a paradoxical one, to create, to stage manage, not only one's own biography but the bonds and networks surrounding it and to do this amid changing preferences and at successive stages of life, while constantly adapting to the conditions of the labour market, the education system, the welfare state and so on (p. 30).

Beck and Beck-Gernsheim's (Beck and Beck-Gernsheim, 2002) formulation of individualization is characterized by two primary features: the individualization of social risks such as unemployment and environmental degradation, so that social

problems are perceived and explained in terms of individuals' flawed behavior, and the rising importance of individual achievement orientation. Whereas in previous epochs, a person's identity was largely "given" by their social positioning, under conditions of individualization fashioning an identity becomes a task with which individuals are charged. Individualization is thus centrally linked with responsabilization: individuals bear practical responsibility for forging their destinies, and moral responsibility for the successes or failures of those efforts.

On the surface, this historically new level of agency is empowering. Presumably, encouraging people to make choices in line with their personal preferences should maximize the number of people who achieve "the good life." However, Beck and Beck-Gernsheim (2002) argue that opportunities for action can quickly become burdens of action. Nagel (2010) draws on evidence from psychology and economics to refute the simplistic assumption that more choice necessarily leads to more well-being: empirical evidence shows that an abundance of choice is often experienced in terms of anxiety, frustration, and anticipated and/or actual regret. One of the primary reasons for this is that "whatever turns out to be a matter of choice and personal control also turns into a candidate for blame and self-blame" (Nagel, 2010, p. 114). This is clearly illustrated in the domain of health, which in recent decades has been increasingly constructed as an outcome of one's lifestyle choices (Rabinow, 1992; Crawford, 2006). While this framing can motivate people to make health-promoting decisions, it can also produce a tendency toward victim blaming when health calamities do befall an individual (Wikler, 1987; Link and Phelan, 1995; Lantz and Booth, 1998; Quinn and Crocker, 1999; Crawford, 2006; Kim and Willis, 2007). The emphasis on individual agency means that the causal influence of uncontrollable biological forces, as well as social factors such as gender, class, and race, are systematically underappreciated in explaining individuals' life outcomes.

An enduring critique of contemporary neuroscience has been that by focusing its gaze inside the human skull, neuroscience perpetuates individualistic modes of explanation (Maasen and Sutter, 2007; Gergen, 2010; Meloni, 2011; Canter, 2012; Joldersma, 2016). Critical theorists' attention has been particularly drawn to the field of neuro-enhancement, due to the parallels between the concept of neuro-plasticity and the neoliberal values of flexibility, mobility, and adaptability (Malabou, 2008; Choudhury et al., 2009; Pitts-Taylor, 2010; Ortega, 2011; Papadopoulos, 2011). The concept of neuro-enhancement implies that aspects of human life previously beyond our control—the biological foundations of cognitive development and decline—are now malleable by deliberate human action. Beck and Beck-Gernsheim's (Beck and Beck-Gernsheim, 2002) theory predicts that in an individualized society, a situation where individuals *can* enhance their brain will fast become a situation where individuals *should* enhance their brain. From this perspective, opportunities for neuro-enhancement mutate into a new form of responsabilization, whereby individuals are obliged to continually "work on" their brain to ensure its health and productivity (Pitts-Taylor, 2010; Biebricher, 2011). Those who fall short of socioeconomic demands for lifelong productivity and self-reliance can be blamed for failing to perform the required neurological self-government.

As Pitts-Taylor (2010) puts it, “Seeing ourselves in neuronal terms may be becoming a duty of biomedical citizenship, since failure to think about our brains in neuroscientific terms, or at all, not only invites risk but may increasingly constitute moral failure” (p. 649). Neuro-enhancement is thus seen as reflecting and reinforcing an increasingly individualistic, competitive culture.

However, understanding of the sociopolitical implications of neuro-enhancement is limited by the fact that much of the existing literature on the topic is speculative in nature. When empirical evidence is included, it is usually restricted to the analysis of media texts or commercial products. While these data contain valuable indicators of how neuro-enhancement is being configured in wider culture, they cannot give direct insight into its manifestation in lived experience. To fully understand the normative implications of new opportunities for neuro-enhancement, we need first to answer the empirical question of how humans do in fact respond to the increased degree of choice and responsibility these technologies entail (Bostrom and Sandberg, 2009; Forlini and Hall, 2016). The research that has investigated how neuro-enhancement ideas are received by the lay public has revealed some unexpected findings: for instance, although people are interested in neuro-enhancement and conscious of normative pressures to engage in it (Cabrera et al., 2014; Fitz et al., 2014; Schelle et al., 2014), actual uptake of neuro-enhancement regimes may be relatively low (Pickersgill et al., 2014; O'Connor and Joffe, 2015). A valid and responsible analysis of neuro-enhancement's cultural implications should be sensitive to its real-life operations, and incorporate the nuances and qualifications that are evident therein.

An inevitable consequence of focusing on real-world human activity is an acknowledgment of the undeniably interdependent state of human existence. An extreme version of the individualist critique of neuroscience suggests that neuroscience promotes a philosophy akin to Sampson's (Sampson, 1977) “self-contained individualism.” Under this conceptualization, human life is desocialized to such an extent that the resulting society is comprised of entirely atomized, alienated individuals. Theoretically, neuro-enhancement could contribute to an “each man/woman for him/herself” mentality by encouraging individuals to constantly seek neurocognitive advantage over others. However, a cursory glance at how neuro-enhancement is enacted in contemporary society shows that pure self-interest cannot be the sole driving force. Almost all analyses of media accounts of neuro-enhancement have highlighted a major focus on enhancing children's brains (Thornton, 2008, 2011; Pitts-Taylor, 2010; O'Connor and Joffe, 2013a). The marketing of neuro-enhancement is often directed at parents who are presumably motivated by promoting their children's interests, rather than their own. As we demonstrate below, another major preoccupation of neuro-enhancement discourses, preventing dementia in later life, is underpinned by concerns about the impact dementia would have on one's loved ones, rather than only the directly affected person him/herself. Thus, interpersonal relationships lie at the core of how neuro-enhancement concepts and technologies play out in everyday life. Imperatives for neuro-enhancement are configured in terms of responsibilities to *others*, as well as responsibilities to oneself (Broer and Pickersgill, 2015). Given these diverse felt responsibilities toward others,

neuro-enhancement discourse and practice must be understood in terms of individuals' connectedness to other people. As we will argue below, it even specifically targets these relationships as the medium through which neuro-enhancement is to be enacted.

Rose and Abi-Rached (2013) cohere with this framing in their assertion that brains are not understood as totally individualized and isolated; they suggest that quite on the contrary, the brain can be conceived as a new locus of sociality. Scrutinizing the discourse around neuro-enhancement shows that optimizing brains is recommended not just for the benefit of individuals, but for the wider social good (Thornton, 2011; Rose and Abi-Rached, 2013; Broer and Pickersgill, 2015). Adults are exhorted to sculpt their children's brains and prevent their own neurocognitive deterioration, in order to cultivate a productive, entrepreneurial society composed of self-sufficient actors who do not burden social resources. Neuro-enhancement has also been proposed as a tool for improving public health (Shaw, 2014) and reducing social inequalities (Ray, 2016). The political implications of neuroscience's use in social policy have already been the subject of much analysis (Wastell and White, 2012; Macvarish et al., 2014; Munro and Musholt, 2014; Broer and Pickersgill, 2015; Edwards et al., 2015). Less attention, however, has been paid to the role played by more “micro” social dynamics, i.e., interpersonal relationships, in the logics and practices of neuro-enhancement. The current paper seeks to fill this gap by considering what is known about the familial contexts in which neuro-enhancement ideas manifest across the lifecourse, with particular attention to the ways applications are targeted at young children and aging adults.

NEURO-ENHANCEMENT IN CHILDHOOD

One of the most common themes in public discussion of neuro-enhancement is the recommendation of intervention in the first years of life, which are positioned as a critical neurodevelopmental period (O'Connor and Joffe, 2013a). Appropriate stimulation in the brain's early development, it is argued, will lay the foundations for healthy cognitive, social, and emotional outcomes (Allen, 2011). Alternatively, failure to take advantage of this time-limited critical period will result in lifelong neurocognitive disadvantage. Neuroscientific concepts have been appropriated by many toy manufacturers, food producers, pharmaceutical companies, and book publishers to propose a wide range of interventions that purportedly optimize brain development during early life (Thornton, 2011). These recommendations for pediatric neuro-enhancement have been challenged for various scientific and ethical reasons (Singh and Kelleher, 2010; Graf et al., 2013).

Inevitably, commercializations of neuro-enhancement are marketed at parents, who are exhorted to implement the enhancement techniques on their child's behalf. The ways pediatric neuro-enhancement is promoted are therefore closely bound up with prevailing cultural constructions of the parent-child relationship. The discourse that surrounds neuro-enhancement is premised on deeply engrained beliefs about parenting, and more particularly mothering (Gillies et al., 2016). In particular, pediatric neuro-enhancement dovetails with an ethic of “intensive parenting” (Hays, 1996) that encourages parents to invest maximal time, energy, and resources in the “concerted cultivation” (Lareau,

2002) of their child's abilities. Nadesan (2002) argues that family life in the twentieth century was marked by the emergence of a desire among parents for their children to *exceed* the norm in developmental achievements. This competitive mindset became particularly fixated on the domain of intelligence (Nadesan, 2002). Neuro-enhancement clearly chimes with this parental preoccupation. Indeed, it could be argued that the logic of neuro-enhancement in childhood only makes sense within the context of a widespread desire to help one's child attain a level of intellectual achievement that excels beyond that of their peers (Wall, 2010).

Thornton (2011) suggests that more recent years have seen a shift in focus away from cognitive achievement toward a superficially more rounded priority of emotional well-being. This construction of emotional well-being is also mediated through the brain, drawing heavily on ideas from attachment theory and affective neuroscience. Here, the means of neuro-enhancement is day-to-day maternal interaction rather than technological intervention. However, this does not render the enhancement agenda any less burdensome for the caregiver. Although suffused with a "back to basics" ethos that emphasizes "natural" maternal "instinct," this new discursive turn is argued to place subtle but heavy pressures on mothers to monitor and regulate their own affective experience (Thornton, 2011). Mothers are advised to classify and count their facial expressions, vocal utterances, and internal feelings to ensure that the infant's "emotional brain" is receiving optimal input. Neuro-enhancement thus feeds into a cultural encouragement of emotionally intensive forms of caregiving.

The small body of research that has directly asked parents about their experiences of these discourses suggests they can impose a heavy burden. Wall's (Wall, 2010) interviews with middle-class Canadian mothers showed that despite some skepticism about the "now or never" logic of the early years discourse, mothers showed full certainty about their ability to affect their child's life outcomes *via* their brains, and a sense of responsibility to do so in the optimally effectual manner. As one mother put it, "I am constantly aware that everything I do affects how their brains are going to develop" (Wall, 2010, p. 257). This pervasive sense of responsibility was matched by guilt regarding inevitable failures to meet the demanding standards of constant intensive, stimulating one-on-one interaction with one's child. Similar research in a British context suggests that some mothers experience the provision of intensive cognitive stimulation as a mandatory part of the maternal identity (Budds et al., 2016). The mothers interviewed in this study invested great importance in their role as a facilitator of their child's cognitive development. Daily interactions with the infant were construed as opportunities for accelerating cognitive development; and by definition, an opportunity can be exploited or lost. The high stakes thereby embedded in the enhancement agenda fostered a widespread moralization of everyday caring activity. For example, mothers equated brief disengagement from their infants with neglect and condemned their self-adjudicated failure to live up to the demands of being a "good mother." Budds et al. (2016) suggest that lay interpretations of the enhancement agenda function to reinforce the gendered division of labor and tighten the bonds linking women's identity to the domestic sphere.

The motivations behind pediatric neuro-enhancement are thus centrally premised on the forms parent-child relationships take in contemporary society. Pediatric neuro-enhancement finds a market because parents want the best for their child. What constitutes "the best" is determined by the culture in which the family lives. Nadesan (2002) suggests that the vogue for cognitive enhancement is driven by parental consciousness of a labor market demand for "entrepreneurial knowledge-workers." As such, neuro-enhancement plays on the understandable parental desire for their child to be recognized as a valuable member of society and receive the attendant social and material rewards. Additionally, in a society characterized by growing awareness of mental health difficulties, neuro-enhancement discourses promise parents a route to ensuring their child's happiness and emotional well-being.

"Doing the best" for one's child is not an entirely selfless enterprise, however. Wall's (Wall, 2010) interviewees expressed an awareness that their own social status among their peers was contingent on their child's achievements. Producing high-achieving children is a means of enhancing one's own social capital, and perhaps one's material security in old age. Demonstrating awareness of the latest scientific concepts is also a cultural signifier, marking oneself as a knowledgeable, up-to-date, and committed parent (Nadesan, 2002). As such, it is difficult to separate the extent to which pediatric cognitive enhancement is driven by an intrinsic desire to serve the child's welfare versus the secondary benefits that a child's accomplishments lend their parent.

NEURO-ENHANCEMENT IN AGING

Besides enhancing child neurodevelopment, the other dominant focus of neuro-enhancement discourse is preventing age-related cognitive deterioration (O'Connor and Joffe, 2015). Aging populations across the developed world have resulted in dramatic increases in dementia prevalence, and great concern about the social and economic repercussions this entails. In this context, health promotion initiatives and the popular press strongly advocate that middle-aged adults should structure their lifestyle around a dementia-prevention regime that infiltrates the most routine dimensions of daily life, dictating appropriate food choices, behavioral practices, and mental activities (O'Connor and Joffe, 2015). The prominence afforded to these ideas means that among the general lay population, there is now high awareness regarding the supposedly protective effects of crossword puzzles, dietary supplements, and social interaction (Friedman et al., 2009; Kim et al., 2015; O'Connor and Joffe, 2015).

Similar to pediatric neuro-enhancement, there is limited evidence for the efficacy of such methods (Katz and Peters, 2008; Palmour and Racine, 2011). However, they retain a grip on the public imagination due to the fear that dementia commands in contemporary culture. Research shows that aging is often accompanied by high levels of dread about future cognitive decline (Cutler and Hodgson, 1996; Corner and Bond, 2004; Kim et al., 2015). A 2014 US poll conducted by the Alzheimer's Association identified Alzheimer's disease as the public's most feared illness, and the recent increase in dementia prevalence is framed in hyperbolic terms of an "epidemic," "tsunami," or "time-bomb" (Peel,

2014). The anxiety surrounding dementia is absent from many non-Western cultures, where cognitive decline and memory loss are seen as normal aspects of the aging process (Faure-Delage et al., 2012; Perkinson and Solimeo, 2013). In contrast, in highly cognitivized Western societies where intellectual performance is a key marker of personal worth, dementia signals a sharp rupture from one's previous identity (von Faber et al., 2001; Williams et al., 2011; Van Gorp and Vercauysse, 2012; Buckley et al., 2015). Research on public understandings of dementia commonly reveals an idea that with the onset of dementia, the person who previously occupied that body "disappears" or becomes "lost" (von Faber et al., 2001; Corner and Bond, 2004; McParland et al., 2012; Buckley et al., 2015). Dementia thus heralds the symbolic although not the physical end of life, a phenomenon Sweeting and Gilhooly (1997) term "social death." In this context, any hope of a means of preventing this highly feared and still incurable disease is eagerly received by the public and heavily covered in the mass media (Kirkman, 2006; Kang et al., 2010; O'Connor et al., 2012; Van Gorp and Vercauysse, 2012; Peel, 2014).

As with pediatric neuro-enhancement, the drive to prevent dementia through lifestyle choices can be characterized as perpetuating the individualization of health problems. Currently healthy individuals are tasked with structuring their daily routine around maintaining neurocognitive resilience, with the implication that the onset of dementia is attributable to the individual's prior self-disciplinary failings (Peel, 2014). Yet, as with neuro-enhancement in children, relationality is paramount in the lived experience of dementia-prevention discourses. Research shows that much of the fear aging adults express toward dementia is not centered on the repercussions for themselves, but the implications for their loved ones who will be forced into caring roles (Corner and Bond, 2004; Steeman et al., 2006; Buckley et al., 2015). Responsibilities for caring for aging adults traditionally fall on their children, although this became more variable in the late twentieth century due to increased geographic mobility and female workforce participation (Mancini and Blieszner, 1989; Beck and Beck-Gernsheim, 2002). Nevertheless, it is still women who are disproportionately allocated caring responsibilities for aging relatives, which they must balance with their existing occupational, domestic, and childcare labor (Brody, 1981; Stephens et al., 2001). In this context, the dread of becoming a physical and emotional burden on one's loved ones accounts for much of the anguish that oncoming dementia elicits (Steeman et al., 2006; Buckley et al., 2015). Interviews with older people reveal a positioning of family members as the "real victims" of dementia, and a belief that the demented person's confusion protects them from fully appreciating the indignities of their situation (Corner and Bond, 2004).

Given that concerns for other people lie at the heart of the alarm dementia elicits, it is likely that the forces that motivate people to engage in dementia-prevention regimes pertain to these relational concerns, rather than pure self-protection. This appeared to be the case in interviews conducted by O'Connor and Joffe (2014, 2015), which asked laypeople to free-associate around the topic of "brain research." Half of the 48 interviewees introduced the topic of dementia, often in the context of the importance of preventing its onset through neuro-enhancement regimes.

Discussion of dementia was permeated with an acute sense of anxiety, especially among older participants. In considering the reasons for this fear, participants often focused not on the intrinsic symptoms of the disorder itself, but on the anticipated loss of important relationships. Especially salient was the specific fear of losing memory of one's children, a prospect that was particularly likely to prey on female participants' minds. The other outcome of dementia that preoccupied people was loss of independence and self-sufficiency. Loss of self-control was seen as compromising the integrity and dignity of the person, such that deterioration of the brain heralded a disintegration of the whole self. Further, damage to the brain was seen as engendering reliance on others. For those who anticipated that caregivers would be family members, the worry focused on the difficulties their loved ones would experience as a result. For those who mentioned reliance on paid caregiving, the primary concerns were vulnerability to exploitation and becoming a drain on public resources.

Thus, a person's unique relational circumstances are pivotal in how they envision life with dementia to unfold, and thus in their motivations to engage with aging-related neuro-enhancement discourses. Adopting neuro-enhancement practices may be driven by the desire to prevent deprivations that would befall one's loved ones rather than oneself.

FROM PERSONAL TO RELATIONAL RESPONSIBILITY: CONSIDERING RELATIONALITY AS KEY TO UNDERSTANDING NEURO-ENHANCEMENT

The evidence reviewed above suggests that to understand the ideological dynamics of current manifestations of neuro-enhancement, we need a conceptualization of how responsibility can be experienced as a relational rather than individual phenomenon. The philosophical literature on responsibility provides some insights in this regard but is surprisingly silent on the relational nature of the everyday experience of responsibility. The notion of responsibility is deeply rooted in Western beliefs about autonomy and morality. Traditionally, responsibility can be understood as either causal or moral responsibility. While causal responsibility only describes the causal relationship between an entity and an event, and therefore does not involve agency (e.g., bacteria's responsibility for a disease), moral responsibility results from an actor's decision to perform a morally significant action, which is characterized by blame- or praiseworthiness (Eshleman, 2016). In the philosophical literature on moral responsibility, there is a long-standing debate regarding whether moral responsibility can be ascribed to groups (collective responsibility) as well as to individuals (individual or personal responsibility) (May and Hoffman, 1991; Sadler, 2006; Björnsson, 2011). These debates focus on the possibility of groups perpetuating morally significant actions, and therefore praise or blame for the collective agent. However, there have been challenges to the notion of associating moral blameworthiness with groups, since moral agency is often understood as an individual property (Sverdlik, 1987).

Recently, a few rare approaches to responsibility have arisen that distance themselves from an individualistic approach.

Gergen (2009, 2011) argues for a relational responsibility that makes individuals care for relationships in order to sustain morality. In what he describes as “second-order morality,” humans need to take responsibility for relationships by devoting “attention and effort to means of sustaining the potential for co-creating meaning” (Gergen, 2011, p. 218). Relational responsibility is needed, in which not only the individuals but also the relations are subject to responsibility. In being responsible for relationships, both narcissism and self-negation can be avoided (Gergen, 2011). Similarly, Visse et al. (2012), with recourse to Walker’s (Walker, 2007) work on moral understanding, demonstrate how responsibility is a relational and contextual practice. Accordingly, moral responsibilities evolve with interaction; they are relational and collaborative. Understanding responsibilities thus requires attention to prevailing narratives of identity, relationships, and value.

Most philosophical literature on responsibility seeks to determine how responsibility “really is” or how it “should be” allocated. Notably, there has been little philosophical discussion of the role played by human relationships in *subjective experiences* of responsibility (Walker, 2007; Gergen, 2011; Visse et al., 2012). The notion of relational responsibility has received minimal elaboration in the theoretical discourses on responsibility, let alone in deliberations regarding the ethical and social questions around neuro-enhancement specifically. This silence on the question of relationality from philosophers and ethicists working on responsibility leaves us under-equipped to conceptualize the lay perceptions of responsibility discussed above in relation to neuro-enhancement in early and late life. As demonstrated, in both cases, concerns for other people lie at the heart of the endeavors and perceived imperatives.

The discussion of relational responsibility that exists in other scholarly literature is mostly rooted in clinical contexts. The relational dimension of personal health decisions is vividly illustrated in the field of genetic testing, where disclosure of one individual’s genetic status necessarily has implications for their genetic relatives. Research with people considering undergoing genetic testing for hereditary cancers shows that the decision is rarely approached by considering the risks and benefits for oneself alone (d’Agincourt-Canning, 2006; Arribas-Ayllon et al., 2008; Kearns et al., 2010). The processes involved in genetic testing are relational at every level: for example, the decision to undergo testing may be motivated more by concern about one’s children’s risk status than one’s own (d’Agincourt-Canning, 2006); some people may feel coerced by relatives to acquire information they would rather not have (ibid); and people may feel an obligation to circulate the results of their own test around their wider kinship network (d’Agincourt-Canning, 2001). These instances of relational responsibilities steering people’s health decisions may reflect similar processes in everyday engagement with neuro-enhancement. However, the relational responsibilities that affect neuro-enhancement may also diverge from those evident in medical contexts, since neuro-enhancement is often initiated by a person him/herself without any professional advice or support, and since it is directed at improving baseline functioning rather than addressing an active dysfunction. Further research is required to establish the extent to which empirical accounts of

relational responsibility in clinical contexts mirror its specific role in neuro-enhancement activities.

Other work on decision-making processes has elaborated the concept of “relational autonomy.” The common view of autonomy expression in health care decision-making can be described as “sterile” autonomy. The clinician bears responsibility to convey the benefits, harms, options, and consequences of treatment options for a presenting problem, from which the patient (or a surrogate speaking for the patient) is expected to choose. In the recent past, feminist and communitarian scholars have developed variants on the alternative concept of “relational autonomy” (Nedelsky, 1989; Friedman, 2000; Christman, 2004; Mackenzie and Stoljar, 2010). Relational accounts of autonomy recognize that when people make decisions, they usually admit input from friends, family, colleagues, or professionals (Nagel and Reiner, 2013). They often do so intentionally, without feeling unduly influenced. Nagel (2015) describes it thus: “Individuals in health care settings who feel overwhelmed or do not perceive themselves as sufficiently qualified might ask for support in a decision process [...] professionals could offer support if they perceive that the patient could benefit from it” (p. 50). Such accounts, which consider the interdependencies characterizing our lives, were recently further substantiated by Specker-Sullivan (2016), who suggested “maternalism” as an alternative ethical framework. “Maternalism” avoids the main objections against paternalism while acknowledging that an individual’s choices often are influenced by others. Those influences mirror the interdependencies, and the various practices premised on these social dynamics are in the individual’s best interest if they follow the individual’s values.

The above philosophical and medical discussions are premised on the principle that symbiotic and interdependent relationships are paramount in lived human experience. It is clear that human beings are not atomized, alienated individuals: we are socially embedded in constant interaction with others, both directly and indirectly. This is particularly evident in the early and late phases in life. In childhood, parent–child relationships are essential for survival, and their significance reemerges in later life as parents’ increasing needs render them dependent on their offspring. Discussing neuro-enhancement in childhood and old age without consideration of the manifold interdependencies that steer motivations thus risks ignoring a key driving force underlying acceptance or rejection of opportunities for neuro-enhancement. Recognizing the impact of social relations for the values and motivations underlying the pursuit of neuro-enhancement fills a gap in our understanding of how neuro-enhancement practices manifest in everyday thought and action. A more holistic understanding of the relational dynamics that characterize everyday engagement with neuro-enhancement technologies will enable better anticipation of the risks and benefits such technologies may entail, due to greater insight into how they are likely to be enacted in context.

CONCLUDING COMMENTS

Previous discussion of the ideological implications of neuro-enhancement has afforded minimal attention to its relational

dimensions. This may be due to a tendency to premise analysis on a false dichotomy between individualistic and socio-structural conceptual frameworks, which assumes that focusing attention on individual brains necessarily implies neglect of socio-structural factors and *vice versa*. As a result of this rhetorical dynamic, the relational dimension, which stands as an intermediary between the individual and socio-structural levels of explanation, is left unexplored. The above accounts of neuro-enhancement in relation to childhood and aging highlight the importance of human relationships in mediating how neuro-enhancement ideas and practices manifest in real-world experience.

The empirical evidence indicating the significance of relationality warrants a caution against simplistic framings of neuro-enhancement as individualistic in essence. The motives that neuro-enhancement harnesses are not just based on individual self-interest but also individuals' investment in the welfare of those around them. The relationality evident in lay engagement with neuro-enhancement can also be found in political appropriations of neuroscience, as a recent analysis of British social policy shows (Broer and Pickersgill, 2015). Broer and Pickersgill (2015) observe responsibility as a key topic in neuroscientifically informed policy reports: it can be found implicitly in the three themes their analysis identifies, i.e., optimization, self-governance, and vulnerability. Citizens' responsibilities for solving social problems are framed in terms of relationships—parents are responsible for optimizing their children's opportunities, people are responsible for governing themselves so others will not have to, and people are responsible for defending against the exploitation of their own or other's vulnerability. Broer and Pickersgill's analysis concludes that "reports discussing policy across the life course ascribe specific social problems to the functioning of brains, yet the solution that they plea for is often a relational one, where parents have a more loving relationship with their children and understand their teenagers better, and where people care for and understand the behavior of those with dementia" (Broer and Pickersgill, 2015, p. 60). Neuro-enhancement does not deny individuals' connectedness to others; on the contrary it specifically targets these relationships as the medium through which neuro-enhancement is to be achieved.

It is important to note that acknowledging the importance of relationality does not negate arguments that neuro-enhancement can function as a vehicle for neoliberal political and cultural agendas. The "social" that is imbricated in neuro-enhancement is a very narrow form of relationality, based on immediate interpersonal relationships rather than collective bonds (Gillies et al., 2016). In close familial relationships, the psychological separation between "self" and "other" is somewhat blurred. For instance, if children are experienced as an extension of the parent, serving their benefit simultaneously serves the parent's own. In this sense then, acknowledging relationality does not disconfirm arguments that neuro-enhancement exacerbates a cultural ethic of self-interest and competitiveness. Moreover, policy interventions that address social relations, but in these very restricted, narrow forms, can contribute to obscuring the wider macro-structural factors which shape people's lives. There is a strong trend of conservative policymakers using neuroscientifically

informed intervention in the socio-emotional lives of "problem families" to discharge their responsibilities to support struggling communities in more material ways (Macvarish et al., 2014; Munro and Musholt, 2014). This notwithstanding, academic analysis that focuses on families' interpersonal relations need not emulate politicians in therefore forgoing consideration of broader social dynamics such as class, gender, and race. Indeed, it is only through daily micro-social relations that the influence of such variables is realized. For instance, exploring the lived experience of neuro-enhancement in childhood and aging reveals the particular burden placed on women, who take a disproportionate share of responsibility in caring for both their children and aging parents.

The above reflections hinge on the premise, well articulated by Forlini and Hall (2016) and Pickersgill (2013), that normative ethical analysis should be closely tied to empirical evidence that enlightens how neuro-enhancement plays out in real-world contexts. A valid ethical analysis of neuro-enhancement must start from a conscientious inspection of how these practices manifest in everyday thought and action. In other words, the priority is on "empirical neuroethics" over "anticipatory neuroethics" (Illes, 2007; Northoff, 2009; Pickersgill, 2013; Fitz et al., 2014). While there is certainly value in preemptive reflection on as-yet-unrealized repercussions of neuroscientific advances, numerous observers have noted that this form of promissory discourse can lean toward collaborating in the "hype" that neuroscience often engenders (Vidal, 2009; Conrad and De Vries, 2011; Pickersgill, 2013). Since neuroscience's profile began to dramatically rise in the late twenty-first century, there have been numerous cases where assertions that neuroscience was inciting transformative societal changes were disconfirmed by empirical evidence (O'Connor and Joffe, 2013b). Extreme versions of the individualist interpretation of neuro-enhancement may be one more such example. The empirical research that has thus far accumulated suggests that far from revolutionizing society, neuroscientific knowledge often perpetuates familiar cultural themes (Hagner and Borck, 2001; Choudhury et al., 2009; Vidal, 2009; Ortega, 2011; O'Connor and Joffe, 2013b). The current paper has argued that neuro-enhancement is premised upon and enacted through existing human relationships, most notably familial bonds. It can therefore reinforce prevailing interpersonal dynamics, whether these are positive or negative in nature. For instance, parental interest in their children's welfare is unarguably a personal and social good. Yet, when cultural trends funnel this natural instinct into practices that place intense and unnecessary pressure on both parent and child, the interests of neither are served. Similarly, intergenerational caring relationships can promote domestic harmony. Yet, many feminist scholars have highlighted the harms of the caring responsibilities delegated to women, who are socialized to subordinate their own needs to those of their kin (Gilligan, 1982; Bartky, 1990; Kittay, 1999; Held, 2006). Neuro-enhancement practices reflect and reinforce these relational dynamics.

The scope of the current paper excludes several potentially fruitful targets of future consideration. First, the extent to which the above considerations are specific to neuro-enhancement or similarly relevant to other forms of bodily enhancement requires

further study of the motivations and practices that characterize both domains. Second, by foregrounding the two life phases of childhood and old age to demonstrate the importance of relationality, our analysis should not suggest that the period “in-between” does not need special attention. To the contrary, it is especially people in this phase of life—being parents of young children and/or children of aging parents—who are delegated the responsibility of overseeing others’ neuro-enhancement. Additionally, exhortations to guard against neurocognitive degeneration target people in mid-adulthood as well as those who have already reached senior citizenship (Broer and Pickersgill, 2015; O’Connor and Joffe, 2015). Discussing the specifics of this “middle” generation, which is not even identified by a specific name, is an important task for future research. Finally, another important dimension that this paper leaves untouched is non-familial relationships

such as peer and professional interactions. These may be particularly crucial in uses of neuro-enhancement in educational, medical, and occupational settings. We encourage the initiation of further research that expands our understanding of how neuro-enhancement interacts with the manifold forms of relationships that characterize the lives of today’s citizenry. Contextualizing neuro-enhancement in light of these relational dynamics is critical for gaining a comprehensive understanding of the promises and perils that new neuro-enhancement technologies are likely to entail.

AUTHOR CONTRIBUTIONS

CO and SN equally contributed to the conceptualization and writing of this manuscript.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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