HOW AND WHY PEOPLE MAKE JUDGMENTS ABOUT THE PRACTICAL, MORAL, AND SOCIETAL IMPLICATIONS OF NEUROENHANCEMENT TECHNOLOGIES

by

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Abstract

In the last several decades, there has been a fiery interdisciplinary debate about the use of biomedical technologies that purportedly enhance mental abilities. While critics and enthusiasts bicker over issues such as safety, pressure, fairness, authenticity, and more, the world moves forward. So what does the general public think? What factors shape their judgments? And what explains our current social norms? To answer these questions, I conducted seven randomized studies (n=7,754) using quantitative and mixed-method methods. I find that risk-benefit judgments track the canonical therapy-enhancement distinction for pills and consumer brain stimulation devices, and that the occupation, but not the gender, of the user influences this calculus (Study 1); perceptions of pressure but not likelihood to use are influenced by peer and societal pressure around pills, brain stimulation, and software (Study 2); the amount of effort and the source of financial resources affect attitudes about the fairness of unequal distribution of enhancement (Study 3); the use of pharmaceuticals and the outcomes of such use in the workplace shape judgments of authentic achievement and worthiness of promotion (Study 4); the occupation of the worker does not affect preferences but does influence obligation judgments, and these attitudes are primarily driven by perceptions of societal benefit and secondarily mediated by perceived prevalence (Studies 5-7). I discuss the implications of these findings for research in neuroethics, social science, and public policy.
Preface

I am the primary author of the work presented in this thesis. I identified the research questions guiding the presented empirical work. I designed the experiments in collaboration with Dr. Peter Reiner. I coordinated the data collection and performed all data analyses. I wrote each chapter and prepared all tables and figures presented in the chapters. Additional contributions for each chapter are described below.

Chapter 1: Introduction

I am the primary author of this chapter, with intellectual contributions from P. Reiner.

Chapter 2: Public attitudes towards cognitive enhancement

A version of this chapter has been previously published: Fitz, N.S., Nadler, R., Manogaran, P., Chong, E.W.J., & Reiner, P.B. (2014). Public attitudes towards cognitive enhancement. I designed experiments 1c, 2-4, supervised data collection, conducted data analyses, and prepared the manuscript. R. Nadler designed experiments 1a and 1b, provided intellectual contributions, and suggested edits to the manuscript. P. Manogaran and E.W.J. Chong provided intellectual contributions and assisted in gathering pilot data. P. Reiner provided intellectual guidance throughout, suggested edits to the manuscript, and provided funding through grants from CIHR.

Chapter 3: Should high-responsibility workers use ‘smart drugs’? Three randomized studies exploring attitudes toward pharmaceuticalization in the 24/7 society

A version of this chapter will be submitted for publication: Fitz, N.S. & Reiner, P.B. (in prep).

Should high-responsibility workers use ‘smart drugs’? Public attitudes toward
pharmaceuticalization in the workplace

I designed the experiments, supervised data collection, conducted the analyses, and prepared the manuscript. P. Reiner provided intellectual guidance throughout, suggested edits to the manuscript, and provided funding through grants from CIHR.

The research presented in this thesis was approved by the UBC Behavioural Research Ethics Board under certificate H15-01367
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To my parents
Chapter 1: Introduction

In the past several decades, there has been an outpouring of interest in the use of so-called cognitive-enhancing (CE) biotechnologies such as pharmaceuticals and brain stimulation devices by healthy people to improve their mental abilities such as attention, memory, and mood (Greely et al., 2008; Dubjlevic, 2014; O’Connor et al., 2012). The topic has sparked a widespread interdisciplinary debate about the practical, ethical and societal implications of these technologies (Farah et al., 2004; Hyman, 2011; Parens, 2014; Hildt and Franke, 2013). Indeed, it touches on central issues in neuroscience, medicine, public health, social psychology, sociology of health and illness, philosophy, law, and science and technology studies; much of the interest in bioethics and neuroethics stems from the lively debate about enhancement ongoing in those fields. Beyond research and academia, the prospect of cognitive enhancement has captured the imagination of governments, clinicians, students, knowledge workers, athletes, musicians, business interests, journalists, authors and filmmakers, and numerous publics.

Broadly construed, human enhancement represents interventions that attempt to improve function beyond species-typical functioning or what is necessary to sustain good health (Daniels, 2000; Juengst, 1998). But unlike traditional means of improving mental performance - sleep, exercise, nutrition, meditation, and educational training (Dresler et al., 2013; Lucke & Partridge, 2012) - the use of biomedical technologies such as pharmaceuticals is thought to raise a number of practical, ethical, and social concerns (Bostrom & Sandberg, 2009; Chatterjee, 2004; Greely et al., 2008; Sahakian & Morein-Zamir, 2007; Hildt, 2013; Farah et al., 2004; Forlini et al., 2013; Greely et al., 2008; Hildt & Franke, 2013; Sahakian & Morein-Zamir, 2007). As a result, the use of cognitive enhancement technologies has garnered considerable attention from both policymakers (Outram & Racine, 2011;
The topic of cognitive enhancement tends to elicits fierce, often-emotional debate, because it is so directly bound up in strongly-held views of morality, political value, and post-Enlightenment social mores (Reiner, 2013; Fitz et al., 2014). As such, the debate is quite polarized along ideological fault lines, with bioconservative critics and technoprogressive enthusiasts on either side (De Witt et al., 2015; Hughes, 2009; Parens, 2014; Reiner, 2013; Roache & Clarke, 2009; Schermer, 2007; Wilson & Haslam, 2009).

In the debate, the primary practical issues are safety, efficacy and prevalence (for reviews, see (Advokat & Scheithauer, 2013; Bagot & Kaminer, 2014; de Jongh et al., 2008; Husain & Mehta, 2011; Lucke et al., 2011; Partridge, 2013; Repantis, 2013; Repantis et al., 2010; Smith & Farah, 2011; Wilens et al., 2008) The dominant ethical issues are authenticity and corrosion of character, autonomy, moral enhancement, naturalness, cheating, fairness, and distributive justice (Bublitz & Merkel, 2009; Buchanan, 2011; Cabrera, 2014; Cakic, 2009; Caplan & Elliott, 2004; Degrazia, 2005; Douglas, 2008; Farah et al., 2004; Fröding, 2010; Fukuyama, 2003; Harris, 2007; Hildt & Franke, 2013; Kass, 2003; Levy, 2011; Lin & Alhoff, 2008; Mehlman, 2004; Parens, 2005; Persson & Savulescu, 2012; Rob Goodman, 2010; Sahakian & Morein-Zamir, 2011; Sandel, 2009; Savulescu, 2009; Schermer, 2008; Siipi, 2011; Wagner, 2013). The primary social issues are the potential for pressure from peers and society, the shaping of social norms and attitudes, the medicalization of normalcy, the proper role of medicine, industry influence, and effective policy (Bostrom & Roache, 2009; Chatterjee, 2004; Covenev et al., 2011; Daniels, 2000; Dijkstra & Schuijff, 2015; Dubljevic, 2013; Elliott, 2004; Fitz et al., 2014; Forlini & Racine, 2012; Greely, 2011; Presidential Commission for the Study of Bioethical Issues, 2014; Larriviere et al., 2009; Nagel, 2010; Outram & Racine, 2011; Parens, 2000; 2013;
In this thesis, I present results from eight quantitative and mixed-method randomized studies that explore public attitudes toward the ethical and social implications of cognitive enhancement technologies. In chapter 2, five studies investigate factors that affects how and why people make judgments and decisions about the cardinal concerns in bioethics: safety and risk-benefit, peer and societal pressure, fairness and distributive justice, and authenticity and worthiness. In chapter 3, three studies illuminate mechanisms that drive attitudes towards enhancement in the workplace: in particular, whether workers in high-responsibility occupations (e.g., surgeons and pilots) should enhance; and how these social norms inform the shifting engines of pharmaceuticalization in the modern 24/7 workplace.

1.1 What are we talking about when we talk about cognitive enhancement?

In the broadest view, ‘enhancement’ refers to any attempts of humans to improve ourselves. This is, of course, nothing new, which is precisely why various ‘pro-enhancement’ authors use this definition (Greely et al., 2008; Savulescu & Bostrom, 2009; Caplan & Mobley, 2002) Greely and colleagues offer a standard example of this rhetorical strategy in their canonical and controversial Nature commentary (2008):

“human ingenuity has given us means of enhancing our brains through inventions such as written language, printing and the Internet. Most authors of this Commentary are teachers and strive to enhance the minds of their students, both by adding substantive information and by showing them new and better ways to process that information. And we are all aware of the abilities to enhance our brains with adequate exercise, nutrition and sleep. The drugs just reviewed, along with newer technologies such as brain stimulation and prosthetic brain chips, should be viewed in the same general category as education, good health habits, and information technology – ways that our uniquely innovative species tries to improve itself.”
In important ways, this observation is accurate: we actually have debated many of the implicated issues for millennia. Famously, in Plato’s Phaedrus, Socrates bemoaned the advent of writing. For many centuries, new tools and technologies – from writing to the printing press to the internet – have evoked fear as they shift how we live our lives. People worry that these technologies will change fundamental aspects of our lives, our beliefs and values, and who we are.

As a result, the debate about CE technologies is often mischaracterized as simply an exercise in pouring new wine into old bottles. Because in other ways, this anthropological observation is misleading: we do live in a unique time. For the vast majority of our 100,000 years on the planet, a single human did not witness much change within his or her lifetime. Today, on the heels of the industrial revolution, we witness enormous technological progress in our own lives: the world we die in is dramatically different, in terms of technological adoption at least, to the world into which we are born. The acceleration of science and technology defines the modern world (Rosa, 2013). In the last few decades alone, we have seen a revolution in our ability to shape ourselves with biomedical technology. Major scientific paradigm shifts -- in genetics and neuroscience in particular – have given rise to an unprecedented levee of control over own biology: instead of bottled wine, we drink pills, brain stimulation devices, genetic editing tools, and ubiquitous internet technologies. In this brave new world, the debate has cycled back yet again and is as hot as ever.

In light of the current debate, a narrower, more appropriate perspective adopts the widespread definition that enhancement “characterize[s] interventions designed to improve human form or functioning beyond what is necessary to sustain or restore good health” (Juengst, 1998) or beyond so-called “species-typical functioning” (Daniels, 2000). While there are various domains of enhancement – cosmetic surgery for bodily appearance, doping in sports for athletic performance, gene-editing for genetic traits, or biotechnological enhancement to improve brain functions (neuroenhancement), the definition emphasizes the helpful (though sometimes fraught) distinction between ‘therapy’ and
‘enhancement.’ Indeed, whether a given technology is considered a treatment or an enhancement will depend on the concrete situation. For example, the use of Adderall by an individual diagnosed with ADHD is considered a therapy, while that same use by a ‘healthy’ person will be viewed as enhancement. Though it carries some fuzzy conceptual baggage (Lin & Alhoff, 2008b) the distinction between treatment and enhancement is widely accepted for its pragmatic value in emphasizing the concepts of health, disease and normality and the aims and role of medicine.

The choice of definitions matters: while the second definition situates technological enhancement within current technologies used in medicine, the first, broader conceptualization tends to trivialize technological forms of enhancement. But what is cognitive enhancement? Put simply, cognitive enhancement is the attempt to increasing cognitive functions such as attention, memory, learning, planning, perception, and analytic reasoning. Unfortunately, some of the literature obfuscates this by viewing the aim of CE to “improve the performance of the healthy” (Greely et al. 2008), to “augment the minds of the healthy” (Cakic, 2009), or as “the amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems” (Bostrom & Sandberg, 2009). Because definitions for CE abound, several authors prefer the term ‘neuroenhancement’ as a broader way of capturing all interventions that are intended to improve brain functions in healthy individuals – this encompasses cognitive enhancement, mood enhancement, moral enhancement, and more (DeGrazia, 2000; Synofzik et al., 2012; Kramer, 1993; Elliot, 2004). Though the lines are far from clear, distinguishing between different forms of enhancements is important because it highlights differences in context, goals, and consequences (Cabrera et al., 2014ab, 2015). Though the present studies speak to the norms around mental modification writ large, they focus on cognitive enhancement, and in particular, on pharmaceutical CE.

The CE debate takes place across diverging discourses in academia, bioethics, and the media (Forlini & Racine, 2009), but consistently raises questions on three levels of analysis: practical, ethical,
and societal. The practical issues are about safety, efficacy, and prevalence, but their answers require ethics as much as epidemiology. The ethical and moral issues engage concerns about moral acceptability (i.e., judgments of right or wrong), ‘authentic’ achievement character judgments, naturalness, cheating, fairness, and distributive justice. The third level raises societal issues including peer and societal pressure, the formation of social norms, the medicalization of normal behavior, the proper role of medicine, industry capture, crafting effective policy, and how CE reflects particularly Western, individualist cultural values in a productivity-obsessed 24/7 capitalist society.

The prospect of CE inspires fierce debate (Hughes, 2009; Reiner, 2013). Critics of CE worry about negative implications of CE, arguing that it is cheating, unnatural, dehumanizing, an affront to our ‘giftedness,’ a frivolous concern in the face of illness, that it will contribute to increasing inequality, and the rise of industry, among other concerns (President’s Council for Bioethics, 2003; Fukuyama, 2003; Sandel, 2009; Elliot, 2004). Proponents of CE enthuse about the possibilities that CE might afford, arguing that humans have always used tools to improve our condition, that CE, in virtue of rapid access to technology, may actually reduce the gap between the ‘haves’ and ‘have-nots,’ and that we may have a moral obligation to enhance ourselves to effectively manage pressing problems that our psychology is built to ignore such as climate change (Persson & Savulescu, 2012; Caplan & Mobley, 2002; Buchanan, 2011; Harris, 2007; ) At the heart of this debate is a question about what it means to be human in the modern world: does technology make us more or less human?

Part of the reason this debate has generated so much heat with so little light, is because, much like our political system, the two sides have become so deeply polarized. And part of the reason these sides have become so polarized is that, much as Jonathan Haidt has shown for our political partisanship (Haidt 2001, 2013), when they argue about cognitive enhancement, the two sides are largely talking past each other with different worldviews, value judgments about the good life, and strongly-held views about human nature. For example, advocates of CE tend to assume that there is no human
essence (i.e., human nature is still evolving); to focus on non-essentialized traits such as intelligence and self-control; to emphasize going ‘beyond nature;’ to see human nature as comprised of modular, separable parts; to reject the “natural” as a guide for what is normatively good or right; to privilege rational, agentic ways of knowing; to believe that enhancement does not affect traits that are fundamental to identity; to view CE as enhancing humanness and producing superhumanized people. In contrast, opponents of CE tend to make the opposite assumptions about such issues, resulting in their strong conviction that CE produces dehumanized beings (Wilson & Haslam, 2009).

In this polarized biopolitical climate, there is a Third Way: an evidence-based moderate position that recognizes important practical and societal realities of CE (Lucke et al., 2011; Lucke & Partridge, 2012, Maslen et al., 2014; Sarewitz & Karas, 2007). That, despite the considerable hype (Partridge et al., 2011; Caulfield, 2004), these biomedical technologies produce moderate to nonexistent effect sizes (Farah, 2015; Repantis, 2013) involve mental trade-offs (e.g., improving attention while degrading creativity) (Husain & Mehta, 2011; Iuculano & Cohen Kadosh, 2013), and are not used by nearly as many people as we believe (Partridge, 2013; Lucke et al., 2011). These moderates tend to reserve judgment about normative issues such as cheating or inauthenticity, and are instead focused more on promoting healthy behaviors, countering hype with data on social trends, and crafting effective regulation.

1.2 What do people think about cognitive enhancement?

In the last decade or so, social scientists have published a growing number studies on the attitudes and behavior of the general public around these issues (Fitz et al., 2014; Forlini & Racine, 2012; Schelle et al., 2014; Cabrera, 2014a,b; Dijkstra & Schuijff). More than 40 studies exist on attitudes towards pharmaceutical CE (Schelle et al., 2014). While the empirical work is not yet developed enough to create a comprehensive theoretical model, there are clear trends: many studies employ
dependent measures for safety judgments, perceptions of coercion or pressure, and attitudes about fairness, honesty, and authenticity; perceptions of fairness mediate moral judgments such as authenticity; attitudes and behavioral-orientations are often moderated by use and familiarity (e.g., people who have used CE technologies before tend to be more accepting of its use, evaluate CE as less risky, and are less worried about safety) and gender (i.e., men tend to be more enthusiastic while women are more skeptical). The present studies are part of this burgeoning movement to empirically investigate what, why, and how people make judgments and decisions about the ethical and social implications of CE.

Amidst the media hype (Partridge et al., 2011), laypeople are generally ambivalent or cautiously optimistic. Taken together, the existing empirical work suggests that public attitudes map many of the relevant concerns in the literature, but that they also are predictably influenced by certain social and cognitive biases. In general, though the public appears more moderate in their opinions than the critics and enthusiasts, many participants generally hold moderately negative attitudes about the use of CE technologies for non-medical, ‘enhancement,’ purposes – as expected, this effect depends on the type of technology and the ability or trait in question (Dijkstra & Schuijff, 2015; Cabrera 2014a,b, Williams et al., 2014; Riis et al., 2008). Currently, the majority of existing studies originate from western countries, cover a broad range of enhancement technologies, and often use different experimental methods including different outcome measures.

1.3 Overview of empirical studies

The present eight experiments use quantitative and mixed methods to explore North Americans’ attitudes about cognitive enhancement technologies today (n=7,754). In Chapter 2, I present data from five randomized studies, finding that judgments about risk-benefit track the restoration-enhancement distinction for pills and consumer brain stimulation devices, and that the occupation, but not the gender,
of the user influences this process (studies 1 & 5); that perceptions of pressure but not participants’
likelihood to use are influenced by peer and societal pressure around pills, brain stimulation, and
software (study 2); the requirement of hard work and self Earned financial resources improve attitudes
about the unequal distribution of CE technologies (study 3); and that the use of pharmaceuticals and the
outcomes of such use in the workplace interact to shape diverging judgments of authenticity in
achievement and worthiness for career advancement (study 4). In Chapter Three, I explore public
attitudes towards pharmaceutical CE in the workplace. In particular, three randomized studies tested
how and why attitudes differ depending on the occupation of worker using CE. These three studies
respond to recent calls for empirical work in neuroethics (e.g., should high responsibility workers
enhance) and in social science and medicine around the meaning of pharmaceuticals in everyday life
and the drivers of pharmaceuticalization in the modern workplace. In three studies, (studies 6-8), I
found that the occupation of the worker does not affect preferences but does influence obligation
judgments, and these attitudes are primarily driven by perceptions of societal benefit and secondarily
mediated by perceived prevalence. Taken together, these eight studies provide insight into complex
public attitudes toward mental modification in the modern world.
Chapter 2: Public attitudes towards cognitive enhancement

2.1 Synopsis

In Chapter 2, we explored the factors that influence people’s attitudes towards the ethics of cognitive enhancement. In particular, we explored judgments about safety and risk-benefit (Study 1 & 5), peer and societal pressure (Study 2), fairness and distributive justice (Study 3), and authenticity and worthiness (Study 4).

Abstract. Vigorous debate over the moral propriety of cognitive enhancement exists, but the views of the public have been largely absent from the discussion. To address this gap in our knowledge, four experiments were carried out with contrastive vignettes in order to obtain quantitative data on public attitudes towards cognitive enhancement. The data collected suggest that the public is sensitive to and capable of understanding the four cardinal concerns identified by neuroethicists, and tend to cautiously accept cognitive enhancement even as they recognize its potential perils. The public is biopolitically moderate, endorses both meritocratic principles and the intrinsic value of hard work, and appears to be sensitive to the salient moral issues raised in the debate. Taken together, these data suggest that public attitudes toward enhancement are sufficiently sophisticated to merit inclusion in policy deliberations, especially if we seek to align public sentiment and policy.

2.2 Introduction

Cognitive enhancement (CE) refers to the use of technology to improve normal cognitive function. A vigorous discussion over the moral propriety of CE has emerged, fueled in no small part by the recognition that cognitive ability is a key component of both prosperity and well-being (Beddington et al., 2008). The debate often pits bioconservatives against technoprogressive optimists; the former worry about the negative implications of CE on society while the latter enthuse about the possibilities that CE might afford (Hughes, 2009; Reiner, 2013). These views are tempered by those of biopolitical
moderates who call for responsible discourse without advocating either widespread availability or heavy-handed prohibition (Hyman, 2011; Farah et al., 2004; Greely et al., 2008; Levy, 2007). The conversation has consistently engaged the popular press: CE is the most common subject addressed in media discussions of neuroscience (O’Connor et al., 2012) suggesting that readers, viewers, and listeners—the public—are similarly enthralled. Despite the public’s apparent interest, their attitudes about the relevant issues in the CE debate are rarely studied. The aim of the present work is to address this gap in our knowledge by using quantitative experimental methods to study public attitudes towards CE.

At the outset it is worth clarifying what we mean by the term attitude. Called “the most distinctive and indispensible concept in contemporary social psychology” (Allport, 1935), the formation and function of attitudes has been a topic of considerable interest in the cognitive sciences (Albarracin et al., 2005; Eagly & Chaiken, 1993). The attitudes that people evince can be influenced by either implicit or explicit processes. In this study, we do not lay claim to whether intuitive or reflective cognitive processing is at work behind individual attitudes. Rather, we investigate the public’s overall judgments about the moral propriety of cognitive enhancement.

There are philosophical and pragmatic reasons for including the public in this ongoing discussion. In the philosophical literature, it is widely recognized that the debate over CE raises profound questions of who we are and who we wish to be, the answers to which are intimately tied up in individual and communal conceptions of the good life. In contemporary Western society, it is a common perception that technology in general may sometimes hold the promise of happiness but at other times disappoint, saddling us with what Taylor has termed the malaise of modernity (Taylor, 1991). The prospect of enhancing any one of the array of cognitive domains—memory, concentration, mood, and more—seems to be particularly effective at invoking this disquiet, but the underlying reasons remain imperfectly understood.
From a practical standpoint, understanding public attitudes towards CE is fundamental to the development of sound policy. There has been a modicum of effort devoted towards developing policy options for CEs (Bostrom & Roache, 2011; Greely, 2010; Schermer et al., 2009; Lucke & Partridge, 2013; Dubljevic, 2012; Lin & Allhoff, 2008), but little consideration given to public attitudes. Governments have hardly ignored the issue: policy debates have been initiated and commissions have issued reports (The President’s Council on Bioethics, 2003; British Medical Association, 2007; Larriviere et al., 2009; Cote, 2009; Academy of Medical Sciences, 2012; Nuffield Council on Bioethics, 2013), but with one notable early exception (Slob et al., 2005), there has been minimal consultation with the public. Inclusion of the public in this debate is overdue.

The public, of course, is not a monolith, but rather a conglomeration of numerous “publics.” The perspectives of specific publics have been investigated to some degree: readers of Nature (Maher, 2008), physicians (Banjo et al., 2010; Forlini & Racine, 2012; Hotze et al., 2011; Franke et al., 2013), students and teachers (Bell et al., 2013; Forlini & Racine, 2012; Franke et al., 2012; Sabini & Monterosso, 2005; Sattler et al., 2013), and those diagnosed with ADHD (Pillow et al., 2012; Bolt & Schermer, 2009; Singh, 2012). The general lay public, the ultimate consumers of CEs, have been less well studied, yet compelling arguments have been made for including the voices of the population at large in discussions of nascent technology (Sarewitz, 2010; Schicktanz et al., 2012; Salloch et al., 2013). Responsive to such entreaties, in the present investigation we have used quantitative methods to investigate the attitudes of the general public towards the issues in the CE debate.

Relying primarily upon quantitative rather than qualitative methods is the exception rather than the rule in neuroethics. In the present set of experiments we have used such an approach to explore the factors that might influence moral attitudes towards CE. The ability to systematically manipulate key variables in the vignettes allows the application of experimental rigour to issues of neuroethical import. Inspired in part by experimental philosophy (Knobe & Nichols, 2008), we term this approach
‘Experimental Neuroethics’; the results allow for replication and can be built upon by other investigators. Most importantly, these tools can provide robust insights into how people think about relevant aspects of ethical issues. Thus, Experimental Neuroethics may be of general utility for the field, particularly for those investigators who are as attracted by the strengths of quantitative rigour as they are by the discernment of reflective equilibrium.

Four cardinal concerns dominate discourse on the neuroethics of CE (Hyman, 2011; Farah et al., 2004; Greely et al., 2008). The first concern is SAFETY, essentially a traditional analysis of the risks and benefits of CE, but one that is given fresh salience by the lack of medical necessity when enhancement is the objective. The second concern is PRESSURE, a term intended to exemplify the set of signals provided by either peers or society that act to effectively endorse CE use. As CE moves from novelty to norm, pressure of this sort is widely expected to increase the likelihood of CE usage. The third concern is FAIRNESS, a concept that encompasses issues of distributive justice, the problem of free riders, and sentiments of cheating. The fourth concern is AUTHENTICITY, which bears on the impact that CE might have upon character and worthiness of achievement, particularly as CE may be perceived as an effortless shortcut to success. In the experiments that follow, we probe public attitudes towards each of these cardinal concerns. While there is considerable fertile ground remaining to be explored, the results present a picture of a public that is engaged and moderate.

2.3 Experimental methods

Because traditional stated-response surveys are notoriously unreliable (Nisbett & Wilson, 1977; Murphy et al., 2005), we used the contrastive vignette technique (CVT) (Burstin et al., 1980) with a between-subjects design to probe the public’s attitudes towards CE. In the CVT, minimally contrastive versions of a master vignette are presented to participants who then answer identical questions regarding their attitudes towards issues presented in the vignette. Each participant is randomly assigned
to a single vignette, and is unaware that other contrastive conditions exist. The responses are analyzed to observe how the purposeful manipulations in the vignette affect answers, revealing underlying moral attitudes. The key outcome measure is the difference in group means between contrastive conditions. Indeed, the value of the CVT lies in de-emphasizing stated-preferences and focusing instead on the differences between groups.

The CVT is especially useful when probing moral attitudes, as such investigations are particularly susceptible to demand characteristics—the desire on the part of participants to appear as ‘good subjects’ (Nichols & Maner, 2008). The CVT mitigates such confounds by keeping participants unaware of the hypothesis under investigation. The hypothesis often investigates how a small modification of the details of the vignette (e.g., enhancement vs restoration or Susan vs Steven) might influence subjects’ answers. Contrastive vignettes have been used with considerable success in social science research (Finch, 1987), and more recently in the field of experimental philosophy (Knobe & Nichols, 2008; Knobe, 2003; Nichols, 2011). The CVT allows researchers to identify the salient factors that modulate people’s attitudes towards moral issues.

2.3.1 Vignette design strategy

The vignettes (see appendix A) were carefully crafted to insure that they were plausible, minimally contrastive, and that the results would be responsive to the hypothesis under consideration. Vignettes were analyzed using the Flesch-Kincaid Reading Ease and Grade Level readability tests, and in each instance we confirmed that the text of the vignettes would be easy for a 15- to 21-year-old to understand.

Vignettes were subject to substantive cognitive pretesting (Krosnick, 1999). In order to minimize hypothetical bias (Murphy et al., 2005), care was taken to describe situations that hewed as close as possible to real-world situations with extant cognitive enhancements. In order to minimize bias
in the results from cultural attitudes framing pharmacological agents as illicit drugs, we only used the term ‘pills’ in our vignettes. In order to control for preconceived antipathy towards technology, in several experiments we used multiple CE modalities (i.e., pill, electrical brain-stimulation device, and software-based brain-training exercise), all of which were designed to resemble existing technologies: the pill as psychostimulant, the electrical brain-stimulation device as transcranial direct current stimulation (tDCS), and the software-based brain-training exercise as an available commercial product.

2.3.2 Sample population & survey format

Participants were recruited via Amazon’s Mechanical Turk. The demographic characteristics of participants on Amazon’s Mechanical Turk are more representative than the common (and extensively criticized) practice of using undergraduate students for experimental work (Eriksson & Simpson, 2010; Rand, 2012; Paolacci et al., 2010; Horton et al., 2011, Berinsky et al., 2012; Burhmester et al., 2011; Henrich et al., 2010). To preclude participants from partaking in the same survey multiple times, we used blocking cookies and, as added insurance against such contamination, manually removed data from participants with the same IP address.

Surveys were administered using Fluid Surveys (http://fluidsurveys.com). Prior to initiating the survey, participants provided informed consent and were presented with a brief demographic questionnaire; the minimum inclusion criterion was that participants be 19 years of age or older. After reading through their vignette, participants were presented with a series of questions and used 9-point Likert scales to respond. Additionally, we included an optional space for participants to explain the rationale behind their choices. We did not employ semantic coding and analysis of these qualitative responses, as they were optional, but we did take them into account for design and quality control purposes. To confirm that participants had read and understood the vignette, we included a comprehension check that asked participants about key features of their vignette; correct answers to the
comprehension check were required for inclusion in the final data set. At the end of the survey, participants were presented with a debrief statement; for successful completion of a survey, participants were compensated $0.25. The survey and data collection strategy was approved by the University of British Columbia’s Behavioural Research Ethics Board.

2.3.3 Statistical analysis

Data were analyzed using SPSS. The sample size calculations assumed that answers on 9-point Likert scales were continuous and, upon confirmation that variances were not statistically different, we compared responses with appropriate statistical tests. The power was set to 80 %, and designed to be sensitive to a Cohen’s d=0.5 (medium effect) (Cohen, 1988), which detects a mean difference of 1 between groups and assumes a standard deviation of 2 (more than sufficient given the 9-point Likert scale).

2.4 Results and discussion

The results are based upon data from 4,011 unique participants who were presented with a single vignette in one of four experiments: safety, pressure, fairness, and authenticity. Of these participants, 261 were from Canada, and 3,750 were from the United States. The demographics of this sample were similar but not identical to that of the general United States and Canadian populations: 55.6 % of participants were male and 43.9 % were female (biased towards males), and their average age was 30.6 (slightly younger than the general population) (Martel & Menard, 2012; Howden & Meyer, 2011).
2.4.1 Safety

Any discussion that touches upon the safety of CE necessarily considers the balance between benefits and harms. The most optimistic scenarios discussed in the literature paint a picture of hypothetical enhancements that provide benefit with essentially no prospect of detriment (Harris, 2007), while dystopian projections evoke images of people injured in pursuit of CE (The President’s Council on Bioethics, 2003; Fukuyama, 2002). Our aim was not to determine whether the safety of CE was of concern to the public; we take that as a given. Rather, our objective was to use the ability of individuals to carry out an internal calculation regarding the trade-off between harms and benefits as a means of exploring their overall normative stance towards the use of CE under a variety of conditions. In order to do so, we kept the harms described in each of six contrastive vignettes constant while systematically manipulating either the perceived benefit or the specific technology for CE.

In a pilot study, participants were asked about their assessments of the risk-benefit profile of five different side effects (facial redness, insomnia, migraine, hearing loss, and vision loss) in an enhancement scenario (data not shown). The objective was to identify a side-effect that was sufficiently bothersome that participants would not conclude that it was usually worth the risk, but not so severe as to lead people to conclude that it was rarely worth the risk. The side effect ‘occasional insomnia’ best satisfied these criteria.

The first set of experiments explored the question of whether people discern the difference between enhancement and restoration, where enhancement is the use of CE by individuals who are fully capable, and restoration is the use of CE by people whose cognitive capacities may be slightly diminished but remain within the normal range (Reiner, 2010). Bordering on the terrain of the traditional treatment-enhancement distinction (Parens, 1998; Daniels, 2000), our hypothesis was that people would be more tolerant of side effects when they arise in the course of restoration than enhancement. To test this hypothesis directly, we randomly assigned participants (n=252) to one of two
vignettes that described a 42-year-old magazine editor whose cognitive abilities were either normal (the ‘enhancement’ condition) or slightly degraded but within the normal range for her age (the ‘restoration’ condition). The enhancement was a pill that improved attention, and had the occasional side effect of modest insomnia. Participants were asked to provide their assessment of whether the treatment (‘enhancement’ or ‘restoration’) was worth the risk, with the primary outcome measure being the participants’ ratings on a 9-point Likert scale with anchors stating ‘not at all worth the risk’ and ‘entirely worth the risk.’ Participants reported that it was significantly more worthwhile for the individual described in the vignette to take on the risk of mild insomnia when restoring as opposed to enhancing using a pill (t(250)=2.689, p<0.01, Fig. 2.1a, PCE).

If public perceptions of the balance between benefits and harms are indeed modulated by the difference between enhancement and restoration, the specific modality of the enhancement should not dictate the results: people should feel that the benefit of using the agent is greater when restoring than when enhancing irrespective of the enhancement technique being employed. To address this issue, a different group of individuals (n=255) were randomly assigned to one of two vignettes that were identical in every respect to those described in the previous experiment except that the enhancement was an electrical device whose description was essentially that of tDCS. We chose tDCS for this experiment because in many ways it is similar to pills for CE: the evidence for its ability to enhance a variety of cognitive functions is relatively compelling, and the side effects appear to be modest (Nitsche & Paulus, 2011). Once again, participants felt that CE was significantly more worth the risk when the outcome was restoration rather than enhancement (t(253)=2.620, p<0.01, Fig. 2.1a, tDCS). There was no difference between assessments as to the proper balance between risk and reward with tDCS versus that of pills for enhancement (t(254)=0.305, p=0.76, Fig. 2.1a) or restoration (t(249)=0.463, p=0.64, Fig. 2.1a). Thus, these first two experiments demonstrate that the public reliably
discerns the difference between restoration and enhancement, and does so to a similar degree with two distinct modalities.

Prospect theory (Kahneman & Tversky, 1979) may bear on participants’ judgments about enhancement and restoration: participants may frame enhancement as a gain and restoration as avoiding a loss. In order to investigate this potential framing effect, we ran a follow-up experiment. After responding to vignettes that were identical to the previous enhancement and restoration conditions, participants (n=161) answered a question asking whether they thought that the pill provided Susan with the opportunity to gain something or to avoid the loss of something. Significantly more participants in the enhancement condition viewed the pill as a gain of something (70/83) than did participants in the restoration condition (54/78), (t (159)=2.300, p<0.05). However it is worth noting that in both the restoration and the enhancement conditions, the majority of participants viewed the pill as providing a gain of something. These data suggest that framing effects may be responsible, in part, for differing attitudes towards the use of CEs for restoration and enhancement, but are unlikely to fully account for the observed effects.

Finally, we utilized the safety vignette to explore the question of whether the calculus regarding the balance between risk and benefit changes when the enhancement is carried out for the common good (Vedder & Klaming, 2010). To test the hypothesis that societal benefit affects the tolerability of enhancements, participants (n=262) were randomly assigned to one of two vignettes, which were identical to the first experiment in this series except that the individual taking the enhancement was a scientist rather than a magazine editor. We further manipulated the prosocial nature of the work by describing the individual as either a cancer scientist (highly prosocial) or a weapons scientist (less clearly prosocial). Consistent with the hypothesis that attitudes towards the risks and benefits of enhancement are modulated by the prosocial nature of an individual’s occupation, participants considered the prospect of a cancer scientist enhancing as significantly more worth the risk than when
the individual was identified as a magazine editor ($t(264)=2.921$, $p<0.01$, Fig. 2.1b). In contrast, participants did not consider the prospect of a weapons scientist enhancing as significantly more worth the risk than when the individual was identified as a magazine editor ($t(246)=1.904$, $p=0.058$, Fig. 2.1b). There was no significant difference in the risk assessments when the individual enhancing was a cancer scientist or a weapons scientist ($t(250)=0.915$, $p=0.361$, Fig. 2.1b). This result may be confounded by the possibility that participants perceive the scientists in other ways, for example as the cancer scientist having greater medical knowledge; further studies are required to clarify these issues.

**Figure 2.1. Study 1. Safety:** public attitudes about the balance of risk and reward in cognitive enhancement (a) Assessments of risk versus reward when enhancing (E) or restoring (R) using either pharmacological cognitive enhancement (PCE) or transcranial direct current stimulation (tDCS) (b) Assessments of risk versus reward when the individual enhancing with PCE is either a magazine editor (ME), cancer scientist (CS), or weapons scientist (WS)

*Note.* Error bars represent 95% confidence intervals, *p<0.01*
2.4.2 Pressure

Pressure to enhance is essentially about the power of social norms to modify attitudes towards, and use of, CEs by the public. In approaching this topic experimentally, we felt it important to mirror the types of situations that appear in the real world. In so doing, we found it helpful to distinguish between two forms of pressure that appear to be on the rise. In one of these, which we term soft societal pressure (sSP), pressure to enhance arises from such quotidian influences as demands of the workplace or expectations of society at large, but is absent specific knowledge indicating that peers are enhancing. This is contrasted with soft peer pressure (sPP), in which these same societal influences exist but are buttressed by a form of implicit social endorsement in which one has specific knowledge that peers are enhancing, albeit no explicit pressure from peers to join in. The distinction between sSP and sPP was intentionally designed to be subtle, capturing the range of situations that are often described as currently occurring on college campuses and may already be emerging in the workplace. Our primary hypothesis was that people would view sPP to use CE as more bothersome than sSP. Our secondary hypothesis was that the bothersome nature of pressure to enhance might be affected by the modality of enhancement.

To test these hypotheses, participants (n=1,219) were randomly assigned to one of six vignettes, arranged in three pairs that differed only in the modality of enhancement employed. In all vignettes, participants were asked to imagine that they worked as a paralegal in a law firm and that their ability to remember things was important. The vignettes clearly stated that performance in the previous year had been only moderately good and that as a result, the bonus that they had received was “less than you had hoped.” The vignettes then described a situation in which the individual reads a magazine article about a new memory enhancing technology. The specific technology that is described varies in the three pairs of vignettes, but all describe CE: in one pair of vignettes the enhancer is a pill, in another the enhancer is tDCS, and in the third the enhancement is in the form of brain fitness software. All are described as
equally safe, inexpensive, and effective. The vignette continues by explicitly pointing out that the enhancement technology does not “put knowledge into the brain” but rather makes it easier to retain information. For each modality of enhancement, one version of the vignette describes sSP, in which participants are told that performance reviews are a few months away and “you consider whether to make use of this CE technology”. A second version of the three vignettes described a situation with sPP by adding a sentence in which participants are told that their co-workers have been using this very same form of enhancement and in the previous year they exceeded their performance goals and received a full bonus.

After reading one of the vignettes, all participants were asked an identical series of questions. The first question asked how likely they would be to use the relevant technology if they were the paralegal described in the vignette. There was a significant increase in participants’ likelihood to use CE in the sPP condition compared to the sSP condition for the tDCS modality (t(274)=2.063, p<0.05), but no difference in likelihood to use for the pill (t(638)=0.981, p=0.327) or software-based brain-training (t(300)=−1.351, p=0.178) modalities (Fig. 2.2, “Likely”). The second question asked participants to rate the degree to which they felt pressure to enhance, given the situation described in the vignette. Essentially an internal control, this question was designed to determine whether participants perceived the intended difference in pressure between sSP and sPP. There was a significant increase in the perceived amount of pressure when it was described as sPP in all three conditions – tDCS (t(274)=4.217, p<0.001), pill (t(638)=4.864, p<0.001), and software-based brain-training (t(300)=2.850, p<0.01) – demonstrating that participants perceived the vignettes as intended (Fig. 2.2, “Pressure”). The final question probed the bothersome nature of any perceived pressure to enhance. The results demonstrate that sPP was significantly more bothersome than sSP for both the tDCS (t(274)=3.189, p<0.01) and pill (t(638)=2.890, p<0.01) modalities, but not for the software-based brain-training modality (t(300)=1.616, p=0.107). Thus pressure to enhance appears to be more
bothersome for some modalities than for others (Fig. 2.2, “Bothered”). Given the results of our fairness and authenticity experiments, one plausible explanation for this result may be that the software-based enhancement appeals to effort (based on training), and triggers intuitions about fairness and authenticity that may neutralize the effects of pressure. Another explanation might be that in the case of technological means of enhancement, sPP more clearly represents a transgression of personal autonomy, with the resultant pressure being perceived as more bothersome.

We have suggested that stated preferences are unreliable because of the cognitive biases inherent the participants’ answers (Nisbett & Wilson, 1977; Murphy et al., 2005; Nichols & Maner, 2008; Kahneman, 2011; Ariely, 2008). While recognizing that the absolute value of the data is unreliable, there is an interesting observation to be made in this particular instance: people generally reported that there was a high likelihood that they would use the enhancement in the context of the workplace. This is all the more striking when viewed in light of the data presented in the experiments on authenticity (below), which suggest that the most socially desirable strategy is to work hard to achieve success rather than to use CE to achieve the same result. Thus, if the answers to our query about likelihood to enhance are skewed by social desirability bias (Fernandes & Randall, 1992; King & Bruner, 2000; Fisher, 1993), the likelihood that people would use CE, at least in the context of the vignette as presented, can be expected to be even greater. How this might translate into real world use is unknown, but may be taken as evidence to suggest that the likelihood that people will choose to enhance in the workplace is relatively high.
2.4.3 Fairness

A dominant theme that runs through the CE debate is that of fairness. The discussion focuses upon distributive justice—the notion that CEs, by virtue of their cost, will be more easily obtained by the wealthy than the poor, and thus will increase the disparity between the “haves” and the “have-nots” (Hyman, 2011; Parens, 1998; Chatterjee, 2004). Indeed, data from neuroeconomics suggest that the human cognitive toolkit does not evaluate all forms of inequality equally (Fehr & Camerer, 2007), and at least in the context of contemporary social democracies, differences in wealth are generally tolerated so long as they do not violate perceptions of what is fair. Moreover, the data suggests that people
generally endorse at least some form of meritocracy (Arrow et al., 2000), viewing unequal distribution of goods as more acceptable when they involve differences in effort than when they arise as a result of luck (Almas et al., 2010; Cappelen et al., 2010). CE tends to evoke objections based upon fairness violations for at least two reasons. First, the source of funds used to purchase CE may be the result of either effort or luck. Second, there is a widespread (if generally erroneous) perception that enhancement allows for achievement without effort, playing into the very sentiments that vilify luck and reward hard work. We designed experiments to directly address both of these issues.

To test the hypotheses that (a) the source of one’s wealth and (b) achievement without effort represent a meaningful fairness violation for the public in the debate over CE, participants (n=535) were randomly assigned to one of four vignettes that described two young men who are studying for a standardized exam. Both are members of a study group, and they read about a CE pill that is moderately expensive ($1200) such that only one of the two individuals—the wealthier one—is able to afford the enhancement. The contrastive features of the vignettes are the source of wealth and the effort required to enhance successfully. For wealth: in the first and second vignettes, the wealthier individual is able to afford the pills because of family wealth, while in the third and fourth vignettes, he is able to afford it because he has saved money from his summer job. For effort: in the first and third vignettes, the pill “makes the hard work of studying feel simple and effortless”, while in the second and fourth vignettes, the pill “improves test performance only if users are diligent and use the extra waking hours to study.” Participants are then asked about the fairness of one individual being able to afford the enhancement while the other was not.

We analyzed the fairness ratings using a two-way, between-subjects ANOVA. This revealed a main effect of effort (F(1, 535)=7.203, p<0.01), and a main effect of wealth (F(1, 525)=16.643, p<0.001). Importantly, we observed an interaction between effort and wealth (F(1, 535)=4.949, p<0.05). Due to this, we performed a one-way, between-subjects ANOVA (F(3, 534)=9.594, p<0.001) to
identify the specific differences between the four groups: (1) family-wealth, no-effort; (2) family-wealth, effort; (3) summer-work, no-effort; (4) summer-work, effort. Post-hoc Bonferroni-adjusted comparisons revealed that the summer-work, effort condition was rated significantly more fair than any of the other three (p<0.001), and that these other three were not significantly different from each other (p=0.748, p=0.190, p=0.321, Fig. 2.3).

Remarkably, when the enhancement was obtained through family wealth, describing the enhancement as effective only if the individual worked hard did not change participants’ judgments of fairness. Moreover, when the enhancement made hard work feel effortless, obtaining the enhancement through summer work did not change participants’ judgments of fairness. Only when both the source of wealth and the enhancement involved hard work was the inequity rated as significantly more fair than in the other vignettes (Fig. 2.3). Thus, it seems that moral sentiments about fairness are sensitive to any hint that there may be a reduction in hard work (be it with respect to sources of wealth or the means by which one achieves success). Presumably, this obliterates the sense that the student’s advantage could be fully traced to individual merit. That is, people’s perceptions of what makes for a meritocratic scenario seem exceptionally fragile. The role of hard work in moral judgments about CE is further explored in the next set of experiments on authenticity.
Figure 2.3. **Study 3. Fairness:** public attitudes about the fairness of unequal access to cognitive enhancement. Assessments of the fairness of unequal distribution of a pharmacological cognitive enhancement when the enhancement (E) either makes studying feel effortless (Low Effort) or requires hard work (High Effort), and the $1200 (W) to obtain the enhancement is acquired by family wealth (No Work) or earned via a summer job (High Work).

*Note.* Error bars represent 95% confidence intervals, ***p<0.001

### 2.4.4 Authenticity

The essence of the argument regarding authenticity is that using technology to enhance represents a shortcut to success, and thus, achievements obtained using CE are not fully authentic (Farah et al., 2004; Greeley et al., 2008; Parens, 1998; Schermer, 2008; Parens, 2005). The debate over the veracity of this claim seems to attract much in the way of thoughtful consideration, but what concerns us in this investigation is less the assessments of experts than the perspective of the public.

In principle, shortcuts to success with CE use could manifest in one of two ways. The first is that CE might improve productivity, allowing one to work more efficiently per unit time. In this view, people who use CE might complete tasks in a shorter period of time, or produce more in the same
amount of time. The second way that CE use might be evident is not a shortcut at all: CE might facilitate cognitive perseverance, allowing one to work longer without mental fatigue. The unifying feature is that enhancement allows individuals to overachieve by making the task appear easier: when productivity is increased, less effort is required to achieve the same objective, and when cognitive perseverance is enhanced, more time may be required but fatigue is lessened. In order to explore public attitudes towards authenticity in the context of CE use, we developed vignettes that systematically modified time and effort independently, corresponding to these two strategies for CE functionality.

In the first group of vignettes, we modulated productivity while keeping time constant. Participants (n=348) were randomly assigned to one of three vignettes, each of which begins with an identical description of an engineer who is being considered for promotion when he is assigned a new project. The task is demanding, and it is explicitly stated that he finds it useful to “keep lots of information in his head and work through mental fatigue.” The vignette recounts how he is having difficulty completing the task in his normal 8-hour day; it seems he needs 10 h to get everything done, but he carpools to work and therefore working longer than 8 h is not practical. He reads about a CE pill that allows “people to keep more information in their brains than they would otherwise,” essentially an enhancement that fosters greater productivity. The three vignettes then diverge. In the Unenhanced/Fail vignette, he does not take the pill and continues to work for 8 h exactly as before but does not complete the task, and receives a mediocre performance review. In the Unenhanced/Success vignette, he once again does not take the pill but rather musters internal resources to work hard and complete the task in his 8-hour day, and receives a glowing performance review. In the Enhanced/Success vignette, he takes the pill and comfortably completes the task in his 8-hour day, receiving a glowing performance review. Irrespective of which version of the vignette they read, all participants were then asked to provide a rating for how authentic his performance was, and how worthy he was of a promotion.
As can be seen in Fig. 2.4a, in the Unenhanced/Fail vignette, participants rated the authenticity of the engineer’s performance as no different than that described in the Unenhanced/Success vignette \((t(229)=1.397, p=0.164)\). In contrast, in the Enhanced/Success vignette, his performance was viewed as significantly less authentic than either the Unenhanced/Fail \((t(227)=-4.975, p<0.001)\) or Unenhanced/Success \((t(234)=-6.059, p<0.001)\) vignettes. Thus, participants perceived that the authenticity of his performance when using the enhancement was diminished irrespective of success.

At the same time, participants generally attributed worthiness of promotion to success (Fig. 2.4b), finding him significantly more worthy of promotion in the Enhanced/Success and Unenhanced/Success vignettes than in the Unenhanced/Fail vignettes \((t(227)=6.210, p<0.001; t(229)=9.831, p<0.001\), respectively).

In order to explore the impact of time while keeping productivity constant, we randomly assigned another group of participants \((n=350)\) to one of three vignettes that were identical to those described above, except that the pill is now described as allowing “people to work longer than they would otherwise without mental fatigue,” invoking cognitive perseverance as the outcome of the CE. To allow for the extended workday, the hypothetical worker finds a colleague who can give him a ride home later in the day, allowing him to work the full 10 h required to complete the job. Both effort and outcome in Unenhanced/Fail, Unenhanced/Success, and Enhanced/Success vignettes were identical to that described previously, except that he spends 10 h rather than 8 h on the task. Note that in the Unenhanced/Success vignette, both effort and time are modulated. Remarkably, the results when time is increased are essentially indistinguishable to those seen when time was held constant, with the exception that now the authenticity of the individual in the Unenhanced/Success vignette is rated as significantly greater than that in the Unenhanced/Fail vignette \((t(232)=3.858, p<0.001, \text{Fig. } 2.4b)\).

The relationship between participants’ assessments of authenticity and their ratings of worthiness for promotion can best be seen in Fig. 2.4c, where the ratio of the two measures are plotted.
What is evident is that authenticity ratings are greater than worthiness ratings in the Unenhanced/Fail vignette, the ratings of both measures are essentially equal in the Unenhanced/Success vignette, and that worthiness ratings outstrip authenticity in the Enhanced/Success vignettes. The substantial variance of these two parameters across vignettes reveals underlying sentiments about the relationship between authenticity and worthiness in the context of the CE debate.

Taken together, these results demonstrate that the public is fully cognizant of the key features of the authenticity concern: whenever the individual enhances, his performance is rated as significantly less authentic than when he does not, including situations in which he fails at the task. The crucial observation is that diminished authenticity does not fully translate into diminished worthiness. Even as they acknowledge that authenticity of effort has been compromised, participants felt that enhanced individuals who succeeded at the task were significantly more worthy of promotion than those who failed. At the same time, participants felt that he was significantly more worthy when he was successful without enhancements than when he enhanced. In the discussion that follows, we shall explore more fully the biopolitical and philosophical implications that these data have for the CE debate in general, and for policy in particular.
Figure 2.4. Study 4. Authenticity & Worthiness: public attitudes toward authenticity and worthiness in cognitive enhancement. (a & b) Assessments of the authenticity of achievement (A) and worthiness of promotion (B) when the individual is enhanced (E) or unenhanced (U), and fails (Fail) or succeeds (Success) in a normal 8-hour workday (8) or an extended 10-hour workday (10) (* p<0.001). The horizontal lines above the paired bars indicate a significant difference between the measure for 8 h in both conditions and the measure for 10 h in both conditions. Although not shown in the figure, there was a significant difference between the 10 h Unenhanced-Fail and 10 h Unenhanced- Success conditions (p<0.05) (c) Ratio assessments of authenticity divided by worthiness across Fail, Success, and Enhanced situations

Note: Error bars represent 95% confidence intervals, *p<0.001
2.4.5 The public is biopolitically moderate

Taken as a whole, the data suggest that the public endorses a view that is biopolitically moderate. Observable throughout the data set, this position was best exemplified by those experiments that explored public attitudes toward the safety of CE. The fact that the responses fell in the middle of the scale is not particularly informative because of the ease with which stated preferences might be manipulated by key features of the vignette. Indeed, the side effect of occasional insomnia was chosen in pilot studies to evoke views that rested in the middle of the scale. More illuminating was the distribution of responses; if the results were based upon data that were clustered at the poles but averaged in the middle, our sample might reasonably be interpreted as providing support for both transhumanist and bioconservative views. Indeed, if one were sensitive to the frequency and volume of the rhetoric emerging from the poles of the debate (The President’s Council on Bioethics, 2003; Sandberg & Bostrom, 2006; Persson & Savulescu, 2012; Elliot, 2004), one might imagine that the populace is biopolitically polarized. In contrast, the data show a unimodal distribution (Fig. 2.5), with the majority of participants clustered in the biopolitically moderate middle.
Figure 2.5. Study 4. Histogram of public sentiments towards safety, with the x-axis indicating the individual responses on the Likert scale and the y-axis indicating the number of responses to all 6 safety vignettes. Responses are distributed unimodally.

2.4.6 The public endorses meritocratic principles yet values effort

Central to egalitarian values is the notion of a meritocratic society, in which individuals are rewarded for their achievements rather than their bloodlines (Arrow et al., 2000). In this view, stratification of goods in society is acceptable so long as those who have attained advantages earned them in a manner that is perceived as being fair (Cappelen et al., 2010). Though a genuine meritocracy is more myth than reality today (Stiglitz, 2013; McNamee & Miller, 2009), people appear to view an equitable, meritocratic distribution of wealth as ideal (Norton & Ariely, 2011). That the use of an enhancement besmirches considerations of merit has generally been the platform upon which bioconservatives have argued that “the merit of disciplined and dedicated striving—though not the deepest basis of our objection to biotechnological shortcuts, is surely pertinent” (The President’s
Council on Bioethics, 2003). Liberal philosophers have generally been successful in discounting this version of the authenticity concern, pointing out that the Calvinist notion of suffering as a mark of worthiness is misguided (Schermer, 2008). Notably, this view makes room for value to be ascribed to hard work under some circumstances, but argues that in the case of CE, the evidence is not compelling. What we are left with in such instances is something very much akin to a consequentialist stance toward CE in which the results of our activities are at least as important as the way they are attained (Harris, 2005). What does the public think?

The results of our Authenticity experiment provide some answers. Participants endorsed aspects of a results-oriented stance, whether consequentialist or not (Baumard et al., 2013), viewing success in the task as the key feature for determining worthiness: the protagonist was consistently judged as less worthy of promotion whenever he was unsuccessful in completing the task, irrespective of whether he appeared slightly indolent in the 8-hour version of the vignette, or more hard working but still incapable in the 10 h version. Moreover, he was deemed significantly more worthy in the vignettes in which he succeeded than in those in which he failed irrespective of whether he enhanced or not. As if to underscore this point, in the enhancement vignette, participants explicitly recognized the inauthenticity inherent in the achievement, yet seemed to agree that ends are more important than means. These are among the most relevant data for understanding the public’s attitudes about the morality of CE: the public imparts value to success regardless of whether one enhances or not, and people explicitly recognize that enhancement diminishes authenticity. Endorsement of this particular version of meritocratic achievement—success as a primary determinant of worthiness—represents a compelling argument that there exists reasonably strong public support for the use of CE.

However, to leave the matter there would do a disservice to the data, for Kass’ frequently derided bioconservative position that hard work determines merit also appears to garner support (President’s Council on Bioethics, 2003). While the public might find success to be a primary
determinant of worthiness, successful individuals who worked hard but did not enhance were viewed as significantly worthier still (or, reversing matters, one might say that enhancement significantly decreased assessments of merit, so long as the bottom line was success). Thus, while public attitudes do not appear to strongly condemn enhancement, they remain sufficiently sensitive to the value of authentic achievement as to consider it more meritorious.

2.4.7 The public appears morally reasonable

Are people’s judgments about the moral propriety of CE reliably discerning? Is the public stubbornly unwavering, appropriately responsive to reasons, or overly sensitive to irrelevant features? In contemporary moral psychology, there exists a healthy debate over the means by which people arrive at moral judgments. Traditionally it was thought that we reason about moral issues, weighing the salient evidence and changing our minds in response to relevant reasons (Kohlberg, 1969; Turiel, 1983). Haidt’s influential critique of rationalist moral psychology—pointing out the influence of automatic, emotional, effortless, and unconscious cognitive work (Haidt, 2001), raised substantive questions about the role of reasoning in moral judgment, but more recent work has reopened the debate (Greene et al., 2001; Greene et al., 2004; Paxton et al., 2012).

It seems reasonable to suggest that our confidence in the value of public attitudes towards CE might be affected by the degree to which their judgments are flexible enough to respond to reasonable arguments in the debate. Judgments need not necessarily be explicitly reflective to qualify as reasonable—we do not expect nor require the public to exhibit the deliberative logic of philosophical analysis—but rather that their thinking and judgments (whether intuitive or deliberative) (Kahneman, 2011) should be, to some considerable degree, flexibly responsive to reasons.
Given how trenchantly partisan the views of the lay public are thought to be, one might suspect that they might exhibit the sort of stubbornness thought to be characteristic of moral judgment (Jacobson, 2013; Haidt, 2013; Haidt & Bjorklund, 2008; Haidt et al., 2000). Indeed, this assumption—that people hold such fierce judgments about CE that they maintain them even in the face of satisfactory reasons—is apparent in the debate about CE (Bostrom & Ord, 2006). The most illuminating data on this point derive from our experiments investigating participants’ attitudes about fairness. The vignette described a situation in which two individuals had unequal access to funds to purchase CE, with two additional fairness violations that acted as modifiers: inherited wealth or lack of effort in the usage of CE. If the public were unresponsive to reasons, we would expect judgments of fairness to be invariant regardless of the presence or lack of supporting moral reasons. Instead, the public’s attitudes appear to be flexible: as a group, they were sensitive to the presence of the modifiers, but when both were removed, participants’ assessments of the fairness of the situation changed significantly. Data derived from the other experiments support this position. In the safety experiment, people were responsive to the balance between benefits and harms; in the pressure experiment, people were sensitive to the difference between societal and peer pressure; and in the authenticity experiment, people exhibited flexible normative positions, adopting a utilitarian stance for questions of worthiness while ascribing value to virtue in considering authenticity. Taken together, these data suggest that the public is responsive to salient moral reasons.

Sensitivity to reasons is a necessary but not sufficient criterion for claiming that the public is morally reasonable. People’s moral judgments must be sensitive to relevant factors and insensitive to irrelevant factors. If people are manipulated by impertinent variables, the consistency of their moral reasoning is drawn into question. In order to test participants’ sensitivity to an obviously irrelevant manipulation, we replicated our Safety PCE enhancement and restoration conditions, but changed the protagonist’s gender (from Susan to Steven) in paired contrastive vignettes. This irrelevant change did
not affect the results. In the enhancement condition, Susan vs Steven: t(147)=−1.368, p=0.173; in the restoration condition, Susan vs Steven: t(121)=−0.636, p=0.526); thus we conclude that at least under these conditions, public attitudes towards CE are not sensitive to an irrelevant factor.

The history of the debate over CE has been one in which expert opinion has dominated and public opinion has been relegated to the back seat, if indeed a role has been considered at all (Nadler & Reiner, 2010; Nadler & Reiner, 2011). We suggest that empirical data demonstrating that the public’s judgments are sensitive to the reasons commonly discussed by experts provides compelling evidence that public attitudes, or even the public themselves, should be included in the development of future policy.

2.4.8 Data should inform future policy

We do not suggest that public policy should slavishly follow public attitudes towards CE. The “is” of public sentiment is not the sole concern of the “ought” of policy prescription. We do, however, make a normative claim: that we should craft regulation so that it reasonably aligns with public attitudes. In a liberal democratic society, there are strong theoretical reasons for including public attitudes in regulatory policy (Sarewitz, 2010; Schicktanz et al., 2012; Salloch et al., 2013; Guston, 2004; Gupta et al., 2012). Of equal importance is the observation that if regulation does not approximate the views of the public, myriad policy inefficiencies arise (Erikson et al., 1993; Levine & Forrence, 1990; Fischer, 2003; Burstein, 2003; Kraft & Furlong, 2012). Primary among these with regard to CE should be consideration of the harms that might arise if policy encourages the formation of illegal markets (Kleiman et al., 2011). Current policies with respect to pharmaceuticals that are used for the treatment of ADHD appear to have already created such black markets, with no metrics available with regard to harms (DeSantis et al., 2008; Outram, 2010). Equally relevant are issues of
workplace pressures to use CE, and the need to balance demands for increased productivity with those of individual autonomy (Appel, 2008).

Our data represent some of the first instances in which quantitative methods have been used to obtain substantive insight into public attitudes toward the moral propriety of CE—precisely the type of information that is required to guide the development of sound policy. Although further studies are required to justify strong recommendations, certain broad observations are worth considering. The most salient among these is that the public recognizes issues such as the nature of pressure to enhance and the authenticity of achievement under the influence of CE, but they do not reject CE outright. The public was moderate in their endorsement of CE; there was essentially no evidence for widespread support of radical enhancement, but moral stances often associated with the bioconservative agenda, in particular the value of hard work as a measure of character, received more than passing sanction. Overall, the public appears to be cautiously accepting of CE, even as they recognize the potential perils.
Chapter 3: Should high-responsibility workers use ‘smart drugs’? Three randomized studies exploring attitudes toward pharmaceuticalization in the 24/7 society

3.1 Synopsis

In Chapter 2, we explored the factors that influence people’s attitudes towards the ethics of cognitive enhancement. Moving beyond the ethical issues, in Chapter 3, we explore the factors that shape judgments about the societal implications of cognitive enhancement in the workplace. In particular, we explore how the occupation of the worker influences attitudes towards enhancement (Studies 1-3).

Abstract. Should workers in high-responsibility occupations take smart drugs? Research on the ethical and social implications of biomedical technologies reveals polarizing viewpoints: enthusiasts argue that workers with social responsibilities may have a moral obligation to use enhancement technologies, critics worry that safety and efficacy are not well established, and social scientists illuminate the rising pharmaceuticalization of the workplace. What are the social norms, and what drives these attitudes? We conducted three between-subject studies using quantitative and mixed-methods to explore practical, moral, and societal judgments about the use of pharmaceuticals to improve the performance of workers in a range of occupations. While the public displays mixed preferences for and against such use, support for an obligation is low but is higher for workers in high-responsibility occupations. These attitudes are driven by social judgments such as societal benefit and perceived prevalence. We discuss how these findings contribute to social science scholarship on pharmaceuticalization and the social construction of drugs in the modern 24/7 society, as well as neuroethics scholarship on the use of pharmaceutical enhancement by workers in high-responsibility occupations.
3.2 Introduction

Imagine a pill that improves one’s ability to concentrate for several hours. Would you want your pilot to take it? Do you think that workers in high-responsibility professions, like surgeons or bus drivers, have some obligation to take it? Why? These questions are at the heart of a burgeoning debate in neuroethics, and they touch on larger issues in the social science of health and medicine such as the construction of drugs and the pharmaceuticalization of society. The present studies respond to recent calls in both fields for empirical work exploring social norms around these issues.

The use of substances to modify mental states, whether directed towards healing the sick or improving the healthy, is not new (Rasmussen, 2008; Herzberg, 2009; Escohotado, 1999; Sargant & Blackburn, 1936). However, in the past twenty years, there has been an outpouring of interest in so-called ‘cognitive-enhancing’ pharmaceuticals. The topic has captured the imagination of scientists, clinicians, governments, popular media, and publics. This has sparked a widespread interdisciplinary debate about the practical, ethical and societal implications of pharmaceuticals in society. Indeed, cognitive enhancement brings together central issues from neuroscience, medicine, psychology, sociology of health and illness, philosophy, law, and science and technology studies. In this article, we present results from three studies that respond to pressing questions in bioethics and in the social science of health and medicine: should high-responsibility workers use pharmaceutical enhancers? Why or why not? And how do public attitudes around their use inform pharmaceuticalization in the 24/7 workplace?

3.2.1 The debate: from therapy to enhancement

Originally developed for often-contested medical diagnoses such as attention deficit hyperactivity disorder and shift work sleep disorder, pharmaceutical stimulants are used by some healthy people to improve their mental functioning. An uptick in diagnoses has contributed to the
increasing use of pharmaceutical stimulants (SAMHSA, 2013; Scripts, 2014; Visser et al., 2014), and their use by the healthy for non-medical ‘enhancement purposes’ has stimulated debate.

Broadly construed, human enhancement represents attempts to improve function beyond species-typical functioning or what is necessary to sustain good health (Daniels, 2000; Juengst, 1998). In recent years, much ink has been spilled deliberating the practical, ethical, and societal implications of enhancing mental function in healthy individuals (Farah et al., 2004; Forlini et al., 2013; Greely et al., 2008; Hildt & Franke, 2013; Sahakian & Morein-Zamir, 2007), with particular attention devoted to the use of the pharmaceuticals methylphenidate (e.g., Ritalin), amphetamine (e.g., Adderall), and modafinil (e.g., Provigil) (Bostrom & Sandberg, 2009; Chatterjee, 2004; Farah et al., 2004; Greely et al., 2008; Hyman, 2011; Sahakian & Morein-Zamir, 2007). As a result, the use of pharmaceutical enhancement (PE) has garnered considerable attention from both policymakers (Presidential Commission for the Study of Bioethical Issues, 2014; Outram & Racine, 2011; President's Council on Bioethics, 2003; Royal Society et al., 2012) and the popular press (O'Connor et al., 2012; Oremus, 2013; Partridge et al., 2011; Petrow, 2013; Schwarz, 2015; Talbot, 2009).

Unlike traditional means of improving mental performance - sleep, exercise, nutrition, meditation, and educational training (Dresler et al., 2013; Lucke & Partridge, 2012) - the use of biomedical technologies, and pharmaceuticals in particular, has raised a number of practical, ethical, and social concerns. The primary practical issues are safety, efficacy and prevalence (for reviews, see Advokat & Scheithauer, 2013; Bagot & Kaminer, 2014; de Jongh et al., 2008; Husain & Mehta, 2011; Lucke et al., 2011; Partridge, 2013; Repantis, 2013; Repantis et al., 2010; Smith & Farah, 2011; Wilens et al., 2008) The dominant ethical issues are authenticity and corrosion of character, autonomy, moral enhancement, naturalness, cheating, fairness, and distributive justice (Bublitz & Merkel, 2009; Buchanan, 2011; Cabrera, 2014; Cakic, 2009; Caplan & Elliott, 2004; Degrazia, 2005; Douglas, 2008; Farah et al., 2004; Fröding, 2010; Fukuyama, 2003; Harris, 2007; Hildt & Franke, 2013; Kass, 2003;
Levy, 2011; Lin & Allhoff, 2008; Mehlman, 2004; Parens, 2005; Persson & Savulescu, 2012; Rob Goodman, 2010; Sahakian & Morein-Zamir, 2011; Sandel, 2009; Savulescu, 2009; Schermer, 2008; Siipi, 2011; Wagner, 2013). The primary social issues are the potential for pressure from peers and society, the shaping of social norms and attitudes, the medicalization of normalcy, the proper role of medicine, industry influence, and effective policy (Bostrom & Roache, 2009; Chatterjee, 2004; Coveney et al., 2011; Daniels, 2000; Dijkstra & Schuijff, 2015; Dubljevic, 2013; Elliott, 2004; Fitz et al., 2014; Forlini & Racine, 2012; Greely, 2011; Presidential Commision for the Study of Bioethical Issues, 2014; Larriviere et al., 2009; Nagel, 2010; Outram & Racine, 2011; Parens, 2000; 2013; Partridge et al., 2011; Pickersgill & Hogle, 2015; Ragan et al., 2013; Sarewitz & Karas, 2007; Schelle et al., 2014; Schwarz, 2013; Sharpe, 2014). The debate about enhancement technologies often erupts along ideological fault lines, with bioconservative critics and technoprogressive enthusiasts at the poles (De Witt et al., 2015; Hughes, 2009; Parens, 2014; Reiner, 2013; Roache & Clarke, 2009; Schermer, 2007; Wilson & Haslam, 2009).

3.2.2 The ‘enhanced role:’ workers in high-responsibility occupations

Recently, the debate has begun to engage one particular issue: that workers in high responsibility occupations - surgeons, pilots, soldiers, and others - might be expected to use pharmaceutical enhancement (British Medical Association, 2007; Bostrom, 2008; Chatterjee, 2004; Coveney, 2011; Coveney et al., 2011; Enck, 2013; Goold & Maslen, 2014a; 2014b; 2015; Greely et al., 2008; Kass, 2003; Kostiuk, 2012; Maslen et al., 2015b; Sahakian & Morein-Zamir, 2007; Santoni de Sio, Faulmuller, & Vincent, 2014a; Santoni de Sio et al., 2014b; Royal Society et al., 2012; Vedder & Klaming, 2010; Vincent, 2013; Warren et al., 2009). For instance, neuroethicists point out that soldiers in the US can be legally required to take stimulants (Greely et al., 2008), surgeons have considered whether expectations to use PE exist (Rose & Curry, 2010; Warren et al., 2009), and medical
regulatory bodies have encouraged healthcare workers to use caffeine and consider PE (Queensland Health, 2009). The UK’s Royal Society’s report (2012) on enhancement and the future of work concludes that, “it is possible that in these high-responsibility occupations enhancement could be seen as a moral obligation, or even demanded by the public” (Royal Society et al., 2012).

In contrast to speculation about the future, there is evidence that pharmaceuticals stimulants are used by some individuals in medicine, science, the military, education, physical labor and other domains (Franke et al., 2013; Lin et al., 2014; Maher, 2008; Maier et al., 2015; McCabe et al., 2005; Pedersen et al., 2015; SAMHSA, 2011; 2013; Smith & Farah, 2011). However, selected results from several studies indicate that the public does not favor workers in high-responsibility occupations using pharmaceuticals (Coveney, 2011; Fitz et al., 2014; Forlini et al., 2014; Franke et al., 2012; Maslen et al., 2015b), and in their thoughtful legal analyses, Goold and Maslen have concluded that surgeons can not be legally obligated to use pharmaceutical stimulants (Goold & Maslen, 2014a; 2014b). Just as Talcott Parsons’ canonical work illuminated norm-based rights and obligations for individuals in the ‘sick role’ (Parsons, 1951), we suggest that the current debate revolves around rights and obligations for high-responsibility workers in what we might call the ‘enhanced role.’.

### 3.2.3 The pharmaceuticalization of the workplace and the social construction of drugs

Alongside the debate about the ethics of pharmaceutical enhancement, social scientists of health and medicine have investigated a range of societal questions that arise from the use of pharmaceuticals. The present studies directly respond to recent calls for empirical contributions to the medicalization of society and the social construction of pharmaceuticals (Coveney et al., 2011; Gabe et al., 2015; Pickersgill & Hogle, 2015).

A great deal of attention has been paid to the processes of medicalization (Conrad, 1992; 2008; Szasz, 2007) and biomedicalization (Clarke & Shim, 2011; Clarke et al., 2003). Put simply, these refer
to the increasing tendency for normal aspects of human behavior and mental states to be understood through biomedical discourses as disorders and open to technological augmentation. The concept of biomedicalization is said to extend medicalization by highlighting the rapidly growing role of technology and science in modern biomedicine (Clarke et al., 2003). Yet Gabe and colleagues note that until recently, surprisingly little attention had been paid to pharmaceuticals (Gabe et al., 2015). Thus ‘pharmaceuticalization’ was introduced to draw attention to the increasingly complex roles that pharmaceutical technologies play in society (Abraham, 2010; Williams et al., 2011). Specifically, pharmaceuticalization involves “the transformation of human conditions, capabilities, and capacities into opportunities for pharmaceutical intervention” (Williams et al., 2011). Though they often overlap, medicalization and pharmaceuticalization do not necessarily implicate each other (Coveney, 2011): medicalization focuses on how ‘normal’ human behaviors come to be seen as ‘medical’ conditions while pharmaceuticalization is broader in that it recognizes the role of pharmaceuticals for ‘non-medical’ as well as medical reasons, encompassing their use for both treatment and lifestyle or enhancement purposes (Gabe et al., 2015; Williams et al., 2011). For instance, the use of cognitive-enhancement drugs by healthy pilots involves pharmaceuticalization but not medicalization: it is an opportunity for pharmaceutical intervention but does not redefine normal behavior as a medical disorder. In fact, Catherine Coveney convincingly argues that pharmaceuticalization best captures the use of cognitive enhancing drugs by the healthy (Coveney et al., 2011).

The present empirical work investigates pharmaceuticalization both in the medical context of off-label prescription (Studies 5 and 6) and beyond (Study 7). Williams and colleagues (2011) describe pharmaceuticalization as a complex, socio-technical process that is part of a ‘Pharmaceutical Regime’, or the network of institutions, organizations, actors, technologies, and attitudes and beliefs that are associated with the creation, production, and use of pharmaceuticals. Taken together, the present studies are particularly relevant for the downstream processes of the regime that concern “the meaning
and use of pharmaceuticals in medical practice and in everyday life” (Gabe et al., 2015). The data inform several key dimensions of pharmaceuticalization: the reconfiguration of normal behavior as having a pharmaceutical solution, the creation of new techno-social identities and the mobilization of consumer groups around drugs, and the use of drugs for non-medical purposes (Williams et al., 2011).

The present studies contribute to broader social science research into the social construction of drugs. Throughout history, views on mental modification have changed dramatically (Berridge, 2013). A common example is coffee: vilified in the 17th century, it is now the world’s most popular psychotropic drug: around 90% of Americans use it every day (Lovett, 2005; Weinberg & Bealer, 2001). Just as the social norms around coffee have dramatically shifted, the norms around opium, tobacco, and, more recently, cannabis have undergone tremendous change (Berridge, 2013; Escohotado, 1999; Kleiman et al., 2011; Nutt, 2014). Nikolas Rose captures this overall perspective in arguing that the effects of a drug “are not simply given in the drug: they are embedded in complex situations and the effects generated require all manner of social and contextual supports” (Rose, 2007).

In 1972, Gerald Klerman used the now-famous terms ‘Pharmacological Calvinism’ and ‘Psychotropic Hedonism’ (Klerman, 1972) to describe the situation. Writing about how drug use was changing attitudes towards medicine and society, Klerman identified a conflict between pharmaceutical worldviews that persists today: pharmacological Calvinists distrust the use of drugs for non-therapeutic purposes and believe that “if a drug makes you feel good, it must be morally bad,” while psychotropic hedonists make no such value-judgment and endorse the use of drugs for various non-medical purposes such as enhancing social relationships (Klerman, 1972). Klerman presciently predicted that the debate around the moral propriety of pharmaceuticals would only intensify.

Though commentators are often polarized – bioconservatives and bioliberals (Hughes, 2009; Reiner, 2013; Roache & Clarke, 2009) with so-called transhumanists and neo-luddites at the margins – laypeople actually hold a number of overlapping beliefs and attitudes about the use of pharmaceuticals.
for various purposes (Fitz et al., 2014; Parens, 2014; Sattler et al., 2013; Schelle et al., 2014). Indeed, people use drugs to wake up, go to sleep, improve mood, increase sexual desire, and more (Dumit, 2012). The production, marketing, and sale of pills is one of the largest industries in the world. While there is now a pill for almost every ill, some go a step further in arguing that the modern expansion of the medical industry is due to pharmaceutical and insurance industries ‘selling sickness,’ and creating an ‘ill for every pill’ (Angell, 2005; Busfield, 2010; Moynihan & Cassels, 2006; Potter, 2010).

Many researchers have demonstrated that pharmaceutical technologies are value-laden. That is, their creation and use are coded with ideologies about the social lives, relationships, self-image and characteristics of their consumers (Coveney, 2011; Elliott, 2004; Kramer, 1993; Lakoff, 2006; Martin, 2006; McCormick et al., 2003). For example, in her work on children’s use of stimulants, Singh has shown that medications are used for specific reasons that embody modern cultural, economic, and political values around identity, productivity, and authenticity (Singh, 2008; 2012). Similarly, consider how the use of Viagra, and more recently, Flibanserin, reflects particular views and interests around sexuality, masculinity, and femininity (Potts et al., 2003, 2004; Angel, 2010; Meixel et al., 2015; Cacchioni, 2015; Manov, 2016). What is ‘normal’ libido and sexual function? Indeed, some drugs are more fit for some sociocultural contexts than others. Today, the use of stimulants such as Adderall and Ritalin reflect western values of efficiency, productivity, and hard work (Elliott, 2004). And, perhaps most prominent over the last three decades, debates about the personal and cultural significance of antidepressants show no sign of abating. Peter Kramer’s *Listening to Prozac* (1993) set the stage for a body of research documenting the creeping hegemony of medicine over day-to-day life (Elliott, 2004; Kramer, 1993; Rose & Rose, 2013; Schwarz, 2013; Sharpe, 2012), and helped popularize the notion that the effects of drugs have as much to do with sociocultural norms as with neurochemical changes (Alexander, 2013; Berridge, 2013; Escohotado, 1999; Nutt, 2014; Singh, 2012).
3.2.4 The always-on 24/7 workplace

Due in large part to the rapid spread of the internet, we live in a constantly-connected global attention economy. The past several decades have seen enormous growth in both the pharmaceutical industry (Abraham, 2010; Britten, 2010; Elliot, 2010; Elliott, 2004; Timmermans & Oh, 2010) and consumer internet technologies (Thompson, 2013). The marketing and sale of pills is among the largest industries in the world, and more than half of US adults use a prescription drug (Kantor et al., 2015). More than half of all adults worldwide own a smartphone (The Economist, 2015). This unprecedented increase in usage of extended mind technologies (Fitz & Reiner, 2016) is not happening in a vacuum, but in a particular time and place. Many authors have documented how the use of these technologies are influenced by a post-Enlightenment individualist culture that valorizes productivity in a neoliberal ‘late-capitalist’ (Harvey, 1992; Picketty, 2014) attention economy (Goldhaber, 1997; Morozov, 2014).

The present studies investigate the use of stimulant pharmaceuticals that are particularly well-suited to the modern world of work: a productivity-obsessed 24/7 workplace.

Identifying the culprit as some combination of technology and culture, a number of social scientists have discussed the so-called 24/7 society (Crary, 2013; Hanson, 2007; Hassan, 2007; Presser, 2005; Rosa, 2013b; Wajcman, 2014; Williams et al., 2013). Much of this scholarship engages with the sociologist Harmut Rosa’s theory of social acceleration (Rosa, 2003; 2010b; 2013b). Rosa identifies three tempo changes of modern life: technical acceleration, evident in transportation, production, and communication; the acceleration of social change, reflected in cultural norms, social institutions, and personal relationships; and third, the acceleration of the pace of life, or the “shrinking of the present,” which occurs despite the expectation that advances in technology would increase leisure time. Today, this Moore-like technological acceleration is apparent in developments such as machine learning, modern medicine, the internet, gene editing, and smartphones. The acceleration of social change is represented in developments such as post-industrial urbanization, the information society, and cultural
acceptance of gay marriage. The acceleration of the pace of life has led to the so-called ‘24/7 society’ and the ‘always-on’ workplace. Rosa explains that we attempt “to realize as many options as possible from the infinite palette of possibilities that life presents to us…No matter how fast we become, the proportion of the experiences we have will continuously shrink in the face of those we missed” (Rosa, 2010a; 2013a).

Today, more than 60% of American workers report high levels of stress and burnout (Staples Research Survey, 2015), and only 30% of workers are engaged in their work (Gallup, 2012). Employed Americans now work 47 hours each week (Gallup, 2014) – much more so than Europeans (Prescott, 2004) – and while workers acknowledge that ubiquitous technology increases their productivity, they also feel that it increases the amount of hours that they work (Pew Research, 2014). But the current situation, as Judy Wajcman argues in Pressed for Time: The Acceleration of Life in Digital Capitalism, stems as much from our particular culture as it does from technology (Wajcman, 2014). This always-on workplace is the new normal (Crary, 2013). The key question in attending to the pathologies of modernity (Ehrenberg, 2010; Elliott, 2004; Taylor, 1991) is how much people endorse using enhancement technologies to treat the symptoms versus dealing with the structural causes of the modern always-on 24/7 workplace. As Anjan Chatterjee opines, “the use of workplace productivity drugs is the probable future” (Chatterjee, 2015).

3.3 The present studies

Taken together, the present studies directly respond to several calls for more empirical work on these issues. In their special issue on pharmaceuticalization in Social Science & Medicine, Gabe and colleagues identify “the need for more empirical research to further map the contours of the regime in different spaces, the dynamic processes that underlie the expansion and contraction of the regime of time, and the different forms of knowledge that are embedded in various practices, artefacts, and forms
of governance” (Gabe et al., 2015). Catherine Coveney lays out five future research agendas that, as a group, assess “the wider implications of cognition becoming pharmaceuticalized in this way for what it means to be human and how we understand the relationship between our bodies, our minds, and ourselves in contemporary society” (Coveney, 2011). And Martin Pickersgill argues that this sort of social science deeply informs and enriches bioethics and social policy (Pickersgill & Hogle, 2015).

We set out to explore in-depth the question of whether the public endorses the use of pharmaceutical enhancement by individuals in high-responsibility (HR) occupations, and how this informs the pharmaceuticalization of society. We defined HR occupations as those whose workers are primarily responsible for the safety of others (Goold & Maslen, 2014a; Greely et al., 2008; Santoni de Sio et al., 2014a; Royal Society et al., 2012), while low-responsibility (LR) occupations as those workers whose jobs do not involve responsibility for the safety of others. Using this distinction as a guide, in a series of between-subjects studies that employ both quantitative and mixed-methods techniques, we investigated attitudes and judgments about the use of PE by individuals in different occupations. We hypothesized that (H1) people evaluating HR workers will prefer use of pharmaceutical enhancement more than people evaluating LR workers, (H2) people reading about HR conditions will endorse an obligation to use pharmaceutical enhancement more than people reading about LR conditions, and (H3) the perception of societal benefit from the use of pharmaceutical enhancement will help explain differences in judgments between HR and LR conditions.

3.4 Methods

3.4.1 Sample

Participants (n=3,743; ~100 per contrastive condition, see below) were recruited via Amazon’s Mechanical Turk, an online labor market commonly used for research in the social, health, and behavioral sciences (Berinsky et al., 2012; Buhrmester et al., 2011; Crump et al., 2013; Paolacci et al.,
2010; Rand, 2012; Rouse, 2015; Shapiro et al., 2013). Participants were from all 50 states and the
District of Columbia, and their sociodemographic characteristics were similar to that of the US
population (see Appendix B). Participants provided informed consent, and were compensated for
completion of the study, which was approved by the UBC behavioral research ethics board.

3.4.2 Design

The experiments employed contrastive vignettes, a staple of the social and behavioral sciences
(Burstin et al., 1980; Finch, 1987; Hargrave, 2014; Krosnick, 1999; Wallander, 2009). Using the Flesh-Kincaid
Reading Ease and Grade Level readability tests, we confirmed that all vignettes were
comprehensible to people with a 12\textsuperscript{th} grade education. In all studies, manipulation checks were used
to confirm attention and comprehension (Hauser & Schwarz, 2015). We used a script from Unique Turker
(https://uniqueturker.myleott.com/) to ensure that we had unique participants across all studies. We
pretested all studies using cognitive interviewing to ensure comprehension (Willis, 2004). Participants
were randomly assigned to read one (and only one) experimental vignette that differed with respect to
the independent variable (see below).

The independent variable was the occupation of the worker. Occupations employed in this set
of experiments were operationally stratified into ‘high-responsibility’ (HR, designated with an asterisk
below) or ‘low-responsibility’ (LR) for the well being of others, in accordance with extant literature in
ethics, law, and psychology (Greely et al., 2008, Bostrom, 2008; Maslen et al., 2015a; Sahakian &
Morein-Zamir, 2007; Santoni de Sio et al., 2014a; Santoni de Sio et al., 2014b; Royal Society et al.,
2012). In studies 6 & 7, the independent variable was systematically varied to describe individuals in
one of eight occupations [PILOT*, SURGEON*, BUS DRIVER*, BRAKE REPAIR TECHNICIAN*, RESTAURANT
SERVER, TAX ACCOUNTANT, GROCERY STORE CHECKOUT CLERK, OR GARBAGE COLLECTOR] who was
contemplating using a pill to improve attention; in study 7, an additional four occupations were
included [SOLDIER*, UNIVERSITY STUDENT, STOCK TRADER HIGH SCHOOL TEACHER]. For full text of all vignettes, Appendix B.

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<tbody>
<tr>
<td>Pilot (study 5)</td>
<td>Michael is a pilot. His friend Dave tells him that he was recently diagnosed with the adult form of ADHD and has been using a pill that improves attention. Dave shows him an article that mentions that the pill can help people with or without ADHD improve attention. The article says that the pill costs about the same as a good cup of coffee, is safe if used properly, but occasionally can cause mild loss of appetite. The next day, Michael makes his annual visit to his family doctor, tells her about the article and that he would like to improve his ability to pay sustained attention to tasks. The doctor runs some tests and after examining the results, she explains to Michael that he does not fulfill the medical criteria for ADHD. Michael asks her if he can get a prescription for the medication anyway.</td>
</tr>
<tr>
<td>Restaurant Server (study 5)</td>
<td>Michael is a restaurant server. His friend Dave tells him that he was recently diagnosed with the adult form of ADHD and has been using a pill that improves attention. Dave shows him an article that mentions that the pill can help people with or without ADHD improve attention. The article says that the pill costs about the same as a good cup of coffee, is safe if used properly, but occasionally can cause mild loss of appetite. The next day, Michael makes his annual visit to his family doctor, tells her about the article and that he would like to improve his ability to pay sustained attention to tasks. The doctor runs some tests and after examining the results, she explains to Michael that he does not fulfill the medical criteria for ADHD. Michael asks her if he can get a prescription for the medication anyway.</td>
</tr>
<tr>
<td>Surgeon (study 6)</td>
<td>Michael is your surgeon. His friend Dave tells him that he was recently diagnosed with the adult form of ADHD and has been using a pill that improves attention. Dave shows him an article that mentions that the pill can help people with or without ADHD improve attention. The article says that the pill costs about the same as a good cup of coffee, is safe if used properly, but occasionally can cause mild loss of appetite. The next day, Michael makes his annual visit to his family doctor, tells her about the article and that he would like to improve his ability to pay sustained attention to tasks. The doctor runs some tests and after examining the results, she explains to Michael that he does not fulfill the medical criteria for ADHD. Michael asks her if he can get a prescription for the medication anyway.</td>
</tr>
<tr>
<td>Tax Accountant (study 6)</td>
<td>Michael is your tax accountant. His friend Dave tells him that he was recently diagnosed with the adult form of ADHD and has been using a pill that improves attention. Dave shows him an article that mentions that the pill can help people with or without ADHD improve attention. The article says that the pill costs about the same as a good cup of coffee, is safe if used properly, but occasionally can cause mild loss of appetite. The next day, Michael makes his annual visit to his family doctor, tells her about the article and that he would like to improve his ability to pay sustained attention to tasks. The doctor runs some tests and after examining the results, she explains to Michael that he does not fulfill the medical criteria for ADHD. Michael asks her if he can get a prescription for the medication anyway.</td>
</tr>
<tr>
<td>Soldier (study 7)</td>
<td>Michael is a soldier. He learns about a pill that improves attention. The pill is reasonably safe and effective.</td>
</tr>
<tr>
<td>University Student (study 7)</td>
<td>Michael is a university student. He learns about a pill that improves attention. The pill is reasonably safe and effective.</td>
</tr>
</tbody>
</table>

Table 3.1 Examples of vignettes randomly assigned to experimental groups. For full text of experimental vignettes, see Appendix B.
3.4.3 Measures

After reading their vignette, participants responded to a set of measures that assessed their attitudes about the use of pharmaceutical enhancement. For quantitative questions, participants answered using a 101-point sliding scale with anchors.

The first of two primary dependent measures was the answer to Question 1 which asked, “Considering that Michael is a [occupation], would you prefer or not prefer that he used pills like these?” with anchors of 0 = strongly prefer they do not use the pill and 100 = strongly prefer they do use the pill. After responding, participants were asked to explain in their own words why they answered as they did to the preference measure using a free response box (Question 2, 25 character minimum); the answers were coded using contrastive quantitative content analysis (see Mixed-Methods, below).

The second primary dependent variable was the answer to Question 3 which asked, “To what degree do you think that [occupation] have an obligation to use pills like these?” with anchors of 0 = no obligation and 100 = substantial obligation.

Following these three questions, a series of further quantitative measures probed respondents’ perceptions of the societal benefit that might accrue if the worker used the pill, the perceived prevalence of usage in the worker’s occupation, the extent to which using the pill would improve the performance of the worker, how much of a competitive advantage using the pill provided the worker, and the extent to which the use of the pill is cheating. Importantly, each question was framed in such a way that it explicitly reminded participants that the individual was a member of the occupation described in the vignette. Participants then completed a manipulation check that measured recall of the worker’s occupation, and provided sociodemographic information. Complete text of the experimental vignettes and measures are available in Appendix B.
3.4.4 Quantitative analysis

Data was analyzed using Stata 13 (Stata Corp., College Station, TX) and SPSS v20 (SPSS Inc., Chicago, IL) with the Hayes’ Process Macro (Hayes, 2013). In accordance with evolving statistical standards, we emphasize effect size (Cohen’s d) and confidence intervals (Cumming, 2013; Funder et al., 2013), while also reporting p-values. To ensure sufficient power to detect even small effects, we decided before data collection (Simmons et al., 2011) to recruit a minimum of 100 participants per condition, as we have found this to be more than sufficient in previous research (Cabrera et al., 2014a; 2014b; Felsen et al., 2013; Fitz et al., 2014). We tested multiple regression models (Hayes, 2013; Zhao et al., 2010) to investigate how and why the occupation of the worker influenced participants’ judgments about the situation. For more details of the design, measures, and procedure, see the Appendix B.

3.4.5 Mixed-methods content analysis

The data from the free-response item that explored participants’ reasons for their preference (Question 2) were analyzed using the mixed-methods strategy Contrastive Quantitized Content Analysis (CQCA) (Cabrera & Reiner, in press). The technique provides a mechanism for quantifying the content of participants’ answers and comparing them across experimental conditions. In order to mitigate experimenter bias, we first randomized the full set of comments and blinded the coders to the particular experimental vignette read by the participant who offered a given comment. We then carried out traditional content analysis of the blinded comments, developing themes iteratively as the coding progressed (Braun & Clarke, 2006; Chi, 1997). An initial subset of ~100 comments were analyzed by two coders, and inter-rater agreement was measured (Lombard et al., 2002) before proceeding to code the entire data set. Each theme was treated as a binary variable, and each comment received either a 1 when the theme was present or 0 when the theme was absent. Once all comments were coded, the data
were unblinded and the frequency with which any theme emerged in the comments was compared across contrastive conditions. Descriptive statistics were used to characterize the composition and properties of the sample, and inferential statistics (Pearson Chi-Square) and effect sizes (Cramer’s V) were used to explore if any observed differences between contrastive conditions were meaningful.

3.5 Results

Following guidelines for best practices (Simmons et al., 2011), we report all experimental conditions and variables collected. We ran three between-subject studies, which explored intuitions about the use of pharmaceuticals to improve attention. Study 5 compares attitudes towards individuals in eight different occupations using pharmaceuticals to improve attention. Study 6 replicates Study 5, but frames the worker in the 2nd person (e.g., “your pilot”) to increase the salience of the manipulation. Study 7 replicates the first two studies using a shorter experimental vignette without the medical context to further increase the salience of the manipulation.

3.5.1 Study 5

In Study 5, we tested the hypothesis that judgments about pharmaceutical enhancement would differ between participants who read vignettes describing HR workers compared to those who read about LR workers. Participants (n=1,720) were randomly assigned to read one of eight vignettes describing a worker who was considering using a pill to improve attention; the vignettes differed by the occupation of the worker: PILOT*, SURGEON*, BUS DRIVER*, BRAKE REPAIR TECHNICIAN*, RESTAURANT SERVER, TAX ACCOUNTANT, GROCERY STORE CHECKOUT CLERK, OR GARBAGE COLLECTOR. In each vignette, the worker mentions the pill to his family physician, explaining that he would like to improve his attention. After the physician informs him that he does not have ADHD, he asks whether “he can get a prescription for the medication anyway.” Whether the physician accedes to his request is left
ambiguous. Participants are then asked the series of questions (see methods, above) regarding their attitudes towards the use of pharmaceutical enhancement by the individual described in the vignette. For the full range of vignettes and dependent measures, see the Appendix B.

A one-way ANOVA revealed that preferences for use did not differ between occupations ($F_{7,1712} = 1.99$, $p = .053$), nor did they differ between occupations classified as HR vs. LR ($M_{LR} = 36.47; M_{HR} = 37.21; F_{1,1718} = 0.22; p = 0.64$) (Figs. 3.1A and 3.1B). On the other hand, judgments of obligation to use significantly differed between occupations ($F_{7,1712} = 5.02, p < 0.001$), and HR occupations were judged to be more obligated to use than LR occupations ($M_{LR} = 9.16; M_{HR} = 15.09; F_{1,1718} = 32.08; p < 0.001; d = 0.27$) (Figs. 3.1C and 3.1D). The between-subjects design emphasizes the differences between the conditions rather than focusing on stated preferences. Nonetheless, preference to use was just below the midpoint suggesting ambivalence, and ratings for obligation to use were notably low, suggesting that overall, participants felt that workers have little obligation to use pharmaceutical stimulants off-label.
Figure 3.1. Study 5. Preference and Obligation Judgments for Use by Various Occupations (Study 5, n=1720). Panels A (individual occupations) and B (HR vs. LR occupations) depict mean preference judgments about worker's use of a pill to improve attention (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panels C and D depict mean obligation judgments about the use of a pill to improve attention (0 = no obligation; 100 = substantial obligation).

Note. Error bars represent 95% confidence intervals; *** p < 0.001

3.5.2 Study 6

Study 5 demonstrated that workers in HR occupations are seen as more obligated to use PE than those in LR occupations, but there was no difference in how much they preferred that members of one
group or another used the PE. One explanation for these observations might be that the relevance of the individual in the occupation described in the vignette was of only modest importance to participants. Therefore, in an effort to increase salience, in Study 6 we modified the vignettes to create a personal tie to the situation (Malle et al., 2007). Specifically, a separate group of participants (n=826) were randomly assigned to read one of eight vignettes describing a worker employed in one of the eight occupations described in Study 5, but now the worker’s occupation and questions were framed in the 2nd person (e.g., “your pilot” instead of “a pilot” as they were in Study 5). Beyond this change, the experimental vignettes and dependent measures were identical to those of Study 5.

A one-way ANOVA between the eight occupation conditions once again yielded no difference in preference for the worker to use PE (F_{7,817} = 1.40, p = 0.201) (Fig. 3.2A), but in this study participants slightly preferred that LR occupations use PE as compared to HR occupations (M_{LR} = 41.49; M_{HR} = 36.58; F_{1,823} = 4.70; p < 0.05, d = 0.15) (Fig. 3.2B). Workers in HR occupations were once again seen as more obligated to enhance than workers in LR occupations (M_{LR} = 11.41; M_{HR} = 17.01; F_{1,823} = 10.44; p < 0.001; d = 0.23) (Figs. 3.2C and 3.2D). Importantly, as in Study 5, obligation scores were once again low, suggesting that even if an individual has responsibility for the safety of the person reading the vignette, people do not endorse the stance that there exists an obligation for workers to use PE to enhance attention.
Figure 3.2. Study 6. Preference and Obligation Judgments for Use by Various Occupations (Study 6, n=826). Panels A (individual occupations) and B (HR vs LR occupations) depict mean preference judgments about worker’s use of a pill to improve attention (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panels C and D depict mean obligation judgments about the use of a pill to improve attention (0 = no obligation; 100 = substantial obligation).

Note. Error bars represent 95% confidence intervals; * p < 0.05, *** p < 0.001

To explore the effect of personal framing (i.e., ‘a’ pilot vs. ‘your’ pilot), we included the data from Study 5 (nboth = 2,545) in two-way ANOVAs (occupational responsibility x personal framing). For participants’ preference to use PE, there were no main effects for HR occupations (F_{1,2541} = 2.29; p = 0.13) or personal framing (F_{1,2541} = 2.54; p = 0.11), but there was an interaction (F_{1,2541} = 4.19; p < 0.05) as noted above: in study 6, preferences for use of PE were higher for LR workers than for HR
workers (Fig. S1, AB). For judgments about an obligation to use PE, the two-way ANOVA yielded a main effect of HR occupations ($F_{1,2541} = 31.51; p < 0.001$) and no main effect of personal framing ($F_{1,2541} = 3.57; p = 0.059$) with no interaction ($p = .27$). Bonferroni-adjusted post-hoc tests reveal that for surgeons ($M_{diff} = 6.53$, $p < 0.05$, $d = .26$) and restaurant servers ($M_{diff} = 6.79$, $p < 0.05$, $d = .31$), participants who read the personal frame (e.g., “your surgeon” or “your restaurant server”) judged the worker as more obligated to use PE than participants who read the impersonal frame (e.g., “a surgeon” or “a restaurant server”) (Fig. S1, CD)

### 3.5.3 Study 7

Studies 5 and 6 used vignettes that attempted to explicitly describe a scenario in which the individual asked a physician for a prescription for a PE in the absence of disease. We reasoned that this situation may have evoked some antipathy towards PE use as the presence of a physician in the vignette may evoke concerns about safety. In an attempt to mimic the less problematic condition of a PE assumed to be safe (Greely et al., 2008; Santoni de Sio et al., 2014b), in Study 7, we recruited a separate group of participants ($n=1,197$) who were randomly assigned to read one of twelve substantially simplified vignettes describing a worker engaged in one of 12 occupations. In addition to the eight occupations used in Studies 6 and 7, four additional occupations were included: SOLDIER*, UNIVERSITY STUDENT, HIGH SCHOOL TEACHER, AND STOCK TRADER. The experimental vignette simply read: “Michael is a [occupation]. He learns about a pill to improve attention. The pill is reasonably safe and effective.” Participants then completed the same dependent measures that were used in Studies 5 and 6.

A one-way ANOVA between all 12 occupations yielded a small effect for preference to use PE ($F_{11,1185} = 2.44, p = 0.005$), but Bonferroni-adjusted follow-up tests for multiple comparisons revealed that there were no significant differences for preference to use PE between any of the 12 conditions.
Thus, there were no differences between participants’ preference that LR workers (M_{LR} = 51.86) or HR workers (M_{HR} = 52.18) use PE (F_{1,1195} = 0.027; p = 0.869) (Figure 3.3). Again, as in Studies 5 and 6, participants who read about workers in HR occupations rated those workers as more obligated to use PE than participants who read about workers in LR occupations (M_{LR} = 13.33; M_{HR} = 19.49; F_{1,1195} = 18.38; p < 0.001; d = 0.25) (Figure 3.3).

![Figure 3.3](image)

**Figure 3.3. Study 7.** Preference and Obligation Judgments for Use by Various Occupations (Study 7, n=1197). Panels A (individual occupations) and B (HR vs LR occupations) depict mean preference judgments about worker’s use of a pill to improve attention (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panels C and D depict mean obligation judgments about the use of a pill to improve attention (0 = no obligation; 100 = substantial obligation).

*Note.* Error bars represent 95% confidence intervals; *** p < 0.001
Overall, 39% of participants preferred that the worker not use while 53.4% preferred that the worker use; 7.6% were on the fence right on the midpoint. For judgments of an obligation to use PE, 85% of participants felt that the worker did not have an obligation while 12.2% did judge the worker as obligated to use; 2.8% were on the fence on the midpoint.

![Figure 3.4. Study 7. Distribution of (A) preference and (B) obligation judgments across all occupations (Study 7, n=1197).](image)

Returning to the issue of overall preference to enhance, we observed that across all occupations, participants that read the simplified vignette in Study 7 preferred that workers enhance significantly more than participants that read the vignettes with physician oversight in Studies 5 and 6 ($M_{studies\ 5\ &\ 6} = 37.56$, $M_{study\ 7} = 53.52$, $M_{diff} = 15.96$; $F_{3326} = 144.88$, $p < 0.001$, $d = 0.49$) (Fig S2, AB). Similarly, across all occupations, participants in Study 7 viewed workers as more obligated to enhance than participants in studies 5 and 6 ($M_{studies\ 5\ &\ 6} = 12.86$, $M_{study\ 7} = 15.79$, $M_{diff} = 2.93$; $F_{3326} = 8.98$, $p < 0.01$, $d = 0.12$) (Fig S2, CD). Thus, the simplified vignette that did not include information about asking the physician for the pill raised overall ratings, but did not change the basic finding: participants exhibit similar preferences for HR or LR workers to use a pill to enhance attention, but participants who
evaluated HR workers do judge them as more obligated to use pharmaceutical stimulants than participants who evaluated LR workers.

### 3.5.4 Societal benefit and perceived prevalence mediate differences between HR and LR occupations

A consistent observation across Studies 6-8 was that people evaluated HR occupations as more obligated to use a pill to improve attention than LR occupations, while they exhibited no preference for either HR or LR occupations to enhance. To explore factors that may influence these effects, we tested a series of hypothesized models using mediation analysis (Hayes, 2013; Zhao et al., 2010), and undertook contrastive quantitized content analysis (Cabrera & Reiner, in press). The results for Study 7 are reported here; the same pattern of results was found when analyzing Studies 5 and 6 (see Appendix B).

There was no direct effect of HR occupation on preference to enhance. However, consistent with contemporary mediation analysis (Zhao et al., 2010), we explore what factors explained the (lack of) effect on participants’ preference that the worker enhance. We employed model 4 of the Hayes SPSS Macro (Hayes, 2013) with 50,000 bootstrap replications. For societal benefit, the 95% confidence interval of the indirect effect did not include zero (b = 7.30, 95% CI = 4.67, 9.94) (Fig. 3.5).

Thus, if one controls for the increased perceived benefit to society in HR occupations, participants actually prefer that LR workers use PE more than they prefer that HR workers do so (Fig. 3.5). In addition, we conducted parallel mediation analyses to examine whether perceived prevalence might also explain the lack of effect of HR occupations on preferences for use. We found that perceived prevalence was a significant mediator, but entering both perceived prevalence and societal benefit as simultaneous mediators revealed that only societal benefit remained significant. To confirm this, we ran multiple regression models (Baron & Kenny, 1986). HR occupation positively predicted social
benefit ($\beta = .16, p < .001$). In turn, perceived societal benefit significantly predicted preference for enhancement ($\beta = .68; p < .001$). When entered into a model that controls for societal benefit, HR gains significance and negatively predicts preference ($\beta = -.11, p < .001$).

![Diagram](image)

**Figure 3.5. Study 7.** Indirect effects of HR occupation on preference for use through societal benefit (Study 7, n=1197).

*Note.* $b$ represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013).

Participants judged workers in HR occupations as more obligated to use a pill to improve attention than workers in LR occupations. For societal benefit and perceived prevalence as mediators, the Hayes SPSS Process Macro (Hayes, 2013) with 50,000 bootstrap replications yielded an overall indirect effect of $b = 4.05$, 95% CI = 2.74, 5.48. The 95% confidence interval of the indirect effect did not include zero for societal benefit ($b = 2.97$, 95% CI = 1.89, 4.18) or for perceived prevalence ($b = 1.08$, 95% CI = 0.58, 1.79), suggesting that HR occupation persuaded participants to be more supportive of an obligation to use pharmaceuticals by increasing perceptions that use would benefit society and that use is more common in HR workers than LR workers (Fig. 3.6). Again to confirm this, we ran multiple regression models (Baron & Kenny, 1986). Perceived societal benefit significantly
predicts judgments that the worker is obligated to use ($\beta = .43 \ p < .001$), as does perceived prevalence ($\beta = .27 \ p < .001$). When entered into a model that controls for societal benefit and perceived prevalence, HR occupation loses significance and no longer predicts obligation ($\beta = .04, \ p = 0.11$) demonstrating that these factors fully mediate the observed effect.

Figure 3.6. Study 7. Indirect effects of HR occupation on obligation to use through societal benefit and perceived prevalence (Study 7, n=1197).

Note. $b$ represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013).

To rule out alternative explanations, we conducted a set of regression analyses in which we included the other explanatory variables such as performance improvement, competitive advantage, and cheating to predict either preference or obligation to enhance and all indirect effects included zero. Such analyses demonstrate that, of the measures employed in this study, only social benefit and
perceived prevalence mediate the relationship between HR and LR. A similar pattern of results was observed in studies 5 and 6; see section 5c of Appendix B. For results of the performance improvement, competitive advantage, and cheating measures, see Figures S11-19.

3.5.5 Content analysis: participants’ reasons differ between HR and LR conditions

Immediately after participants rated how strongly they preferred that the worker use (or not use) the pill, they were asked to tell us why they answered as they did using a free-response box, with responses analyzed using the mixed methods technique of CQCA (see methods). Inter-rater agreement for the coding scheme was 0.95. The themes that emerged represented reasons that fell into two main categories: Against Use or Prefer Use or Neutral (Figs. 3.7 & 3.8; Tables. 3.2 & 3.3; see Table S2 for codebook).

Overall, 44% of participants gave an Against Use reason; four Against Use reasons were given by at least 5% of participants, cumulatively, across all occupation conditions (Fig. 3.7): SAFETY CONCERNS (n=243, 20.3%), ENDANGERS OTHERS (n=84, 7%), NO NEED (n=217, 18.1%), and DRUGS Я BAD (n=132, 11%). Reasons Against Use that were mentioned by less than 5% of participants included DEGRADES WORKPLACE PERFORMANCE (2.4%), CHEATING (0.8%), and UNNATURAL (2.1%); these were not further analyzed. Comparing across contrastive conditions reveals that participants who read a vignette about an HR worker raised SAFETY CONCERNS and ENDANGERS OTHERS as Against Use reasons significantly more than people who read a vignette about an LR worker (Fig. 3.7). Close to a third (30.4%) of participants in HR conditions raised SAFETY CONCERNS, while only 13.2% of participants in LR conditions did so (Χ^2_{1,1197} = 53.11; p < 0.001, V = .21), and 16.2% of participants in HR conditions mentioned ENDANGERS OTHERS while virtually no one (.01%) did so in the LR conditions (Χ^2_{1,1197} =
108.96; p < 0.001, V = .30). There were no differences between HR and LR for NO NEED and DRUGS BAD (p > 0.05, for both).

Overall, 59% of participants gave a Neutral or Prefer Use reason; five were given by at least 5% of participants, cumulatively, across all occupation conditions (Fig. 3.8): DON’T CARE (n=195, 16.3%), HIS CHOICE (n=86, 7.2%), BENEFIT OTHERS (n=168, 14%), SAFE OR EFFECTIVE (n=238, 19.8%), and IMPROVES WORKPLACE PERFORMANCE (n=297, 24.8%). Reasons that were mentioned by less than 5% of participants included: COMMON (0.8%), FAMILIAR (0.8%), and ANALOGY (1.3%); these were not further analyzed. Comparing across contrastive conditions revealed that participants who read a vignette about an HR worker mentioned BENEFIT OTHERS significantly more and raised DON’T CARE and HIS CHOICE significantly less than participants who read a vignette about an LR worker (Fig. 3.8).

Almost a third (30.2%) of participants in HR conditions mentioned BENEFITS OTHERS, while only 2.7% of participants in LR conditions did so ($X^2_{1,1197} = 182.06; p < 0.001, V = .39$). However, only 6.1% of participants in HR conditions mentioned DON’T CARE while almost a quarter (23.4%) did so in the LR conditions ($X^2_{1,1197} = 64.02; p < 0.001, V = .23$). Similarly, only 1.6% of participants in HR conditions mentioned HIS CHOICE while 11.1% in the LR conditions did so ($X^2_{1,1197} = 38.89; p < 0.001, V = .18$). There were no differences between HR and LR for SAFE OR EFFECTIVE (19.1% of HR participants; 20.4% of LR participants) and IMPROVES WORKPLACE PERFORMANCE (23.3% of HR participants; 25.9% of LR participants).
Figure 3.7. Study 7. The most common reasons for preferences in Against Use (Study 7, n=1197). Panel A depicts the proportion of participants within HR or LR groups who gave those reasons. Panel B depicts the frequency of Safety Concerns and Endangers Others mentioned by participants in each condition.
Figure 3.8. Study 7. The most common reasons for preferences in *Prefer Use or Neutral* (Study 7, n=1197). Panel A depicts the proportion of participants within HR or LR groups who gave those reasons. Panel B depicts the frequency of *Don’t Care, His Choice, and Benefits Others* mentioned by participants in each condition.
<table>
<thead>
<tr>
<th>Reasons Against Use</th>
<th>Low-Responsibility</th>
<th>High-Responsibility</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any reason against use</td>
<td>39.9%</td>
<td>49.9%</td>
<td>44%</td>
</tr>
<tr>
<td>Endangers Others***</td>
<td>0.6%</td>
<td>16.2%</td>
<td>7%</td>
</tr>
<tr>
<td>Safety Concerns***</td>
<td>13.2%</td>
<td>30.4%</td>
<td>20.3%</td>
</tr>
<tr>
<td>No Need</td>
<td>19%</td>
<td>16.8%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Drugs R Bad</td>
<td>12.2%</td>
<td>9.3%</td>
<td>11%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reasons For Use or Neutral</th>
<th>Low-Responsibility</th>
<th>High-Responsibility</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any reason for use or neutral</td>
<td>60.1%</td>
<td>57.4%</td>
<td>58.9%</td>
</tr>
<tr>
<td>Benefits Others***</td>
<td>2.7%</td>
<td>30.2%</td>
<td>14%</td>
</tr>
<tr>
<td>Don’t Care***</td>
<td>23.4%</td>
<td>6.1%</td>
<td>16.3%</td>
</tr>
<tr>
<td>His Choice***</td>
<td>11.1%</td>
<td>1.6%</td>
<td>7.2%</td>
</tr>
<tr>
<td>Safe or Effective</td>
<td>20.5%</td>
<td>19.1%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Improves Work Performance</td>
<td>25.9%</td>
<td>23.3%</td>
<td>24.8%</td>
</tr>
</tbody>
</table>

Table 3.2 Proportion of participants offering reasons (*Against Use or For Use or Neutral*), as a function of the occupation of the worker (Study 7, n=1197). Reasons cited by less than 5% of participants overall are excluded (see Appendix B);

*Note.*** represent significant differences (LR vs. HR) at the p < 0.001 level.

### 3.5.6 Gender differences in preferences for use of pharmaceuticals in the workplace

A body of research literature has documented gender differences in perceptions of science and technology. In general, men display more positive, optimistic attitudes and behaviors, while women have more negative, skeptical views towards biotechnology-related topics (Bryant & Pini, 2006; Franke et al., 2012; Hayes & Tariq, 2000; Kauffman et al., 1997; Pew Research Center, 2015; Qin & Brown, 2007; Siegrist, 1998; 2000; Simon, 2010; 2011; 2012).

We examined gender as a moderator of the relationship between occupation of the worker and preference for the use of pharmaceutical stimulants. A two-way ANOVA revealed a main effect for gender ($F_{1,1193} = 13.86, p < 0.001$) and a significant interaction ($F_{1,1193} = 5.57, p < 0.05$) (Fig 3.9A). To confirm this, we ran a regression exploring whether HR occupations predicted preference, and the unstandardized coefficient for male participants was 4.09, while it was -5.26 for female participants, providing support for the interaction. Thus, men preferred that HR workers use PE more than they
prefer LR workers use, while women preferred that HR workers use less than they preferred LR workers use.

Across all three studies, female participants expressed significantly lower preference and obligation views around workers’ PE use than male participants (see Figs. S6-S8). In studies 5 and 6, male participants exhibited a significantly higher preference than female participants for PE use by HR workers (study 5: $F_{1,1716} = 20.61, p < 0.001, d = .32$; study 6: $F_{1,821} = 22.88, p < 0.001, d = .49$) and for LR workers (study 5: $F_{1,1716} = 19.29, p < 0.001, d = .29$; $F_{1,821} = 4.38, p < 0.05, d = .21$) (Fig. S6-S8). In study 7, male participants expressed a significantly higher preference for HR workers to use than female participants ($F_{1,1193} = 15.79, p < 0.001, d = .36$), but no gender difference emerged for preference judgments of LR workers ($F_{1,1193} = 1.12, p = 0.29$) (Fig. 3.9A). For obligation judgments, in studies 5-7, male participants judged HR workers to be significantly more obligated to use than female participants (study 5: $F_{1,1716} = 5.58, p < 0.05, d = .17$; study 6: $F_{1,821} = 15.66, p < 0.001, d = .40$; study 7: $F_{1,1193} = 5.65, p < 0.05, d = .22$) while no gender difference emerged for judgments of LR workers (study 5: $F_{1,716} = 2.44, p = 0.12$; study 6: $F_{1,821} = 07, p = 0.80$; study 7: $F_{1,1193} = 0.01, p = 0.92$) (Fig. 3.9B; S6-S8).

Figure 3.9. Study 7. Preference and Obligation Judgments by Gender and Occupation (Study 7, n=1197). Panel A depicts mean preference judgments that workers use a pill to improve attention as a function of occupational responsibility and
participant gender (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panel B depicts mean obligation judgments that workers use a pill to improve attention as a function of occupational responsibility and participant gender (0 = no obligation; 100 = substantial obligation).

To explore the factors that might explain these differences, we conducted mediation analyses using the Hayes SPSS Process Macro with 50,000 bootstrap replications (Hayes, 2013). For societal benefit, performance improvement, and cheating as mediators, this procedure yielded an overall indirect effect of $b = -4.07$, 95% CI = -7.06, -1.10. The 95% confidence interval of the indirect effect did not include zero for societal benefit ($b = -1.90$, 95% CI = -3.80, -0.12), for performance improvement ($b = -0.87$, 95% CI = -1.82, -0.05), or for cheating ($b = -1.30$, 95% CI = -2.59, -0.10), suggesting that female participants preferred PE use less than male participants due to less optimistic perceptions of societal benefit and performance improvement as well as harsher cheating judgments (Fig. 3.10). The exact same mediation pattern was seen in studies 5 and 6 (Figs S9 and S10).
Figure 3.10. Study 7. Indirect effects of gender on preference for worker to use through societal benefit, performance improvement, and cheating (Study 7, n=1197).

Note. $b$ represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013). The range in brackets represents the 95% confidence interval of the indirect effect. * $p < 0.05$, *** $p < 0.001$.

3.6 Discussion

3.6.1 Summary and interpretation of results

While participants displayed similar preferences for HR or LR workers to use PE, the HR-LR distinction was still salient. In three studies, we found that people who evaluated workers in HR occupations did not prefer that these workers use pharmaceutical stimulants any more than people who evaluated workers in LR occupations. However, the contrastive quantitized content analysis revealed different reasons for these judgments, mediation analysis found differences when controlling for societal benefit as an explanatory factor, and moderation analysis showed gender differences. Though
HR workers are deemed more obligated than LR workers to use PE, only a small minority of people supports such an obligation. In all three studies, we found that people who evaluated workers in HR occupations did view them as somewhat more obligated to use pharmaceutical stimulants than people who evaluated workers in LR occupations. However, there was very little support for the view that workers have an obligation to use PE.

In the present studies, women held more skeptical and realistic attitudes towards HR and LR workers using PE than men. Throughout the literature, gender consistently influences perspectives on science and technology: men tend to have more positive, optimistic attitudes while women hold more negative, skeptical views towards biotechnology-related topics (Johnson & Simon, 2012; Pew Research Center, 2015; Qin & Brown, 2007; Simon, 2010; 2012). Why might that be? In his work, the sociologist Richard Simon finds a surprising interaction with gender and knowledge of biotechnology: in line with an information-deficit model, the more men know about it, the more likely they are to support biotechnology. But contra the deficit model, women are more critical of biotechnology with more knowledge (Simon, 2010). Simon argues (2012, 2011), building on the work several ecofeminists (Nelkin, 1981; Mallory, 2006; Bryant & Pini, 2006; DuPuis, 2000; Napolotano & Ogunseitan, 1999), that, due in part to health and gender roles associated with parenting, women tend to be more personally affected by biotechnologies’ negative consequences. Why are women substantially less in favor of HR or LR workers using PE than men? The present studies do not directly test the technological salience theory (Johnson and Simon, n.d.) – we did not measure knowledge or familiarity with biotechnology – but the data do find that, compared to men in all three studies, women are more skeptical that PE use will benefit society or that PE actually improves workers’ performance, and women are more likely to feel that PE use constitutes cheating. Future research should clarify the causes and consequences of gender differences in perceptions of enhancement technologies.
Attitudes about societal effects help explain intuitions. We found that the people perceived more of a benefit to society from use of PE by HR workers, and this primarily explained differences in preference and obligation judgments between HR and LR workers. Similarly, people believed that use of PE is more prevalent in HR workers, which also secondarily explained differences in judgments. In addition, when asked for their reasons, people who evaluated HR workers were much more likely to say that use of pharmaceutical stimulants might benefit others or that it could endanger others and be unsafe. In turn, people who evaluated LR workers were much more likely to say that using pharmaceutical stimulants was a matter of the worker’s own choice and that they didn’t care one way or the other.

Public attitudes reflect much of the academic debate while also illuminating different views and values. In previous research, we found that the attitudes of the public often capture the relevant issues raised in the literature, but also emphasize different concerns and values (Fitz, Nadler et al., 2014; Cabrera et al., 2014a, 2014b). Indeed, this feature is typically lauded as one of the benefits of studying judgment and reasoning about controversial ethical issues such as pharmaceutical enhancement (Sarewitz, 2010; Schicktanz et al., 2012). Some of the quantitative and qualitative data in the present three studies corresponds with the arguments in the literature in support of PE use by high-responsibility workers. In particular, judgments were primarily driven by the perception that the use of PE by HR workers may benefit society, and many participants reasoned that this use would benefit others. Like a number of academic commentators, participants also argued that use was the workers own personal choice, reflecting the individualism and autonomy so enshrined in modern western societies. Surprisingly, a surprisingly sizeable group of participants preferred that low-responsibility workers use PE so that their workplace improved (e.g., “I want my restaurant servers to pay better attention), which is a perspective that is largely absent from ethical debate.
Similarly, the data from these three studies reflect many of the arguments in the literature against the use of PE in the workplace. The most cited reasons against use by HR workers – concerns about safety of the worker and others – represent the strongest argument in the literature against enhancement enthusiasts. Participants also argue that there is no need for either HR or LR workers to use PE, which supports much of the sociological and health scholarship around enhancement: participants appear to push back against the perceived medicalization and pharmaceuticalization of the workplace. Finally, a number of participants argue that drugs are generally bad and wrong, which reflects scholarship on the moralization of substances and value-laden negative intuitions about the enhancement agenda. Notably, while scientists and the media are criticized for contributing to hype around pharmaceutical enhancement (Caulfield, 2004; Lucke et al., 2011; Partridge et al., 2011; Zohny, 2015), laypeople generally exhibit ambivalence, blending tempered skepticism with cautious optimism (Fitz et al., 2014; Forlini & Racine, 2012; Schelle et al., 2014). In the present three studies, we found judgments and reasons from across the biopolitical spectrum: critics, enthusiasts, and moderates.

3.6.2 Pharmaceuticalization in the modern workplace

These results are relevant to a growing body of scholarship on pharmaceuticalization and the social construction of drugs in the modern workplace. The results from the present three studies help (a) illuminate various technosocial positions (b) reveal social and psychological drivers in how people engage with the use of pharmaceutical technologies for non-medical purposes in the workplace, and (c) inform our understanding of the relationship between our bodies, minds, and selves in contemporary society (Coveney et al., 2011; Williams et al., 2011).

The present studies reveal a complex array of positions toward PE in the workplace. We find evidence for at least three main biopolitical groups with varying beliefs and motivations: (i) Pharmaceutical Critics who exhibit a strong preference against workers’ use of pharmaceutical
enhancement, arguing that there is no need to use PEs, that PEs are wrong and akin to unfavorable ‘drug use,’ and that they are unsafe and their use may endanger others; (ii) **Pharmaceutical Moderates** who display mixed preferences for use, note both potential benefits and risks, or express ambivalence and/or apathy; (iii) **Pharmaceutical Enthusiasts** who are optimistic about their benefits, claiming that they are safe, that they improve workplace performance, and that their use will benefit society.

The present studies illuminate aspects of social norms that can drive the pharmaceuticalization process. First, to the extent that the performance of healthy HR workers is pharmaceuticalized, the more that people perceive increasing benefits to society from the use of pharmaceutical stimulants, the more likely they are to embrace and normalize their use. Second, the more that people view the use of pharmaceuticals as increasingly common, the more likely they are to accept them as a normal part of everyday life. The latter observation is consistent with research on the effects of social norms around alcohol which has demonstrated that drinking is influenced by perceptions of peer prevalence (Foxcroft et al., 2015). Third, the data reveal that men are more willing to endorse pharmaceutical interventions in the workplace, while women are more reticent to do so. This gender difference emerged from divergent judgments about how much PE usage benefits society, how much PE improves workplace performance, and moral judgments about the use of PE. This suggests that we should be particularly cognizant of increasing pharmaceuticalization in workplaces with higher rates of men. In addition, the present studies provide strong support for the distinction between medicalization and pharmaceuticalization. Participants were much more supportive of PE in the non-medical pharmaceuticalization context of study 7 than they were in the off-label medical regime of physician oversight in studies 5 and 6. In studies 5 and 6 – in which a healthy worker asks his physician for the pill – the majority of participants preferred that the worker *not use* the pill. However, in study 7 – in which a healthy worker considers using a pill with no mention of the medical establishment – a majority of participants leaned toward preferring that the worker *use* the pill.
Participants’ in-their-own-words responses provide a window into how people conceive of our relationship to pharmaceutical technologies in the modern workplace. The participants that were against workers’ use of PE gave reasons that represented themes such as ‘safety’ or ‘endangering others’ – concerns that were much more frequently cited by participants who evaluated high-responsibility workers such as pilots or surgeons – and ‘no need’ or ‘drugs are bad’ that emerged irrespective of the experimental condition to which they were assigned. That many participants felt that there is ‘no need’ for a healthy worker to use PE fits with recent empirical work (Cabrera, Fitz, & Reiner, 2014a) that reflects the canonical ‘therapy-enhancement’ distinction (Daniels, 2000), and highlights the fact that some participants explicitly reject the pharmaceuticalization of the workplace.

At the same time, the most common theme of reasons in support of the use of PE was that it ‘improves work performance.’ Whether participants evaluated a restaurant server or a surgeon, many supported the use of PE precisely because it improved workers’ performance, which reflects the extent to which our culture valorizes workplace productivity across many fields.

Whether the pharmaceutical regime expands or contracts will depend on how consumers’ perceptions of PE change in the future. Looking ahead, support for pharmaceutical enhancement in the workplace will increase if the perception of societal benefits, prevalence, workplace performance, and safety increases, but it just as easily may fade if these perceptions decrease. Thus, researchers and the media should be particularly keen to emphasize the realities of PE – marginal benefit at best, trade-offs and safety concerns, and low prevalence (Advokat, 2010; Farah, 2015; Lucke et al., 2011; Partridge, 2013; Repantis et al., 2010) – rather than feeding into the hype that has been endemic to the topic (Partridge et al., 2011).
3.6.3 Neuroethics and policy implications

Neuroethicists have grappled with the use of pharmaceutical enhancement by workers in high-responsibility occupations. In his seminal article in *Neurology* (2004), the neurologist, Anjan Chatterjee kicks off the debate: “a second form of coercion, which has not received attention, is the explicit demand of superior performance by others...should pilots be expected to take such medications?...Closer to home, should post-call residents take modafinil” to deal with sleep deficits? Chatterjee wonders whether the public would pay more for “cholinergic copilots” and whether hospitals, insurance companies, and/or patients might require this practice -- the very same questions posed about the drivers of pharmaceuticalization. Similarly, in their comprehensive legal analysis (2014a), Goold and Maslen handle both sides of the pharmaceuticalization coin: “one can readily imagine the attractions to hospitals” of PE, but “one can also foresee the development of a medical culture in which taking enhancers is progressively normalised if those enhancing drugs offer benefits with minimal side-effects.” Appel (2008) wonders what happens, “if hospitals started to demand that medical residents dose up on methylphenidate” and aptly illustrates the tension bound up in the topic: “to some, these technologies offer an opportunity to maximise employee productivity and enhance the society’s overall quality of life. To others, they bring us one step closer to the dystopia of Brave new world.”

Recently, several commentators in neuroethics have argued that, at least under certain conditions, these HR workers have an obligation to use such PEs. By applying their ‘nature-of-activities’ approach, several philosophers (Santoni de Sio, Robichaud, & Vincent, 2014) argue that PE “should be allowed in some prominently goal-directed activities, such as high-responsibility professions, the goal of which has significant moral or social value” and that relatively safe and effective PE “may even be obligatory in those high-responsibility professions under certain special circumstances.” A group of practicing surgeons (Warren et al., 2009) writes that the reality of tired surgeons taking PE “is perhaps not as far-
fetched as some may suggest.” In their oft-cited Nature editorial (2008), Greely and colleagues “can imagine other occupations for which enhancement might be justifiably required” to ensure the safety of the worker and others who depend on him or her. In the same issue (2008), Nick Bostrom argues that more workers than just those in ‘special occupations’ such as soldiers would benefit from PE: “other jobs are just as important and intellectually taxing — including the jobs of many scientists and academics, [and] anything that can help our brains deal better with the complex challenges of the twenty-first century is to be not only welcomed but actively sought.” But does the public agree? Do they welcome pharmaceutical enhancement that purportedly helps our brains in this way? In their Nature editorial a year earlier (2007), Sahakian and Morein-Zamir also “can even imagine situations where such enhancing-drug-taking would be recommended,” such as by soldiers (Sahakian & Morein-Zamir, 2007). The authors argue that there are “situations in which many would agree that the use of drugs to improve concentration or planning may be tolerated, if not encouraged” such as their use by surgeons. Would many people encourage the use of PE in these situations?

In the present three between-subject mixed-method studies, we tested these claims extensively, providing several opportunities for effects to emerge. We found that people view HR workers as slightly more obligated than LR workers, but nine out of ten people do not think workers have any obligation to use PE. Though there is little demand, the public is more split about whether they prefer that a worker use PE or not. More than half of people were opposed, ranging from strongly against use to moderately skeptical, and approximately a third of people were in favor of use, ranging from cautiously optimistic to enthusiastically endorsing. Much about participants’ judgments does echo the scholarship on HR-LR workers – their preferences were primarily driven by perceptions of societal benefit and their comments were mostly comprised of key concerns around safety and benefits vs. harms to others. However, people did not prefer that HR workers use pharmaceutical enhancement any more or less than people preferred that LR workers do so. This was surprising: given the literature, we
hypothesized that there would be substantial difference, and each successive study was designed to elicit a difference in participants’ preferences between HR and LR workers.

The present studies tie into the formation of social policy. From a regulatory perspective, policymakers have recently begun to address the issue. In their fatigue management policy documentation, Queensland Health, the medical regulators of the Australian state, suggest that overworked healthcare workers take “naps of less than 30 minutes in length to provide measurable boosts in alertness and performance…[and up to] 400mg of caffeine [which is] equivalent to about five to six cups of coffee” only because “compared with other psychoactive drugs (e.g. modafinil), caffeine is…more readily available and less expensive” (Queensland Health, 2009). Greely and colleagues (2007) remind us that American soldiers can be legally required to take stimulants to improve their military performance. In their report on enhancement and the future of work (2009), four United Kingdom academies note that, “occupations that require particular patterns of focus could benefit from enhancements that facilitate achieving such patterns. For example, surgeons may need to be able to concentrate for extended periods…As an extrapolation to this, it is possible that in these high-responsibility occupations enhancement could be seen as a moral obligation, or even demanded by the public.” The present studies respond to these claims from policymakers, and show that there is almost no public demand for healthy workers’ use of PE. In fact, current public opinion may discourage the use of PE in the workplace. Whether through their choices as consumers or their attitudes towards biotechnology in general, public opinion directly affects the development and distribution of biotechnologies (Simon, 2012; Weber et al., 2009), often operating as a “crucial constraint” (Bauer & Gaskell, 2002). The present studies find that most people are against the use of PE in the workplace.

Given the ambivalent social norms and the absence of evidence for safety and efficacy, we argue for a position of watchful waiting. The scientific and medical reality is that, in healthy people, pharmaceutical stimulants can have small positive effects on certain cognitive tasks, but also can
simultaneously impair other functions (Farah, 2015; Repantis, 2013; Husain & Mehta, 2011; Iuculano & Cohen Kadosh, 2013). There is no evidence that PE can reliably improve real-world outcomes that are relevant for HR workers, and there are important concerns around longer-term effects such as sleep debts. While there is substantial interest in PE (Partridge et al., 2013), and some workers from across the economy are reportedly using PE (Schwarz, 2015), we do not appear to be on the brink of a deluge of pharmaceutical enhancement in the workplace. The science is not yet there, nor is the public demand. Instead of encouraging potentially unsafe PE in the workplace, policymakers should protect employees from pressures to use PE (Kostiuk, 2012).

3.6.4 Future directions

The present studies naturally map out several future research directions. As Maslen and colleagues have argued (2015), empirical work in this vein should not only explore how people from the general public make decisions about these issues (e.g., the present studies), but should also explore the beliefs and behaviors of those in high-responsibility occupations – that is, the groups in society who are directly affected by these emerging technologies (i.e., pilots, surgeons, soldiers). Though they will be influenced by their employers, workplace regulations, and societal demands, workers themselves will determine practice by deciding whether or not to actually use these biomedical technologies. The present three studies explore judgments and decisions around the use of stimulant pills by healthy workers in low- and high-responsibility occupations. Building on these, future research could randomize the worker’s HEALTH STATUS OR PURPOSE such as enhancement for a healthy surgeon (the present studies) vs. therapy for a surgeon with ADHD vs. restoration for an exhausted surgeon; the worker’s RESPONSIBILITY FOR OTHERS such as a pilot with five passengers vs. a pilot with 500 passengers vs. a pilot of a freight plane; and the TECHNOLOGICAL MEANS that the worker uses, varying, for example, the risks, benefits, and prevalence of so-called smart drugs (Rasmussen, 2008; M. E.
Smith & Farah, 2011) and mood enhancers (Herzberg, 2009), non-invasive brain stimulation (Cohen Kadosh, 2015), CRISPR-Cas9 genome engineering (Mali et al., 2013), energy drinks (Reissig, Strain, & Griffiths, 2009), coffee (Lovett, 2005), and ubiquitous technologies such as smartphones (Economist, 2015). In particular, Gabe and colleagues (2015) call for more work on these technologies (Fitz & Reiner, 2016) that will drive a so-called ‘Pharmaceuticalization 2.0.’

### 3.6.5 Conclusions

The present studies suggest an ongoing policy climate of watchful waiting and echo the growing call for robust empirical work that employs meaningful real-world outcome measures. Until we know more about the benefits and long-term impacts of PE on these workers and those affected by them, there will likely be little political movement. More important, perhaps, we ask whether this is a decision to be made by “experts” alone, or whether the public should be more heavily involved in the formation of policy both as a matter of principle and public acceptance (Sarewitz, 2010).

At the same time, attitudes shape policy just as policy shapes attitudes. If, in the future, people perceive greater benefits to others and less harms from pharmaceutical technologies, the pressure to craft regulatory policy that facilitates or discourages the use of such technologies will shift accordingly. At present, public attitudes and the medical evidence are aligned in pushing back against the use of pharmaceuticals in the modern workplace.
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Appendices

Appendix A contains supplementary materials for studies 1-5, and Appendix B contains supplementary materials for studies 6-8.
Appendix A

The Vignettes

On the pages that follow, we give the full text of each vignette. In our contrastive vignette methodology, each individual saw one vignette, and then saw the questions at the bottom of the page. Respondents answered on a Likert scale from 1-9 with anchors that are noted after each question (in parentheticals). In each case, the first vignette is the index vignette, and what is shown in red are the changes in the associated minimally contrastive vignette.
Susan, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved pill that improves the brain’s ability to pay sustained, deep attention to tasks. Susan’s doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Q1: Susan ultimately decides that she will take the pill to improve her existing capacity to focus at work. Do you think that her choice to [enhance/restore] this ability is worth the risk she is taking on? (not at all worth the risk…entirely worth the risk)
Susan, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved device that improves the brain's ability to pay sustained, deep attention to tasks. The device strengthens neural pathways by delivering a tiny electric current (about the same as a common battery) to the brain using small sticky pads that attach to the outside of the head. Susan's doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the device has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Q1: Susan ultimately decides that she will use the device to improve her existing capacity to focus at work. Do you think that her choice to [enhance/restore] this ability is worth the risk she is taking on? (not at all worth the risk…entirely worth the risk)
### Study 1, Safety

#### Societal Benefit of CE Vignettes

<table>
<thead>
<tr>
<th>Enhancement</th>
<th>Cancer Scientist</th>
<th>Weapons Scientist</th>
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<tr>
<td>Susan, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved pill that improves the brain's ability to pay sustained, deep attention to tasks. Susan's doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.</td>
<td>Susan, a close family friend of yours, is a healthy 42-year-old scientist working at a prestigious university on a highly promising cure for liver cancer. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved pill that improves the brain's ability to pay sustained, deep attention to tasks. Susan's doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.</td>
<td>Susan, a close family friend of yours, is a healthy 42-year-old scientist working at a weapons laboratory on a new virus for biological warfare. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved pill that improves the brain's ability to pay sustained, deep attention to tasks. Susan's doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.</td>
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Q1: Susan ultimately decides that she will take the pill to improve her existing capacity to focus at work. Do you think that her choice to enhance this ability is worth the risk she is taking on? (not at all worth the risk…entirely worth the risk)
Study 1, Safety

Framing Vignettes

Enhancement

Susan, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved pill that improves the brain’s ability to pay sustained, deep attention to tasks. Susan’s doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Q1: Susan ultimately decides that she will take the pill to improve her existing capacity to focus at work. Do you think that her choice to [enhance/restore] this ability is worth the risk she is taking on? (not at all worth the risk…entirely worth the risk)

Q2: On the previous page, do you think that the pill provided Susan with the opportunity to gain something or to avoid the loss of something? (gain something; avoid the loss of something)
Study 2, Pressure
Pharmacological CE Vignettes

Soft Societal Pressure

Imagine that you are a paralegal at a large law firm. As part of your job, you are required to retain large amounts of information - your ability to remember details is a key skill. You have been doing only moderately well at work, and as a result last year you received a smaller bonus than you had hoped. You read a magazine article describing a new pill that improves memory. The pill strengthens neural pathways by altering the levels of several neurotransmitter systems in the brain. The result is a substantial improvement in memory. The pill does not put knowledge into the brain, but rather makes it easier to retain information; one pill per day is enough to enhance one’s ability to remember things for the next 24 hours, and the expense of its daily use adds up to roughly the cost of your daily cup of coffee. The pill has been shown to be safe; as a result, it has been approved for use by normal, healthy adults. As performance reviews are only a few months off, you consider whether to make use of this cognitive enhancement technology.

Q1: Given the situation, how likely are you to use the pill? (highly unlikely…highly likely)

Q2: Please indicate the extent to which you agree with the following statement: “Given the situation, I feel pressured to use the pill.” (strongly disagree…strongly agree)

Q3: How bothered are you by the pressure to use the pill? (not at all bothered…strongly bothered)

Soft Peer Pressure

Imagine that you are a paralegal at a large law firm. As part of your job, you are required to retain large amounts of information - your ability to remember details is a key skill. You have been doing only moderately well at work, and as a result last year you received a smaller bonus than you had hoped. You read a magazine article describing a new pill that improves memory. The pill strengthens neural pathways by altering the levels of several neurotransmitter systems in the brain. The result is a substantial improvement in memory. The pill does not put knowledge into the brain, but rather makes it easier to retain information; one pill per day is enough to enhance one’s ability to remember things for the next 24 hours, and the expense of its daily use adds up to roughly the cost of your daily cup of coffee. The pill has been shown to be safe; as a result, it has been approved for use by normal, healthy adults. You subsequently learn that some of your co-workers have been using the very same memory improvement method, and as a result they exceeded their performance goals this past year, receiving a full bonus. As performance reviews are only a few months off, you consider whether to make use of this cognitive enhancement technology.
Imagine that you are a paralegal at a large law firm. As part of your job, you are required to retain large amounts of information - your ability to remember details is a key skill. You have been doing only moderately well at work, and as a result last year you received a smaller bonus than you had hoped. You read a magazine article describing a new device that improves memory. The device strengthens neural pathways by delivering a tiny electric current (about the same as a common battery) to the brain using small sticky pads that attach to the outside of the head. The result is a substantial improvement in memory. The device does not put knowledge into the brain, but rather makes it easier to retain information; a 15-minute session is enough to enhance one’s ability to remember things for the next 24 hours, and the expense of its daily use adds up to roughly the cost of your daily cup of coffee. The device has been shown to be safe and painless; as a result, it has been approved for use by normal, healthy adults. As performance reviews are only a few months off, you consider whether to make use of this cognitive enhancement technology.

Q1: Given the situation, how likely are you to use the device? (highly unlikely…highly likely)

Q2: Please indicate the extent to which you agree with the following statement: “Given the situation, I feel pressured to use the device.” (strongly disagree…strongly agree)

Q3: How bothered are you by the pressure to use the device? (not at all bothered…strongly bothered)
Imagine that you are a paralegal at a large law firm. As part of your job, you are required to retain large amounts of information - your ability to remember details is a key skill. You have been doing only moderately well at work, and as a result last year you received a smaller bonus than you had hoped. You read a magazine article describing a new software-based brain-training exercise that improves memory. The brain-training exercise strengthens neural pathways by activating them repeatedly in several different ways. The result is a substantial improvement in memory. The brain-training exercise does not put knowledge into the brain, but rather makes it easier to retain information; a 15-minute session is enough to enhance one’s ability to remember things for the next 24 hours, and the expense of its daily use adds up to roughly the cost of your daily cup of coffee. The brain-training exercise has been shown to be safe; as a result, it is being marketed for use by normal, healthy adults. As performance reviews are only a few months off, you consider whether to make use of this cognitive enhancement technology.

Q1: Given the situation, how likely are you to use the brain-training exercise? (highly unlikely…highly likely)

Q2: Please indicate the extent to which you agree with the following statement: “Given the situation, I feel pressured to use the brain-training exercise.” (strongly disagree…strongly agree)

Q3: How bothered are you by the pressure to use the brain-training exercise? (not at all bothered…strongly bothered)
Greg and John are students in their final year of university. Both are planning to apply to graduate school in journalism, and have joined an informal study group to prepare for a standardized exam that is a requirement for admissions. They both read a magazine article about a new motivation-enhancing pill that inspires enthusiasm for studying. The pill does not give students answers to tests, but rather improves test performance by making the hard work of studying feel simple and effortless; it costs $1,200 for a three-month supply. Greg, who is from a wealthy family, decides to take the pills to enhance his work in the study group and thereby improve his chances of getting a top score. John is unable to afford the pill as he is already overburdened with student loans, but he participates in the study group just as much as Greg does.

Q1: In your opinion, how fair is it that Greg is able to improve his chances of getting into graduate school by taking a pill while John cannot afford the same? (not at all fair…completely fair)
Study 3, Fairness

Earned Wealth Vignettes

Low Effort

Greg and John are students in their final year of university. Both are planning to apply to graduate school in journalism, and have joined an informal study group to prepare for a standardized exam that is a requirement for admissions. They both read a magazine article about a new motivation-enhancing pill that inspires enthusiasm for studying. The pill does not give students answers to tests, but rather improves test performance by making the hard work of studying feel simple and effortless; it costs $1,200 for a three-month supply. Greg, who saved money from his job last summer, decides to take the pills to enhance his work in the study group and thereby improve his chances of getting a top score. John is unable to afford the pill as he is already overburdened with student loans, but he participates in the study group just as much as Greg does.

High Effort

Greg and John are students in their final year of university. Both are planning to apply to graduate school in journalism, and have joined an informal study group to prepare for a standardized exam that is a requirement for admissions. They both read a magazine article about a new wakefulness-enhancing pill that minimizes the need for sleep. The pill does not give students answers to tests, but rather improves test performance only if users are diligent and use the extra waking hours to study; it costs $1,200 for a three-month supply. Greg, who saved money from his job last summer, decides to take the pills to enhance his work in the study group and thereby improve his chances of getting a top score. John is unable to afford the pill as he is already overburdened with student loans, but he participates in the study group just as much as Greg does.

Q1: In your opinion, how fair is it that Greg is able to improve his chances of getting into graduate school by taking a pill while John cannot afford the same? (not at all fair…completely fair)
Michael is a normal, healthy, 37 year-old engineer at a software company. He is aware that he is being considered for promotion, and he has just been assigned a new project. The job is quite complicated, and it is very useful for him to be able to keep lots of information in his head and work through mental fatigue. Unfortunately, he has been struggling to get the job complete in his normal 8-hour day; it seems that unless he puts in 10 hours of hard work, he cannot get everything done. Michael carpool to work, making it difficult for him to put in more than 8 hours per day.

During a lunch break he reads a magazine article about a cognitive enhancing pill. The article describes a pill that is both safe and effective, and must be used five days per week for four weeks to get the full effect. The cognitive-enhancing pill does not put information into the brain – it is not magic - but it does allow people to keep more information in their brains than they would otherwise. The pill works by changing the chemistry of the brain, and has only one modest side effect: occasionally, a few people develop mild insomnia.

<table>
<thead>
<tr>
<th>Unenhanced-Fail</th>
<th>Unenhanced-Success</th>
<th>Enhanced-Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael decides not to use the pill. After 4 weeks he is still unable to finish his work each day in 8 hours. The following month Michael receives a mediocre performance review.</td>
<td>Michael decides not to use the pill. Instead, he works extra hard each day and after 4 weeks he is able to finish his work each day in 8 hours. The following month Michael receives a glowing performance review.</td>
<td>Michael decides not to use the pill. After 4 weeks he is able to comfortably finish his work each day in 8 hours. The following month Michael receives a glowing performance review.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unenhanced-Fail</th>
<th>Unenhanced-Success</th>
<th>Enhanced-Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael decides not to use the pill. He asks around the office and finds someone who can give him a ride home later in the day, and tries to work an extra 2 hours each day. After 4 weeks he is unable to finish his work in 10 hours, as he feels more weary at the end of the day than when he previously put in 8 hours. The following month Michael receives a mediocre performance review.</td>
<td>Michael decides not to use the pill. Instead, he asks around the office and finds someone who can give him a ride home later in the day, and tries to work an extra 2 hours each day. After 4 weeks he is able to finish his work in 10 hours, even though he feels more weary at the end of the day than when he previously put in 8 hours. The following month Michael receives a glowing performance review.</td>
<td>Michael decides not to use the pill. He asks around the office and finds someone who can give him a ride home later in the day, and tries to work an extra 2 hours each day. After 4 weeks he is able to comfortably finish his work in 10 hours, as he feels no more weary at the end of the day than when he previously put in 8 hours. The following month Michael receives a glowing performance review.</td>
</tr>
</tbody>
</table>

Q1: To what degree do you think that Michael’s performance is authentic? (not at all authentic…completely authentic)

Q2: How worthy do you think Michael is of promotion? (highly unworthy…highly worthy)
The Public Appear Morally Reasonable: Irrelevant Factor Sensitivity (Gender)

Susan Enhancement

Susan, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, she has recently become interested in a newly approved pill that improves the brain’s ability to pay sustained, deep attention to tasks. Susan’s doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Steven Enhancement

Steven, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Steven tells you that although his ability to focus on a given task and resist distractions has always been above average, he has recently become interested in a newly approved pill that improves the brain’s ability to pay sustained, deep attention to tasks. Steven’s doctor has confirmed that he does not have any underlying disease or psychological disorder, and also informed him that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Susan Restoration

Susan, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Susan tells you that although her ability to focus on a given task and resist distractions has always been above average, over the past few years she has increasingly experienced difficulty in maintaining focus, and she has become interested in a newly approved pill that improves the brain’s ability to pay sustained, deep attention to tasks. Susan’s doctor has confirmed that she does not have any underlying disease or psychological disorder, and also informed her that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Steven Restoration

Steven, a close family friend of yours, is a healthy 42-year-old with a good job working as an editor at a national magazine. Steven tells you that although his ability to focus on a given task and resist distractions has always been above average, over the past few years he has increasingly experienced difficulty in maintaining focus, and he has become interested in a newly approved pill that improves the brain’s ability to pay sustained, deep attention to tasks. Steven’s doctor has confirmed that he does not have any underlying disease or psychological disorder, and also informed him that the pill has only one side effect: in a very small percentage of people it can cause occasional insomnia.

Q1: [Susan/Steven] ultimately decides that [she/he] will take the pill to improve [her/his] existing capacity to focus at work. Do you think that [her/his] choice to [enhance/restore] this ability is worth the risk [she/he] is taking on? (not at all worth the risk…entirely worth the risk)
Appendix B

1. Table S1. Demographic Information of Participants (Studies 6-8)

\[ N = 3,743 \]
Study 5 = 1720
Study 6 = 826
Study 7 = 1197
Age (years) 
    Mean = 32 (SD = 10.69)
Gender 
    Men, 2147 (0.574)
    Women, 1575 (0.421)
    I’d rather not answer, 21 (0.005)
Educational Attainment 
    Some high school, 39 (0.010)
    High school diploma, 379 (0.101)
    Some college or university, 1389 (0.371)
    College or university degree, 1438 (0.384)
    Some post-graduate, 155 (0.041)
    Post-graduate degree, 343 (0.091)
Household Income 
    <$22,500, 930 (0.248)
    $22,500-$39,999, 931 (0.249)
    $40,000-$59,999, 817 (0.218)
    $60,000-$89,999, 645 (0.172)
    $90,000 or more, 420 (0.112)
Location 
    All 50 states and Washington DC
2. Complete Text of Experimental Vignettes and Independent Variables

2a. Study 5

After providing consent, participants are randomly assigned to read one of the eight experimental vignettes below.

Michael is a pilot
Michael is a brake repair technician
Michael is a bus driver
Michael is a surgeon
Michael is a tax accountant
Michael is a restaurant server
Michael is a grocery store clerk
Michael is a garbage collector

His friend Dave tells him that he was recently diagnosed with the adult form of ADHD and has been using a pill that improves attention. Dave shows him an article that mentions that the pill can help people with or without ADHD improve attention. The article says that the pill costs about the same as a good cup of coffee, is safe if used properly, but occasionally can cause mild loss of appetite. The next day, Michael makes his annual visit to his family doctor, tells her about the article and that he would like to improve his ability to pay sustained attention to tasks. The doctor runs some tests and after examining the results, she explains to Michael that he does not fulfill the medical criteria for ADHD. Michael asks her if he can get a prescription for the medication anyway.

2b. Study 6

After providing consent, participants are randomly assigned to read one of eight experimental vignettes below.

Michael is your pilot
Michael is your brake repair technician
Michael is your bus driver
Michael is your surgeon
Michael is your tax accountant
Michael is your restaurant server
Michael is your grocery store clerk
Michael is your garbage collector

His friend Dave tells him that he was recently diagnosed with the adult form of ADHD and has been using a pill that improves attention. Dave shows him an article that mentions that the pill can help people with or without ADHD improve attention. The article says that the pill costs about the same as a good cup of coffee, is safe if used properly, but occasionally can cause mild loss of appetite. The next day, Michael makes his annual visit to his family doctor, tells her about the article and that he would like to improve his ability to pay sustained attention to tasks. The doctor runs some tests and
after examining the results, she explains to Michael that he does not fulfill the medical criteria for ADHD. Michael asks her if he can get a prescription for the medication anyway.

2c. Study 7

*After providing consent, participants are randomly assigned to read one of the twelve experimental vignettes below.*

<table>
<thead>
<tr>
<th>Michael is a pilot</th>
<th>Michael is a brake repair technician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael is a bus driver</td>
<td>Michael is a surgeon</td>
</tr>
<tr>
<td>Michael is a tax accountant</td>
<td>Michael is a restaurant server</td>
</tr>
<tr>
<td>Michael is a grocery store clerk</td>
<td>Michael is a garbage collector</td>
</tr>
<tr>
<td>Michael is a soldier</td>
<td>Michael is a stock trader</td>
</tr>
<tr>
<td>Michael is a high school teacher</td>
<td>Michael is a university student</td>
</tr>
</tbody>
</table>

He learns about a pill that improves attention. The pill is reasonably safe and effective.
3. Complete Text of Dependent Measures and Response Scales (Studies 6-8)

Below, the [gray text in brackets] labels each measure for clarity and were not shown to the participants. The bracketed [occupation] was replaced by the occupation of the worker that corresponded to the each participant’s particular experimental vignette. The response scales provide the labels that appeared as anchors of the sliding scales or choices of Likert scales.

Primary Measures

a. [Preference] Considering that Michael is a [occupation], would you prefer or not prefer that he used pills like these? Response Scale, 101-point sliding-scale, 0 = I would strongly prefer that he does not use the pill; 100 = I would strongly prefer that he uses the pill

b. [Reasons] Please tell us why you answered as you did. (free response box, 25 characters minimum, for qualitative analysis)

c. [Obligation] To what degree do you think that [occupation] have an obligation to use pills like these? (0 = no obligation; 100 = substantial obligation)

Secondary Measures

d. [Societal Benefit] Considering that Michael is a [occupation], how large of a benefit to society would there be if he used pills like these? (0 = no benefit; 100 = substantial benefit)

e. [Perceived Prevalence] How common do you think it is that [occupation] use pills like these? (0 = not at all common; 100 = very common)

f. [Performance Improvement] How do you think taking a pill like the one described above would affect the performance of [occupation] like Michael? (0 = no change; 100 = make it better)

g. [Competitive Advantage] How much of a competitive advantage do you think taking the pill offers a [occupation] like Michael? (0 = not very much; 100 = very much)

h. [Cheating] To what extent do you think that taking the pill is cheating? (0 = not at all cheating; 100 = definitely cheating)

Manipulation Check (randomized)

i. [Recall] In the previous story, Michael was a…(1 = pilot; 2 = bus driver; 3 = surgeon; 4 = brake repair technician; 5 = tax accountant; 6 = restaurant server; 7 = grocery store checkout clerk; 8 = garbage collector; 9 = soldier; 10 = stock trader; 11 = high school teacher = 12; university student)

Sociodemographics (c.f. General Social Survey)

j. [Age] What is your age (in years)? (positive integers, 0-125)

k. [Gender] What is your gender? (0 = male; 1 = female; 2 = I’d prefer not to answer)
1. [Education] What is your highest level of education attained? (0 = some high school; 1 = high school diploma; 2 = some college or university; 3 = college or university degree; 4 = some post-graduate; 5 = post-graduate degree)

m. [Income] What is your total annual household income? (0 = <$22,500; 1 = $22,500-$39,999; 2 = $40,000-$59,999; 3 = $60,000-$89,999; 4 = $90,000 or more)

After reading the debrief form and submitting the study, participants were given the code to receive payment.
4. Table S2. Coding Sheet.

Table S2. Description for each code within a given category. * depicts reasons that were raised by more than 5% participants.

<table>
<thead>
<tr>
<th>Against Use because</th>
<th>Safety Concerns*: this code captures comments about side-effects and safety concerns for the worker or in general</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Endangers Others*: this code captures comments that the worker’s use of PE will endanger other people</td>
</tr>
<tr>
<td></td>
<td>No Need*: this code captures comments that explicitly mention that there is no need for the worker to use PE, that it PE is not necessary, or that there is no reason to use PE.</td>
</tr>
<tr>
<td></td>
<td>Drugs I Bad*: this code captures general comments that drugs or the use of PE are bad, wrong, or should not be used.</td>
</tr>
<tr>
<td></td>
<td>Degrades Work Performance: this code captures comments that the worker’s use PE will degrade performance in the workplace.</td>
</tr>
<tr>
<td></td>
<td>Unfair or Cheating: this code captures comments that the worker’s use of PE is unfair or is cheating</td>
</tr>
<tr>
<td></td>
<td>Naturalness: this code captures concerns that PE is not natural or is artificial, as well as concerns about modifying human nature and species-typical functioning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prefer Use or Neutral because</th>
<th>Safe or Effective*: this code captures comments that PE is safe or effective for the worker or in general</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Benefits Others*: this code captures comments that the worker’s use of PE will benefit other people</td>
</tr>
</tbody>
</table>
**His Choice**: this code captures comments that the worker’s use of PE is his choice and similar libertarian sentiment

**Don’t Care**: this code captures comments that the participant does not care or is indifferent to the worker’s use of PE

**Improves Workplace Performance**: this code captures comments that the worker’s use of PE will improve performance in the workplace

**Common**: this code captures comments that the use of PE is common by the worker or in general

<table>
<thead>
<tr>
<th>Others</th>
</tr>
</thead>
</table>

**Familiar**: this code captures comments that the participant is familiar with PE including that they have used or know someone who has used PE.

**Coffee Analogy**: this code captures comments that compare PE to coffee

**Energy Drink Analogy**: this code captures comments that compare PE to energy drinks

**Caffeine Pill Analogy**: this code captures comments that compare PE to caffeine pills

**Rx Analogy**: this code captures comments that compare PE to prescription medicine

**Vitamin Analogy**: this code captures comments that compare PE to vitamins

**Cocaine Analogy**: this code captures comments that compare PE to cocaine
5. Supplementary Results

5a. Figure S1. Personal Framing (Study 6 vs. Study 7)

To explore the effect of personal framing (i.e., ‘a’ pilot vs. ‘your’ pilot), we included the data from Study 5 (n<sub>both</sub> = 2,545) in two-way ANOVAs (occupational responsibility x personal framing). For participants’ preference to use PE, there were no main effects for HR occupations (F<sub>1,2541</sub> = 2.29; p = 0.13) or personal framing (F<sub>1,2541</sub> = 2.54; p = 0.11), but there was an interaction (F<sub>1,2541</sub> = 4.19; p < 0.05) as noted above: in study 6, preferences for use of PE were higher for LR workers than for HR workers (Fig. S1, AB). For judgments about an obligation to use PE, the two-way ANOVA yielded a main effect of HR occupations (F<sub>1,2541</sub> = 31.51; p < 0.001) and no main effect of personal framing (F<sub>1,2541</sub> = 3.57; p = 0.059) with no interaction (p = .27). Bonferroni-adjusted post-hoc tests reveal that for surgeons (M<sub>diff</sub> = 6.53, p < 0.05, d = .26) and restaurant servers (M<sub>diff</sub> = 6.79, p < 0.05, d = .31), participants who read the personal frame (e.g., “your surgeon” or “your restaurant server”) judged the worker as more obligated to use PE than participants who read the impersonal frame (e.g., “a surgeon” or “a restaurant server”) (Fig. S1, CD).

Fig S1. Preference and Obligation Judgments for Use of PE by Occupation (Studies 6 and 7, n=2546). Panels A (individual occupations) and B (HR vs LR occupations) depict mean preference judgments about worker’s use of PE (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panels C and D depict
mean obligation judgments about the use of PE (0 = no obligation; 100 = substantial obligation). Error bars represent 95% confidence intervals; * \( p < 0.05 \).

5b. Figure S2. Preference & Obligation (Studies 6 & 7 vs. Study 7)

We observed that across all occupations, participants that read the simplified vignette in Study 7 preferred that workers enhance significantly more than participants that read the vignettes with physician oversight in Studies 1 and 2 (\( M_{\text{studies 6 & 7}} = 36.82, M_{\text{study 7}} = 53.52, M_{\text{diff}} = 16.7; t_{2515} = 11.95, p < 0.001, d = 0.51 \)) (Fig S2, AB). Similarly, across all occupations, participants in Study 7 viewed workers as more obligated to enhance than participants in studies 1 and 2 (\( M_{\text{study 3}} = 15.79, Mean = 12.2, M_{\text{diff}} = 3.54, t_{2515} = 3.60, p < 0.001, d = 0.15 \)) (Fig S2, CD). Thus, the simplified vignette that did not include information about asking the physician for the pill raised overall ratings, but did not change the basic finding that people do not prefer that workers in certain occupations use a pill to enhance attention.

Fig S2. Preference and Obligation Judgments for Use of PE by Occupation (Studies 1-3, n=3743). Panels A (individual occupations) and B (HR vs LR occupations) depict mean preference judgments about worker’s use of PE (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panels C and D depict mean obligation judgments about the use of PE (0 = no obligation; 100 = substantial obligation). Error bars represent 95% confidence intervals; * \( p < 0.05 \), ** \( p < 0.01 \), *** \( p < 0.001 \).

5c. Figures S3-S5. Preference & Obligation Mediation (Studies 1 and 2)
We report the mediation results for Study 7 in the main text. Below, we report the mediation analysis for studies 6 and 7.

**Study 5, Preference**

In study 5, there was no direct effect of HR occupation on preference to enhance. For societal benefit and perceived prevalence as mediators, the Hayes SPSS Process Macro \{Hayes:2013ta\} with 50,000 bootstrap replications yielded an overall indirect effect of 7.33, 95% CI = 5.09, 9.59) (Fig. S3). The 95% confidence interval of the indirect effect did not include zero for societal benefit (b = 6.78, 95% CI = 4.62, 8.95) or for perceived prevalence (b = 0.55, 95% CI = 0.22, 1.03). Thus, if one controls for the increased perceived benefit to society and increased prevalence in the use of PE in HR occupations, people prefer that LR workers use a pill to improve attention more than they prefer that HR workers do so (Fig. S3). These results replicate those found in study 7.

**Fig. S3. Indirect effects of HR occupation on preference for worker to use PE through societal benefit and perceived prevalence (Study 5, n=1720).** Notes: b represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013). The range in brackets represents the 95% confidence interval of the indirect effect. *** p < 0.001.

**Study 5, Obligation**

Participants judged workers in HR occupations as more obligated to use a pill to improve attention than workers in LR occupations. The Hayes SPSS Process Macro \{Hayes:2013ta\} with 50,000 bootstrap replications yielded an overall indirect effect of b = 3.42, 95% CI = 2.42, 4.52 (Fig. S4). The 95% confidence interval of the indirect effect did not include zero for societal benefit (b = 2.53, 95% CI = 1.70, 3.49) or for perceived prevalence (b = 0.88, 95% CI = 0.52,
suggesting that HR occupation persuaded participants to be more supportive of an obligation to use PE by increasing perceptions that the use of PE would benefit society and that it is more common. These results replicate those found in studies 2 and 3.

Study 6, Preference

In study 6, there was a small effect of HR occupation on preference to enhance such that participants who read about HR workers displayed lower preferences for PE than participants who read about LR workers ($\beta = -0.75$, $p = 0.30$). And while entering societal benefit and perceived prevalence as mediators reveals a larger effect of HR occupation ($b = -7.25$) than the effect of HR occupation without those mediators ($b = -4.92$), the Hayes Macro with 50,000 replications reveals that the confidence intervals for both mediators do include zero ($b_{society} = 2.06$, 95% CI = -0.92, 5.09; $b_{prevalence} = 0.27$, 95% CI = -0.27, 1.00) Thus, in study 6, we find that people prefer that LR workers use a pill to improve attention more than they prefer that HR do so, and that societal benefit and perceived prevalence increases this effect but do not officially mediate it. The only difference between studies 1 and 2 was framing – study 6 used personal framing (e.g., “your surgeon”) while study 5 used general framing (e.g., “a surgeon”), see figure S1. Given this, it appears that framing does the work – people prefer LR workers to HR workers in study 6 -- so that societal benefit and perceived prevalence are less influential than in studies 1 and 3.

Study 6, Obligation

Fig. S4. Indirect effects of HR occupation on obligation for worker to use PE through societal benefit and perceived prevalence (Study 5, n=1720). Notes: $b$ represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013). The range in brackets represents the 95% confidence interval of the indirect effect. * $p < 0.05$, *** $p < 0.001$. 

<table>
<thead>
<tr>
<th>Societal Benefit</th>
<th>Obligation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b = 9.17^{***}$</td>
<td>$b = 0.28^{***}$</td>
</tr>
<tr>
<td>$b = 5.93^{**<em>}$ ($b = 2.52^</em>$)</td>
<td>$b = 0.12^{***}$</td>
</tr>
</tbody>
</table>

Indirect Effect = 2.53 [1.70, 3.49]

Indirect Effect = 0.88 [0.52, 1.36]
Participants judged workers in HR occupations as more obligated to use a pill to improve attention than workers in LR occupations. The 95% confidence interval of the indirect effect did not include zero for perceived prevalence (b = 2.53, 95% CI = 1.38, 3.99), suggesting that HR occupation persuaded participants to be more supportive of an obligation to use PE by increasing perceptions that the use of PE is more common in HR occupations.

![Diagram](image)

**Fig. S5. Indirect effects of HR occupation on obligation for worker to use PE through societal benefit and perceived prevalence (Study 6, n=826).** Notes: b represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013). The range in brackets represents the 95% confidence interval of the indirect effect. * p < 0.05, *** p < 0.001.

**5d. Figures S6-S8. Gender Differences (Studies 1-3)**

In the main text, we report the gender differences from studies 1-3. Below, we provide the figures for the gender differences for studies 1-3.

![Fig S6. Preference and Obligation Judgments by Gender and Occupation (Study 5, n=1720).](image)

Panel A depicts mean preference judgments that a worker use PE as a function of occupational responsibility and gender (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panel B depicts mean obligation judgments that a worker use PE as a function of occupational responsibility and gender (0 = no obligation; 100 = substantial obligation). Error bars represent 95% confidence intervals; * p < 0.05, *** p < 0.001.
Fig S7. Preference and Obligation Judgments by Gender and Occupation (Study 6, n=826). Panel A depicts mean preference judgments that a worker use PE as a function of occupational responsibility and gender (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panel B depicts mean obligation judgments that a worker use PE as a function of occupational responsibility and gender (0 = no obligation; 100 = substantial obligation). Error bars represent 95% confidence intervals; * p < 0.05, *** p < 0.001.

Fig S8. Preference and Obligation Judgments by Gender and Occupation (Study 7, n=1197). Panel A depicts mean preference judgments that a worker use PE as a function of occupational responsibility and gender (0 = strongly prefer that he not use the pill; 100 = strongly prefer that he use the pill). Panel B depicts mean obligation judgments that a worker use PE as a function of occupational responsibility and gender (0 = no obligation; 100 = substantial obligation). Error bars represent 95% confidence intervals; * p < 0.05, *** p < 0.001.

5e. Figures S9 and S10. Gender Mediation (Studies 1 and 2)

In the main text, we report the mediation analyses from study 7. Below, we report the results of mediation analyses from studies 1 and 2. In study 5, female participants expressed a significantly lower preference for workers to use PE than male participants (Fig S6). For societal benefit, performance improvement, and cheating as mediators, the Hayes SPSS Process Macro (Hayes,
2013) with 50,000 bootstrap replications yielded an overall indirect effect of $b = -6.98$, 95% CI = -9.27, -4.65. The 95% confidence interval of the indirect effect did not include zero for societal benefit ($b = -3.54$, 95% CI = -5.22, -1.93), for performance improvement ($b = -1.30$, 95% CI = -2.08, -0.66), or for cheating ($b = -2.14$, 95% CI = -2.94, -1.46), suggesting that female participants preferred PE use less than male participants due to less optimistic perceptions of societal benefit and performance improvement as well as harsher cheating attributions (Fig. S9).

Fig S9. Indirect effects of gender on preference for worker to use PE through societal benefit, performance improvement, and cheating (Study 5, n=1720). Notes: $b$ represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013). The range in brackets represents the 95% confidence interval of the indirect effect. * $p < 0.05$, *** $p < 0.001$.

In study 6, female participants expressed a significantly lower preference for workers to use PE than male participants (Fig S7). For societal benefit, performance improvement, and cheating as mediators, the Hayes SPSS Process Macro {Hayes:2013ta} with 50,000 bootstrap replications yielded an overall indirect effect of $b = -8.80$, 95% CI = -12.06, -5.53. The 95% confidence interval of the indirect effect did not include zero for societal benefit ($b = -5.50$, 95% CI = -8.03, -3.25), for performance improvement ($b = -1.11$, 95% CI = -2.24, -0.31), or for cheating ($b = -2.19$, 95% CI = -3.52, -1.08), suggesting that female participants preferred PE use less than male participants due to less optimistic perceptions of societal benefit and performance improvement as well as harsher cheating attributions (Fig. S10).
Fig S10. Indirect effects of gender on preference for worker to use PE through societal benefit, performance improvement, and cheating (Study 6, n=826). Notes: $b$ represents unstandardized regression coefficients obtained through bootstrapping using 50,000 resamples (Hayes, 2013). The range in brackets represents the 95% confidence interval of the indirect effect. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

5f. Figures S11-S13. Cheating (Studies 1-3)

In the main text, we included cheating judgments as a mediator for gender differences (see Figs 9, S9, and S10) but we did not present the primary results. Below, we report the cheating results by occupation condition and HR/LR condition for studies 1-3.

**Cheating, Study 5**

The one-way ANOVA between all 8 occupations revealed an effect for cheating judgments ($F_{7,1712} = 2.45$, $p < 0.05$), and Bonferroni-adjusted post-hoc tests revealed that surgeons’ use of a PE was judged as cheating significantly more than brake repair technicians’ use ($M_{\text{diff}} = 10.39$, $p < 0.05$, $d = .32$) and garbage collectors’ use ($M_{\text{diff}} = 10.39$, $p < 0.05$, $d = .35$) (Fig S11A). However, there was not a significant difference between cheating judgments of HR and LR workers as groups ($p = 0.21$) (Fig S13B).
**Fig S11. Cheating Judgments for Use of PE by Various Occupations (Study 5, n=1720).** Panels A (individual occupations) and B (HR vs LR occupations) depict mean cheating judgments about worker’s use of PE (0 = not at all cheating; 100 = definitely cheating). Error bars represent 95% confidence intervals.

*Cheating, Study 6*

The one-way ANOVA between all 8 occupations revealed no effect for cheating judgments ($F_{7,817} = 1.77, p = 0.90$); accordingly, there was not a significant difference between cheating judgments of HR and LR workers as groups ($p = 0.19$) (Fig S12).

**Fig S12. Cheating Judgments for Use of PE by Various Occupations (Study 6, n=826).** Panels A (individual occupations) and B (HR vs LR occupations) depict mean cheating judgments about worker’s use of PE (0 = not at all cheating; 100 = definitely cheating). Error bars represent 95% confidence intervals.

*Cheating, Study 7*

The one-way ANOVA between all 12 occupations yielded an effect for cheating judgments ($F_{11,1185} = 5.62, p < 0.001$), and Bonferroni-adjusted post-hoc tests revealed that certain occupations, such as university students and pilots, are judged as cheating significantly more...
than others, such as garbage collectors, grocery store checkout clerks, and brake repair technicians (Fig S13A). However, there was not a significant difference between cheating judgments of HR and LR workers as groups (p = 0.21) (Fig S13B).

**Fig S13. Cheating Judgments for Use of PE by Various Occupations (Study 7, n=1197).** Panels A (individual occupations) and B (HR vs LR occupations) depict mean cheating judgments about worker’s use of PE (0 = not at all cheating; 100 = definitely cheating). Error bars represent 95% confidence intervals.

5g. **Figures S14-S16. Competitive Advantage (Studies 1-3)**

In the main text, we did not present the results from competitive advantage. Below, we report the competitive advantage results by occupation condition and HR/LR condition for studies 1-3.

**Competitive Advantage, Study 5**

The one-way ANOVA between all 8 occupations revealed an effect for competitive advantage judgments ($F_{7,1712} = 15.96, p < 0.001$), and Bonferroni-adjusted post-hoc tests revealed that certain occupations, such as garbage collectors, grocery store checkout clerks, and bus drivers are thought to receive much less of competitive advantage from the use of PE than others, such as tax accountants and surgeons (Fig S14A). Participants rated workers in HR occupations as gaining slightly more of a competitive advantage from PE than participants who evaluated LR workers ($M_{diff} = 3.15, p < 0.05, d = 0.10$) (Fig S14B).
Competitive Advantage, Study 6

The one-way ANOVA between all 8 occupations revealed an effect for competitive advantage judgments ($F_{7,817} = 5.82, p < 0.001$), and Bonferroni-adjusted post-hoc tests revealed that certain occupations, such as garbage collectors, brake repair technicians, and grocery store checkout clerks are thought to receive much less of competitive advantage from the use of PE than others, such as tax accountants and surgeons (Fig S15A). However, there was not a significant difference between competitive advantage from PE for HR and LR workers as groups ($p = 0.28$) (Fig S15B).
Competitive Advantage, Study 7

The one-way ANOVA between all 12 occupations revealed an effect for judgments of performance improvement ($F_{11,1185} = 8.39$, $p < 0.001$), and Bonferroni-adjusted post-hoc tests revealed that certain occupations, such as garbage collectors, grocery store checkout clerks, bus drivers, and restaurant servers are thought to receive much less of competitive advantage from the use of PE than others, such as soldiers and stock traders (Fig S16A). Indeed, participants attribute a greater competitive advantage from PE for HR workers than for LR workers ($M_{diff} = 4.56$, $p < 0.01$, $d = .16$) (Fig S16B).

Fig S16. Competitive Advantage Judgments for Use of PE by Various Occupations (Study 7, n=1197). Panels A (individual occupations) and B (HR vs LR occupations) depict mean competitive advantage judgments about worker’s use of PE (0 = not very much; 100 = very much). Error bars represent 95% confidence intervals. ** $p < 0.01$

5h. Figures S17-S19. Performance Improvement (Studies 1-3)

In the main text, we did not present the results from performance improvement. Below, we report the performance improvement results by occupation condition and HR/LR condition for studies 1-3.

Performance Improvement, Study 5

The one-way ANOVA between all 8 occupations revealed an effect for judgments about performance improvement ($F_{7,1712} = 6.20$, $p < 0.001$), and Bonferroni-adjusted post-hoc tests revealed that participants perceive that PE improves performance significantly less for certain occupations, such as garbage collectors and grocery store checkout clerks, than others, such as
tax accountants and surgeons (Fig S17A). However, there were no differences in judgments of performance improvement between HR and LR conditions overall (p = .23) (Fig S17B).

**Fig S17. Performance Improvement Judgments for Use of PE by Various Occupations (Study 5, n=1720).** Panels A (individual occupations) and B (HR vs LR occupations) depict mean performance improvement judgments about worker’s use of PE (0 = no change; 100 = make it better). Error bars represent 95% confidence intervals.

**Performance Improvement, Study 6**

The one-way ANOVA between all 8 occupations revealed a small effect for judgments about performance improvement ($F_{7,817} = 2.42, p < 0.05$), and Bonferroni-adjusted post-hoc tests revealed one difference: participants perceive that PE improves performance substantially more for restaurant servers than for garbage collectors ($M_{diff} = 14.65, p < 0.01, d = .50$) (Fig S18A). There were no differences in judgments of performance improvement between HR and LR conditions overall (p = .66) (Fig S18B).
Fig S18. Performance Improvement Judgments for Use of PE by Various Occupations (Study 6, n=826). Panels A (individual occupations) and B (HR vs LR occupations) depict mean performance improvement judgments about worker’s use of PE (0 = no change; 100 = make it better). Error bars represent 95% confidence intervals.

Performance Improvement, Study 7

The one-way ANOVA between all 12 occupations revealed an effect for judgments of performance improvement ($F_{11,1185} = 5.75, p < 0.001$), and Bonferroni-adjusted post-hoc tests revealed that participants perceive that PE improves performance significantly less for certain occupations, such as surgeons and garbage collectors, than others, such as stock traders, university students, and soldiers (Fig S19A). However, there were no differences in judgments of performance improvement between HR and LR conditions overall ($p = .24$) (Fig S19B).

Fig S19. Performance Improvement Judgments for Use of PE by Various Occupations (Study 7, n=1197). Panels A (individual occupations) and B (HR vs LR occupations) depict mean performance improvement judgments about worker’s use of PE (0 = no change; 100 = make it better). Error bars represent 95% confidence intervals.