

# Empirical Support for the Moral Salience of the Therapy-Enhancement Distinction in the Debate Over Cognitive, Affective and Social Enhancement

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**Abstract** The ambiguity regarding whether a given intervention is perceived as enhancement or as therapy might contribute to the angst that the public expresses with respect to endorsement of enhancement. We set out to develop empirical data that explored this. We used Amazon Mechanical Turk to recruit participants ( $N=2776$ ) from Canada and the United States. Each individual was randomly assigned to read one (and only one) vignette describing the use of a pill to enhance one of 12 cognitive, affective or social (CAS) domains. The vignettes described a situation in which an individual was using a pill to enhance the relevant domain under one of two possible enhancement conditions, one perceived as enhancing above the norm (EAN), what most people recognize as a clear case of enhancement, whereas the other perceived as enhancing towards the norm (ETN), with the individual using the enhancement having a modest, but subclinical deficit. Participants were asked how comfortable they were with the individual using the enhancement and about the impact the enhancement might have had in the individuals' success in life. We found that irrespective of the domain to be enhanced, participants felt significantly more comfortable with ETN than with EAN, and they regarded the enhancement intervention as contributing to greater success in

life with ETN rather than EAN. These data demonstrate that the therapy enhancement distinction is morally salient to the public, and that this distinction contributes to the angst that people feel when considering the propriety of CAS enhancement.

**Keywords** Enhancement to the norm · Enhancement above the norm · Experimental neuroethics · Public attitudes · Cognitive · Social · Affective

## Introduction

The distinction between 'therapy' and 'enhancement' is a common theme in discussions about the propriety of enhancement. A number of scholars have attempted to define the distinction with varying degrees of success. Perhaps the most enduring definition is based on Daniels' quasi-statistical concept of normality [1, 2], which proposes that "any intervention designed to restore or preserve a species-typical level of functioning for an individual should count as treatment, leaving only those that would give individuals capabilities beyond the range of normal human variation to fall outside the pale as enhancement" [3]. The Bush-era President's Council on Bioethics offered a strictly health-based definition, defining therapy as an intervention designed "to treat individuals with known diseases, disabilities, or impairments, in an attempt to restore them to a normal state of health and fitness" [4] and enhancement as any intervention designed to go beyond this. Both the normality and health-based definitions endure: the recent

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President's Commission report defines enhancement as "pharmacological and technological interventions meant to improve mental and physical capacities beyond normal functioning" or when used for a "non-disease capacity" [5]. Supporters of enhancement argue that it is not possible to draw a bright line between therapy and enhancement [6, 7], a conclusion that seems justified by the observation that there are fuzzy borders delineating both of these concepts [8–10]. The debate is regularly couched in moral terms, with those leaning towards a more bioconservative worldview casting therapy as morally appropriate and enhancement as morally problematic [2, 5, 11], while more liberal commentators suggest that even if one could distinguish between therapy and enhancement, there is no moral difference between the two [6, 7, 12]. As we can see, these positions depend to some degree on one's biopolitical worldview [13].

Consensus about the propriety of brain enhancement is elusive [4, 8–10, 14–20]. One way of approaching the issue is to query the public about their enthusiasms and concerns with regard to enhancement of human brains [21–23]. This is not merely a matter of philosophical and bioethical concern, but also one with substantive policy implications [24, 25] for the closer we align policy with public norms, the less likely we are to encounter transgressions such as diversion of prescription pharmaceuticals [26].

To explore these issues directly, the present study interrogated members of the general public to discern their attitudes towards the use of pharmacological enhancements along the continuum from improving a subclinical deficit to outright enhancement. We crafted vignettes that described an individual using a pill either to *enhance above the norm* (EAN) – essentially, what is commonly thought of as enhancement – or to *enhance to the norm* (ETN) – the poorly-defined borderline situation between therapy and enhancement.<sup>1</sup> The experiment explored whether people were more comfortable with pharmacological enhancements that improved abilities up to the norm than with those that enhanced

beyond the norm across 12 different cognitive, affective, and social (CAS) domains.<sup>2</sup> Thus, our primary hypothesis was:

H1: People feel more comfortable using the same pharmacological interventions to enhance towards the norm than when enhancing above the norm, irrespective of the cognitive, social or affective domain being enhanced.

A secondary hypothesis investigated whether ETN or EAN interventions differentially affected peoples' perceptions of the degree to which improving a given domain has upon success in life, a consequentialist consideration.

H2: Peoples' perceptions regarding the impact of pharmacological enhancement upon success in life are modulated to a different degree by whether one enhances to the norm or enhances above the norm, irrespective of the cognitive, social or affective domain being enhanced.

We discuss our findings within the framework of the therapy-enhancement distinction with an eye towards their implications in the policy debate regarding the propriety of cognitive, affective and social enhancement.

## Experimental Methods

Building on the emerging experimental neuroethics endeavor [22], we used the contrastive vignette technique [27] to explore public attitudes towards pharmacological CAS enhancement. By enabling the experimenter to systematically manipulate key variables in the vignettes, this methodology has the advantage of bringing quantitative rigor to issues of neuroethical salience. The key outcome measure is always the difference in group means between contrastive conditions, rather than

<sup>1</sup> Here it is important to emphasise that we are fully aware that what is regarded as normal is ambiguous as it can refer to what is normal for the individual or for the species, or normal for a specific developmental stage but no other, as well as being easily affected by changing social values.

<sup>2</sup> Our working characterization of the 12 domains that were tested in this experiment are as follows (some domains overlap two categories): Cognitive: Attention, working memory, narrative memory and alertness; Affective: mood and open to experience; Social: sociability and cooperation; Cognitive and affective: Self control, perseverance and creativity; Social and Affective: empathy.

individual stated preferences, as participants are blind to the existence of contrastive conditions. In the present experiment, we have expanded our use of contrastive vignettes to develop a novel mixed-method analysis that utilizes not only standard quantitative measures but also content analysis of free-responses which were subjected to quantization and assessed in a contrastive fashion [28].

The vignettes explored attitudes towards pharmacological enhancement of CAS domains. Following acknowledgement of informed consent and completion of demographic questions regarding age and biological sex, participants were randomly assigned to read one (and only one) of 24 vignettes composed of orthogonally rotated primary [*enhancement condition*: ETN or EAN] and secondary [*CAS domain*: ALERTNESS, ATTENTION, COOPERATION, CREATIVITY, EMPATHY, MOOD, NARRATIVE MEMORY, OPENNESS TO EXPERIENCE, PERSEVERANCE, SELF-CONTROL, SOCIABILITY OR WORKING MEMORY] independent variables, resulting in a  $2 \times 12$  between-subjects design. The selection of the different domains was inspired by the self-identity and personality literature, as well as bioethical literature in general [29]. To increase the likelihood that all participants interpreted the CAS domain described in the vignette in a similar way, we provided both a word descriptor (e.g. “sociable”) and a specific domain definition (“e.g. outgoing in social situations”).

The intent was to compare attitudes towards the use of pharmacological CAS enhancement in the ill defined borderline situation between therapy and enhancement, using the distinction between ETN and EAN. For example, in the MOOD scenario, participants in the ETN group read that “John is a healthy 35-year-old man who has had modest challenges being cheerful ever since he was a young boy”, while participants in the EAN group read that “John is a healthy 35-year-old man who has been moderately cheerful ever since he was a young boy”. The Master vignette can be found in the [Supplementary Information](#).

The vignettes were crafted to ensure that they were plausible, minimally contrastive, and that the results would be responsive to the hypothesis under consideration. We used second-person vignettes in order to reduce actor–observer asymmetries that can bias respondents [30]. 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 comprehensible by 15 to 21 year-olds. Vignettes were subject to cognitive pre-testing to insure that participants understood the thrust of the narrative [31]. Participants from Canada and the United States were recruited via Amazon’s Mechanical Turk [32–37] and were compensated \$0.25 for completion of the survey. Once they accepted the assignment, they were directed to an external website (FluidSurveys.com) which hosted the survey.

Participants were randomly assigned to read one contrastive vignette and then were asked three questions, with answers provided on a 101-point slider that ranged from  $-50$  to  $+50$ ; the first question was followed by a free-response question. Participants were first asked to rate how comfortable they felt with John having taken the pill, with anchors at *not at all comfortable* and *completely comfortable*. The free-response box that followed asked participants to provide, in their own words, their reasons for answering as they did. The two follow-up questions were presented on successive pages together with the vignette, which was included for reference purposes only. Question 2 asked participants to imagine that they were a close friend of John’s, and to rate the degree to which they considered John to be a different person after having used the pill, with anchors at *the same person* and *a changed person*. This question acted as a control to provide confidence that the magnitude of perceived change induced by the pill was similar in the ETN and EAN conditions. Question 3 asked participants to rate how large of a change enhancement with the pill might have played in John’s success in life, with anchors at *a very small change* and *a very large change*. A comprehension question at the end insured that participants had read the vignette carefully by asking them to choose which of four possible cognitive, affective and social domains the individual in the vignette had been trying to improve. The available options included the domain in question and three random domains from the list of 12 domains that were part of the experiment. The experimental design was approved by the University of British Columbia’s Behavioural Research Ethics Board.

#### Quantitative and Qualitative Analysis

Statistical analysis: Data were analyzed using SPSS. Responses to slider questions were adjusted by adding 50 points to each data point to provide results ranging from 0 to 100.

To insure that samples were sufficiently powered, we used an online power calculator to determine the minimum number of responses required (<http://www.stat.ubc.ca/~rollin/stats/ssize/n2.html>); power was set to 80% and designed to be sensitive to Cohen's  $d=0.5$  (medium effect). In accord with evolving statistical standards [38], we emphasize effect size (ES) and confidence intervals (CI) [39], while also reporting  $p$  values.

**Contrastive Quantized Content Analysis:** In order to obtain a richer account of public attitudes towards CAS enhancement, we developed a novel mix-methods strategy to quantify what is essentially qualitative data. With the aim of mitigating experimenter bias, we randomized all comments and blinded the coders as to the contrastive vignette read by the individual who contributed the comment. We then carried out traditional content analysis of the comments to explore salient aspects of content, with themes being developed as the coding process progressed [40, 41]. Each theme was assigned a unique numeric code (quantization [42–44]), and then, depending upon its content, each comment was assigned one or more of these numeric codes. Once all comments were coded, inter-rater reliability was measured and the data were unblinded allowing us to compare the frequency of themes in comments across contrastive conditions. Descriptive statistics were used to characterize the composition and properties of the sample, and inferential statistics used to test if any observed differences between contrastive conditions were meaningful. The result is a new technique that we call CONTRASTIVE QUANTIZED CONTENT ANALYSIS (CQCA) [28]. This new form of analysis capitalizes upon the philosophically thick features of qualitative research while maintaining the generalizability and reproducibility of quantitative analysis and is part of an exploratory undertaking aimed at informing future experiments in this area.

## Results

The data are based upon results collected from 2,891 participants who took the survey. From this, 50 respondents were eliminated from analysis because they were not located in the US or Canada (as determined by examining IP addresses), 55 respondents were excluded because they either did not answer the comprehension check or did not complete all parts of the survey ( $n=47$ ), and 10 respondents were excluded because they failed

the comprehension check. This left us with 2,776 unique participants residing in Canada and the United States. Mean age of participants was 30.0; 57.4% of the participants were male (17 individuals did not specify their biological sex). With respect to the primary independent variable of enhancement condition, 1,368 participants read vignettes in which the pharmacological CAS enhancement described ETN, while 1,408 participants read vignettes in which the pharmacological CAS enhancement described EAN. The effects of domain upon attitudes towards EAN alone are described in a separate manuscript [29]. In the present study, we focus upon the difference in attitudes towards the use of ETN versus EAN.

### Participants' Comfort With Enhancement is Modulated by Enhancement Condition

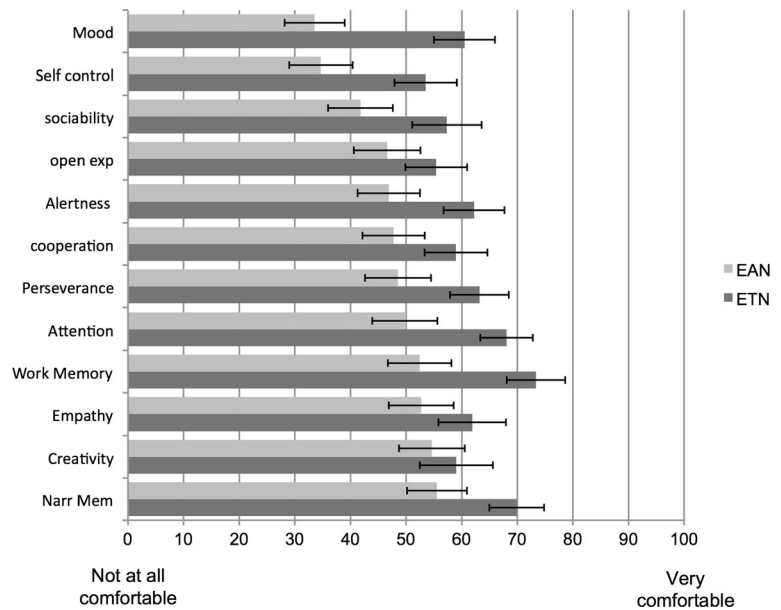
The first question presented to participants probed how comfortable they were with the individual in the vignette using a pharmacological enhancement to improve a particular CAS domain (Fig. 1). A two-way, between subjects ANOVA revealed a statistically significant main effect of domain ( $F(11, 2752)=8.38, p<.001, \eta_p^2=.032$ ), as well as of enhancement condition ( $F(1, 2752)=162.42, p<.001, \eta_p^2=.056$ ). Similarly, there was a statistically significant interaction between the effects of domain and enhancement condition on comfort level of participants ( $F(11,2752)=2.25, p=0.01, \eta_p^2=.009$ ).

Post-hoc tests revealed statistically significant differences between ETN and EAN for COOPERATION ( $M_{diff}=11.234, 95\%CI [3.334, 19.135], p=0.007, d=0.38$ ) and that pattern repeated for all other domains ( $M_{diff}>14, p<0.001, d>0.45$ ), except for CREATIVITY ( $M_{diff}=4.407, 95\%CI [-4.341, 13.156], p=0.304, d=0.13$ ), EMPATHY ( $M_{diff}=9.156, 95\%CI [.783, 17.528], p=0.029, d=0.29$ ) and OPEN TO EXPERIENCE ( $M_{diff}=8.837, 95\%CI [.725, 16.949], p=0.027, d=0.28$ ).

### Participants' Perceptions About Changes to the Person are not Modulated by Enhancement Condition

Participants might have been more comfortable with ETN than EAN because they viewed CAS enhancement under the EAN condition as producing an individual with superhuman capabilities. We constructed vignettes in which the magnitude of the change wrought by the pharmacological enhancement was held constant, but

**Fig. 1** Effect of enhancement condition upon comfort level. Error bars represent (95%) Confidence Intervals. *ETN* enhancement towards the norm; *EAN* enhancement above the norm

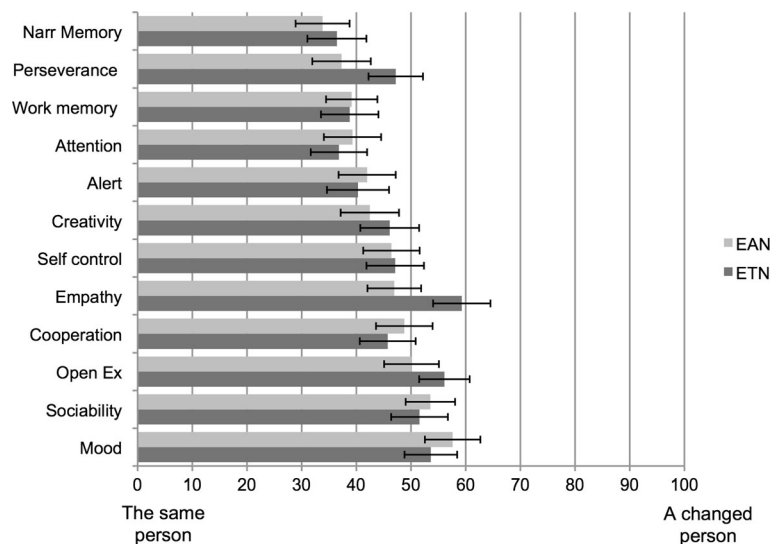


despite the experimenters' intent, participants might have viewed one or the other manipulation as producing a particularly large change in the person. To control for such confounds, question 2 asked participants to rate the magnitude of the change to the person as a whole brought about by enhancement of the 12 CAS domains in each of the two enhancement conditions (Fig. 2). A two-way between subjects ANOVA revealed that there was no difference in the magnitude of perceived change to the person based upon enhancement condition ( $F(1,2752)=2.93, p=.087, \eta_p^2=.001$ ), but there was a

statistically significant interaction between the effect of domain and enhancement condition ( $F(11,2752)=2.078, p=0.019, \eta_p^2=.008$ ). Thus, the observation that participants were more comfortable with ETN than EAN cannot be accounted for by the magnitude of the change induced by the pharmacological enhancement.

In order to further validate that the difference between ETN and EAN was similar across domains we carried out a simple effect analysis. The difference between ETN and EAN for each domain was found to be indistinguishable from that seen for the overall group

**Fig. 2** Effect of enhancement condition upon perceived change to the person. Error bars represent (95%) Confidence Intervals. *ETN* enhancement towards the norm; *EAN* enhancement above the norm



difference between ETN and EAN, except for EMPATHY ( $M_{\text{diff}}=12.35$ , 95%CI [5.20, 19.5],  $p=0.001$ ,  $d=0.45$ ) and PERSEVERANCE ( $M_{\text{diff}}=9.922$ , 95%CI [2.66, 17.18],  $p=0.009$ ,  $d=0.34$ ). These results gave us confidence that our descriptions for the two different enhancement conditions across domains were balanced except for empathy and perseverance.

As another measure of whether participants view ETN and EAN differently, we correlated participants' ratings of their comfort with their perceptions of the degree to which John was a changed person after taking the pill. There was a moderate negative correlation between the amount of reported comfort and the perceived magnitude of the change to the person (overall  $r=-.233$ ; ETN  $r=-.198$ ; EAN  $r=-.291$ ). We did not find any statistically significant difference between correlation for ETN and EAN (Table 3S).

#### Participants' Perceived Impact of Enhancement in Success in Life is Modulated by Enhancement Condition

Participants' comfort with enhancement might be driven by an assessment of the consequences of using the pharmacological enhancement. Question 3 explored one aspect of this issue, asking participants how large of a role taking the pill might have in John's success in life. A two-way between subjects ANOVA revealed a significant main effect of domain ( $F(11,2752)=3.77$ ,  $p<.001$ ,  $\eta_p^2=.015$ ) and of enhancement condition ( $F(1,2752)=199.49$ ,  $p<.001$ ,  $\eta_p^2=.068$ ) on the impact to success in life reported by participants (Fig. 3). We also found a significant interaction between the effects of domain and enhancement condition ( $F(11,2752)=3.15$ ,  $p<.001$ ).

We correlated participants' perceived changes to success in life ratings with their ratings of comfort towards pharmacological enhancement use. We found a statistically significant ( $p<0.01$ , two-tailed) positive correlation between these variables (overall  $r=.30$ ; ETN  $r=.28$ ; EAN  $r=.25$ ). MOOD, ALERTNESS and ATTENTION were domains in which the relationship was stronger for both enhancement groups (Table 3S).

In order to test our secondary hypothesis – whether participants' perceptions of the impact that enhancing a given domain has upon success in life might depend upon enhancement condition, we carried out a simple effect analysis. For all domains except for NARRATIVE

MEMORY ( $M_{\text{diff}}=4.748$ , 95%CI [-1.70, 11.2],  $p=0.098$ ,  $d=0.18$ ) and CREATIVITY ( $M_{\text{diff}}=0.698$ , 95%CI [-5.95, 7.35],  $p=0.862$ ,  $d=0.02$ ), ETN produced a significantly greater effect upon success in life than EAN ( $p<0.001$  and  $d>0.45$ ).

Overall, the data suggest that while success in life may contribute to the acceptability of enhancement, this effect is stronger when the enhancement normalizes (ETN) rather than when it improves CAS domains beyond what is understood as the social norm (EAN) (Fig. 4). We discuss possible interpretations of these results in the “Discussion” section.

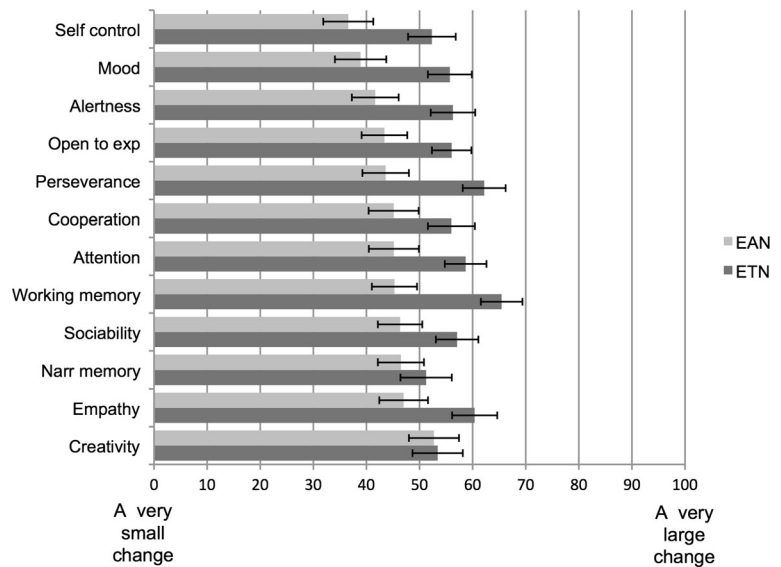
#### Contrastive Quantitized Content Analysis

Immediately after asking participants to rate how comfortable they were with the individual in the vignette using the domain-specific pharmacological enhancement, they were asked to tell us why they answered as they did, providing them with a free-response box to address this question. Responses were analysed using content analysis (see methods), with inter-rater reliability confirmed ( $\kappa=0.79$ ). The themes that emerged represented REASONS that fell into four main categories: *Not Comfortable*, *Comfortable*, *Ambivalent* and *Others*.

In the *Not Comfortable* category, five REASONS represented >5% of responses, cumulatively, across all domains and enhancement conditions (Fig. 5): NO NEED ( $n=835$ , 30.1%), SAFETY CONCERNS ( $n=614$ , 22.1%), CONCERNS ABOUT PILLS ( $n=539$ , 19.4%), CONCERNS ABOUT CHANGING THE BRAIN ( $n=447$ , 16.1%) and CONCERNS ABOUT CHANGING A PROMINENT FEATURE OF THE PERSON ( $n=189$ , 6.8%). The least mentioned reasons were RELIGIOUS CONCERNS ( $n=5$ , 0.2%) and SOCIAL PRESSURE TO FIT IN ( $n=31$ , 1.1%) (See Table 1S and Table 2S).

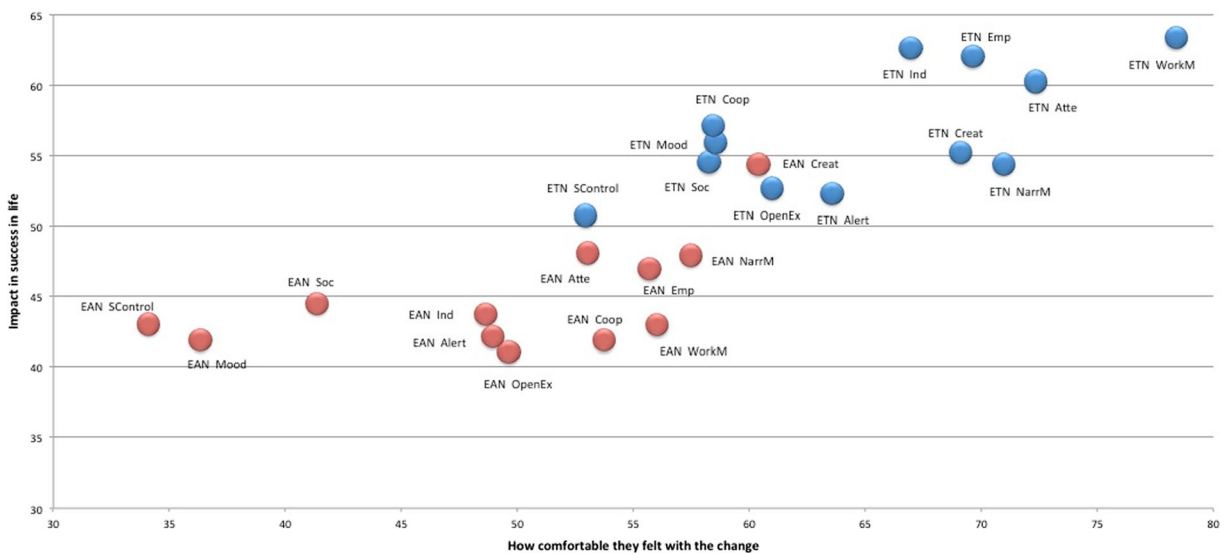
Even though these main REASONS for discomfort emerged in both enhancement conditions, certain REASONS were more prominent than others depending on enhancement condition. Notably, NO NEED was more commonly mentioned as a REASON supporting people's discomfort when participants read vignettes describing EAN than ETN ( $p<0.001$ , two-tailed Fisher's exact test, Cramer's  $V=0.29$ ). Similarly, we found that CHANGING THE BRAIN ( $p=0.039$ , two-tailed Fisher's exact test, Cramer's  $V=0.04$ ) and SAFETY CONCERNS ( $p<0.001$ , two-tailed Fisher's exact test, Cramer's  $V=0.081$ ) were

**Fig. 3** Effect of enhancement condition upon perceived changes to success in life. Error bars represent (95%) Confidence Intervals. *ETN* enhancement towards the norm; *EAN* enhancement above the norm



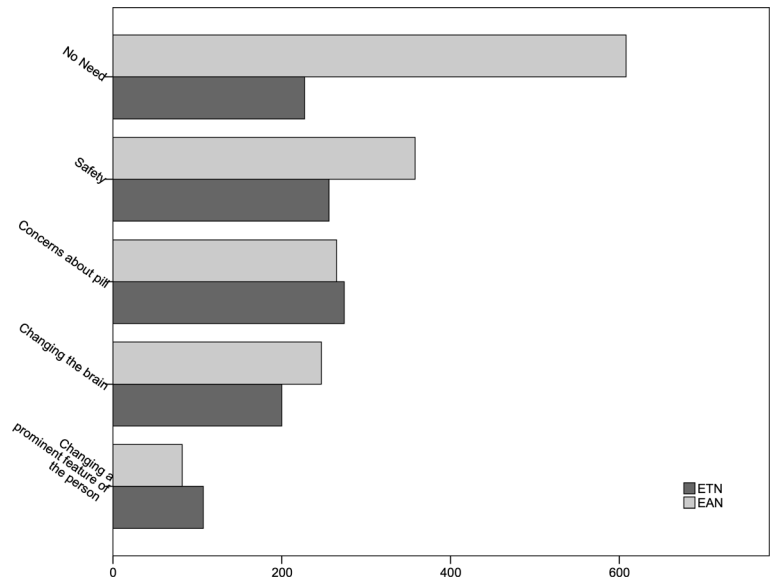
more frequently mentioned as concerns by participants who had viewed EAN vignettes than those who read about ETN. The REASON denoted as CHANGING A PROMINENT FEATURE OF THE PERSON was more frequently mentioned when participants had read a vignette about ETN than EAN ( $p=0.042$ , two-tailed Fisher’s exact test, Cramer’s  $V=0.04$ ). CONCERNS ABOUT PILLS were not different between enhancement conditions ( $p=0.443$ , two-tailed Fisher’s exact test, Cramer’s  $V=0.015$ ).

In the *Comfortable* category, once again five REASONS represented >5% of responses, cumulatively, across all domains and enhancement conditions (Fig. 6): that the pharmacological enhancement resulted in a POSITIVE OUTCOME ( $n=866$ , 22.5%), was regarded as SAFE ( $n=803$ , 28.9%), overall ENDORSEMENT OF PILLS ( $n=408$ , 14.7%), that taking the pill was HIS CHOICE ( $n=365$ , 13.1%), and that the individual had used the agent under conditions of INFORMED CONSENT to the risks involved ( $n=138$ , 5%). The least invoked reason for



**Fig. 4** Perceived changes to success in life as a function of comfort level. Each marker represents a specific domain according to enhancement condition

**Fig. 5** Most common REASONS under *Not Comfortable* category. Frequency of the theme as mentioned in comments ( $n=2776$ ). *ETN* enhancement towards the norm; *EAN* enhancement above the norm



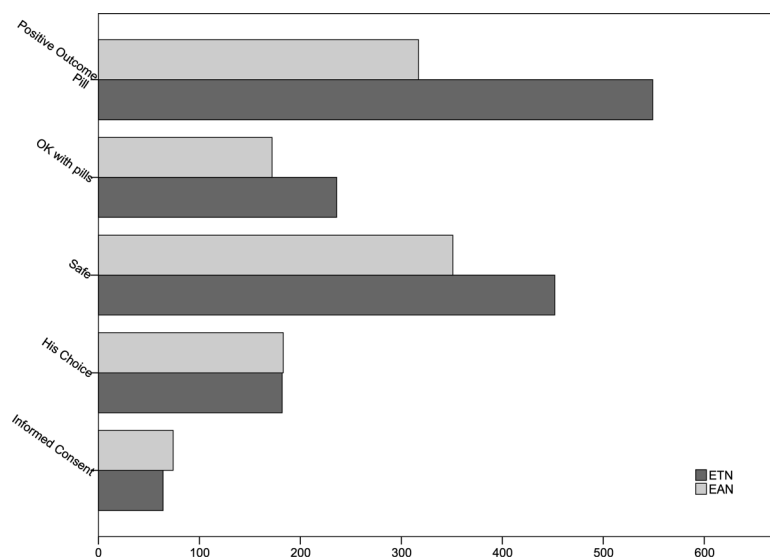
being *Comfortable* was NOT REALLY CHANGING A PROMINENT FEATURE OF THE PERSON ( $n=31$ , 1.04%).

Enhancement condition once more played an important role in the REASONS that were given for feelings of *Comfort* with the enhancement intervention. We found that POSITIVE OUTCOME OF PILL ( $p<0.001$ , two-tailed Fisher’s exact test, Cramer’s  $V=0.19$ ), being OK WITH PILLS ( $p<0.001$ , two-tailed Fisher’s exact test, Cramer’s  $V=0.071$ ) and that the pill was regarded as SAFE ( $p<0.001$ , two-tailed Fisher’s exact test, Cramer’s

$V=0.089$ ) were more frequently brought forward as REASONS for comfort when participants read vignettes describing ETN than EAN. Other main reasons for comfort, such as that it was HIS CHOICE ( $p=0.867$ , two-tailed Fisher’s exact test, Cramer’s  $V=0.004$ ) and NOT REALLY CHANGING A PROMINENT FEATURE OF THE PERSON ( $p=1$ , two-tailed Fisher’s exact test, Cramer’s  $V=0.002$ ) were not different between enhancement conditions.

Overall, 21.1% ( $n=587$ ) of the comments expressed AMBIVALENCE about CAS enhancement, characterized as

**Fig. 6** Most common REASONS under *Comfortable* category. Frequency of the theme as mentioned in comments ( $n=2776$ ). *ETN* enhancement towards the norm; *EAN* enhancement above norm





expressing both comfort and discomfort in the same comment, or (in a few cases) by the explicit mention of ambivalence. These feelings of AMBIVALENCE were very similar for both enhancement conditions ( $p=.546$ , two-tailed Fisher's exact test, Cramer's  $V=0.012$ ).

In order to determine whether the quantized data from the content analysis were consistent with the quantitative data, for each participant we calculated the NUMBER OF REASONS GIVEN by assigning to each *Comfortable* reason a +1 and to each *Not Comfortable* reason a -1; thus if an individual offered 3 reasons for why they were uncomfortable their NUMBER OF REASONS GIVEN would be -3. We found a strong positive correlation between the NUMBER OF REASONS GIVEN with each participant's rating of comfort level in Q1 (Overall: 0.80, ETN=0.78, EAN=0.80) suggesting that there was consistency between our quantized and our quantitative data.

The data also suggests that when people have multiple REASONS for discomfort, their level of discomfort increases accordingly (Fig. 7). However, the level of comfort with pharmacological CAS enhancement appears to reach saturation with a single reason, as the average comfort level with enhancement remains almost the same regardless of the number of REASONS people have for feeling comfortable.

## Discussion

The present experiments demonstrate that when pharmacological enhancement enabled enhancement towards the norm (normalization), participants feel more comfortable than when it enabled improvements above the norm, irrespective of cognitive, affective or social domain. Participants also view ETN as providing a greater impact upon success in life than EAN. Three major insights emerge from these data.

### The Therapy-Enhancement Distinction Modulates Comfort Over the use of Pharmacological CAS Enhancement

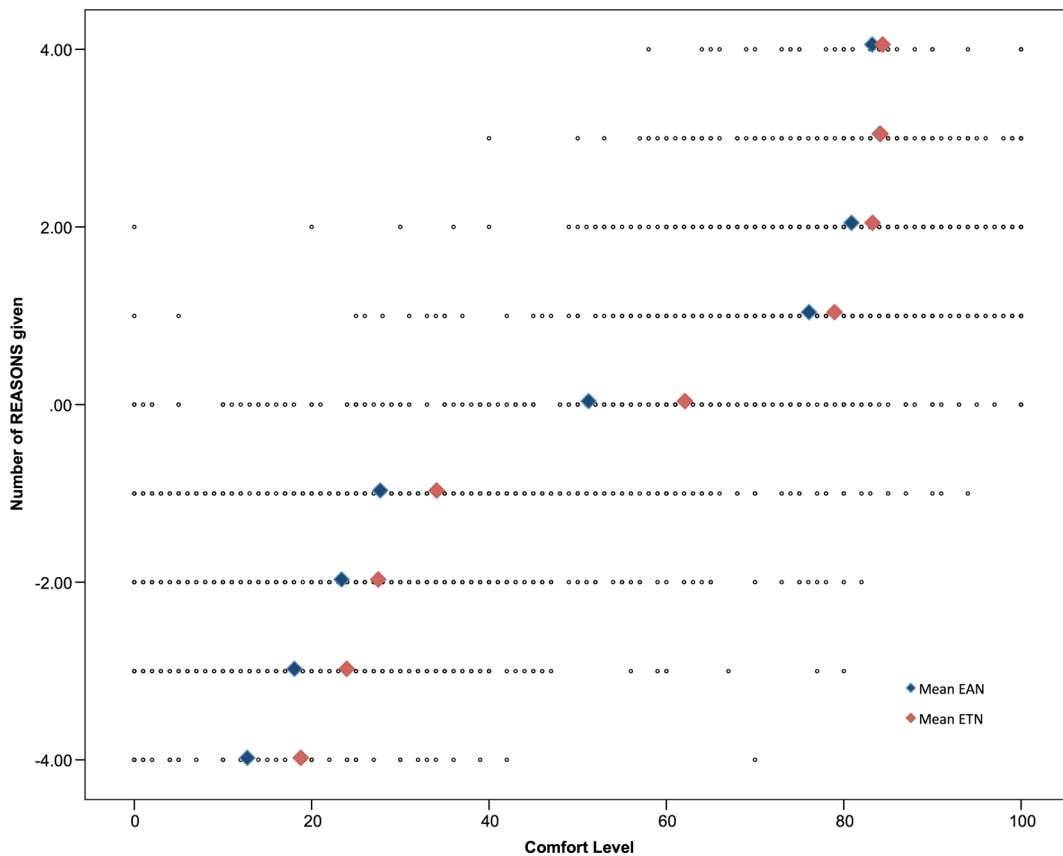
The first conclusion is that the public is sensitive to the therapy-enhancement distinction: across 12 cognitive, affective and social domains, participants were more comfortable with enhancement interventions that enabled ETN than EAN. That respondents were sensitive

to this distinction is perhaps unsurprising, as it has long been considered a cornerstone of the debate over the ethics of enhancement *writ large* [45]. Indeed, a similar result emerged from an early study of student attitudes towards the propriety of cognitive enhancement use, finding that people are "somewhat tolerant of allowing memory-and attention-enhancing drugs for performers in the bottom 10%", but not so much in cases of average or high achievers [46]. The current findings offer new insight in that respondents in the ETN condition readily offered answers indicating they were more comfortable with the intervention than those in the EAN condition, without either group knowing that the other option was even being considered. Thus, it is not just that respondents preferred one situation over the other, but rather that the key contrastive feature of the vignette – ETN vs. EAN – was able to modulate comfort over the use of pharmacological CAS enhancement in a significant manner.

The most plausible interpretation of these findings is that our participants were viewing ETN as a form of quasi-therapy, whereas they viewed EAN as an example of what is generally meant by enhancement within the biomedical paradigm of enhancement [8]. Thus, while some scholars have provided cogent arguments that the therapy-enhancement distinction is irrelevant [47, 48], the public appear to find it an important factor when considering the propriety of CAS enhancement use.

These observations are buttressed by the results of our exploration of CQCA as a means of providing a philosophically thicker explanation of our results. When respondents were asked to tell us why they answered as they did, almost half (608/1408) opined that they were uncomfortable with the situation because there was NO NEED for the pill when the condition was framed as EAN, while only 227/1368 participants felt similarly when the condition was framed as ETN. Their comments echo quite nicely the primary argument used by Daniels to distinguish therapy from enhancement [45]: medical necessity. That the public would come to the same conclusion *without prompting* lends strong credence to the universality of this sentiment, and supports the notion that *necessity* plays a key role in distinguishing therapy from enhancement.

These data should not be taken to suggest that we should ban pharmacological CAS enhancement because people are more uncomfortable with enhancement than therapy. Rather, they suggest that reassurances offered by proponents of CAS enhancement need to be



**Fig. 7** Correlation between number of reasons given for each comment and the rating of comfort level. Dots represent each individual response and diamond markers represent means

sufficiently robust to overcome this reticence on the part of the public, whether the issue be safety of the pills themselves or the social impact of widespread pharmacological CAS enhancement use. Some interlocutors might dismiss these findings on the grounds that these are but folk intuitions; that once expertise is brought to bear, the logical imperative will hold sway. The debate over this issue is not likely to abate anytime soon [49, 50], but we would suggest that in matters of public policy, especially when they concern positional goods such as CAS enhancement for which medical necessity is lacking, the views of the public should be given due consideration.

#### Perceived Positive Outcome Modulates Angst Over the Use of Pharmacological CAS Enhancement

While participants were sensitive to the key principles underlying the therapy-enhancement distinction, the perceived outcome of the use of pharmacological CAS

enhancement mattered as well. The observations that (a) participants' perceptions of pills as having an effect upon success in life modulated comfort with CAS enhancement and (b) that POSITIVE OUTCOME was evoked more frequently as a REASON for comfort with CAS enhancement in the ETN than EAN condition both indicate that consequences of CAS enhancement use are germane. These data are congruent with our previous finding that the public is at least partly consequentialist in their views towards the use of cognitive enhancement in the workplace [22]. In important ways, this finding suggests that the view of the public is consistent with the welfarist definition of enhancement as "any change in the biology or psychology of a person which increases the chance of leading a good life in the relevant set of circumstances" [51]. While hardly the only issues that might guide our thinking about pharmacological CAS enhancement, the welfarist definition does seem to capture one of the reasons offered by participants for

being more or less comfortable with enhancement interventions.

What are the implications of success in life acting as a moderating influence on attitudes towards pharmacological CAS enhancement? In modern western societies, success in life has become a measure of the good life. In line with such trends, some scholars have argued that the more cognitive faculties one has, the more successful one is likely to be, not only in terms of highly demanding jobs, but also in everyday life [52]. Others regard cognitive, affective and social prowess as both consumption goods (desirable and happiness-promoting) and capital goods that reduce risk and increase earning capacity [53]. In this view, pharmacological CAS enhancements that improve job performance or allow students to achieve better grades will be regarded as better than those that do not achieve these objectives. Some commentators would even argue that this is a main reason for embracing enhancement or even considering it a moral imperative [54–56].

Interestingly, the perceived benefits from enhancing a certain CAS domain were not higher when EAN than when ETN. Evidence of this is that for all domains except CREATIVITY and NARRATIVE MEMORY, participants perceived ETN as bringing a larger change to success in life than when EAN. Similarly, participants saw POSITIVE OUTCOMES as more likely when interventions are towards the norm (549/1368) than when they are above the norm (317/1408). One way to interpret these results is that there exists a general intuition regarding an optimal range, according to which having too much of a certain thing can be as detrimental to success in life as a lack of it. This “nothing in excess” motto has been an old ideal, that can be traced back even before Aristotle’s idea of the golden mean. The fact that people perceive a greater benefit for ETN than EAN, and that the benefit correlated with comfort, challenges one of the main arguments offered by supporters of enhancement, namely that the more we have of a certain cognitive, affective or social faculty, the better.

#### The Public Endorses Fair Distribution of Mental Capital

One of the more surprising findings of our CQCA experiment was the rare mention of distributive justice as a cause for discomfort with both ETN and, more strikingly, EAN. While our experimental paradigm emphasizes reliance on contrastive data rather than stated

preferences, this finding was so robust that it merits discussion. Distributive justice is one of the cardinal concerns of the enhancement debate, mentioned as an important issue by nearly all commentators [22, 23, 57]. One interpretation of our results is that they contradict a large body of empirical research focused on concerns regarding inequality of access to pharmacological CAS enhancement [22, 46, 58–64]. It is worth noting that the key difference between our results and these previous studies is that participants were *unprompted* as to potential causes of their discomfort towards the use of pharmacological CAS enhancement. A more compelling explanation is that, given the fact that there was no mention of the cost of the pill in the vignettes, readers were invited to focus more on the individual than on societal impact of taking the pill, thus explaining the near absence of any mention of distributive justice. Further experimental work on the issue would be appropriate.

While participants did not identify distributive justice with respect to resources as a source of discomfort, participants views in relation to NO NEED indicated that they were keenly sensitive to the issue of fair distribution of cognitive, affective and social capital [65]. There are distinct views of what constitutes social justice, depending on the criteria used. Respondents appeared to feel that when someone already enjoys an acceptable range of opportunity, it is unjustified to desire more of it. This idea is at the core of the capabilities approach, a theory of social justice that focuses upon whether everyone has access to a level of opportunity that is needed to function well as a cooperative member of society [66–68]. The capabilities approach has been regarded as reflecting widely shared intuitions about human well being, and our data is entirely congruent with such a view.

#### The Role of Norms in the CAS Enhancement Debate

A *leitmotif* of the current set of studies is the concept of normality, one that is fraught with difficulty. ‘Normal’ can refer to a defined standard, a naturally occurring state, as being free of disease, as balanced or stable and also as acceptable. Maggie Little has written about “complicity with harmful concepts of normality” [69], arguing that a skewed view on what is normal has been a clear engine for the expanding medicalization that has taken place in recent decades [70]. Indeed, at the same time as the issue of normality intrudes upon the

enhancement debate, DSM-V has been criticised for excessively medicalizing what many people view as ‘normal’ human behaviour [71]. In the end, norms are set of agreed upon principles that society adopts, and our analysis of public attitudes captures at least a version of the current norms towards the propriety of pharmacological CAS enhancement. Such norms are hardly static, changing as the values and desires of society change. Understanding what the norms of society are today helps us craft public policy that is in alignment with those of the public.

### Limitations

We acknowledge that our results do not apply to all 12 domains, however the trend holds for most of the domains tested. In order to help us explain these differences we considered whether the type of domain (whether is cognitive, affective or social) could have an effect but we did not find any relationship. We also looked at the results from CQCA, as these might provide some insight into the reasons why for certain domains we obtained different results than the overall trend, but again we did not see any consistent pattern that could help explain our results. Another possibility is that the words used for the vignettes could have had different effects upon participants’ attitudes across domains. Thus, at this point we do not have an explanation for the differences found for specific domains, but future experiments will help us clarify further the reasons for these differences.

### Conclusions

There are many possible sources of comfort and discomfort that are evoked by the idea of enhancing cognitive, affective or social domains. The present study investigated variations in the outcome provided by a given enhancement intervention based on whether it enabled normalization (ETN) or it conferred abilities above what is regarded to be the norm (EAN) for a given CAS domain. Our data builds upon the emerging experimental neuroethics paradigm by introducing a novel mixed-method approach which enables thicker insight into the sources of comfort and discomfort regarding CAS enhancement. Overall, our results suggest that people’s comfort or discomfort with enhancement might be driven by key underlying features of the

therapy-enhancement distinction and that necessity, a key concept underlying the therapy-enhancement distinction, is morally salient to the public.

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