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Examining the prevalence of trans phantoms among transgender, nonbinary and gender diverse individuals: An exploratory study

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ABSTRACT

***Background*:** Trans phantoms are bodily sensations of gendered body parts that a person was not born with (i.e., a phantom penis experienced by a trans man, or a phantom vagina experienced by a trans woman). This is distinct from the experience of many transgender and gender diverse (TGD) people, who experience awareness of their bodies as missing a gendered body part, or configuration, which is a major characteristic of gender dysphoria.
***Aims*:** Our purpose was to gain greater understanding of the prevalence and quality of trans phantoms.
***Methods*:** Data was gathered through a brief, online survey on trans embodiment. Respondents who had both completed the survey, and were deemed appropriate for inclusion in the study, based on their survey responses, comprised our sample of 1,446 adults.
***Results*:** Results indicated that trans phantoms are a typical embodied experience of TGD people. Almost 50% of study participants reported experiencing a trans phantom, most of whom also reported feeling erotic sensation in their phantom.
***Conclusions*:** Though the phenomenon of trans phantoms is not universal, it is clearly one that warrants further study.

KEYWORDS
Aplasic phantoms; embodiment; gender; nonbinary; phantom sensation; trans phantoms; transgender

Introduction

The lived sensorial experiences of transgender, nonbinary, genderqueer, and gender diverse (TGD) people have only just begun to be investigated beyond the recognition of gender dysphoria. The study of trans phantom sensation is at the vanguard of embodiment. Trans phantoms are bodily sensations of gendered body parts that a person was not born with. For example, a phantom penis may be experienced by a trans man (someone who was assigned female at birth, or, "AFAB," for short), and a phantom vagina may be experienced by a trans woman (someone who was assigned male at birth, or, "AMAB," for short). This is distinct from the awareness that a gendered body part is missing or misshapen—an awareness that is experienced by many TGD people, and is a significant characteristic of gender dysphoria. Phantom perceivers uniquely experience not only the awareness of what is missing, or smaller than the size that would align with the person's embodied experience, but also the physical sensation of it. Such experiences are not limited to TGD individuals, of course; cisgender people are also capable of experiencing gendered body parts with which they were not born, though such reports seem to be far less commonplace and anecdotal.

It has been theorized that this phenomenon in TGD people is analogous to aplasic phantom sensation, which is experienced when a person is born without a limb (Langer, 2014, 2019), suggesting that cortical representations of congenitally missing body parts may exist (Brugger et al., 2000). This may be explained through the free-energy principle (Friston, 2009), and the theory of the Bayesian brain: The predictive processing of the brain holds prior predictions of the afferent sensations it expects to receive from the body (Friston, 2009; Friston & Stephan, 2007). These predictions either match the bodily signals it receives, or they do not. When they do, the

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result is homeostasis. When they do not, the result is a *mis*match, which produces surprise, or free energy, and will need to be resolved.[1] For instance, the brain predicts for a certain level of oxygen, so, when a person is running, and the body begins to experience oxygen starvation, there is a mismatch between the body and the brain, and that feeling is the sense of free energy. In keeping with the free-energy principle (Friston, 2009), some hyperpriors of gendered bodily experiences are not reciprocated by the material body—a concept that Langer (2019) has applied to TGD people's experiences of gendered bodily dysphoria. Certain prior predictions, known as *hyperpriors*, cannot be altered, rendering internally-driven homeostatic responses ineffectual, and, thusly, require external action to achieve resolution. Like all hyperpriors, gendered hyperpriors can only be resolved through external action, such as, in the case of certain TGD people, gender affirming interventions (i.e., hormone treatment, and/or surgery).

For trans phantom perceivers, predictive processing extends to a physical perception of the missing or smaller body part, in contrast to non-perceivers, who experience the need for that part, but not the physical extension of it (e.g., some trans women know their bodies will not be congruent until they have a vagina, while a small subset of these women both know this, *and* feel the sensation of a vagina).

An alternate theory of what underlies the experience of a trans phantom is that it originates at, or from, the site of the phantom (e.g., genitalia). Following this theory, phantom penis sensation, for example, could emanate from the clitoris, or phantom vagina sensation can relate to the prostate (Case, 2020; Puppo & Puppo, 2016). As Straayer (2020) aptly pointed out, trans phantoms may be visually missing, but a person without a penis, or vagina, is not a person without genitalia. There could be an interplay of afferent signals from a phantom perceiver's anatomy, and predictive priors from their brain. However, Case (2020) cautions that there is much flexibility of brain representations in the body schema, and body image. Therefore, more research is still needed in this area.

There have, however, been a number of studies on limb-deficient phantoms (which can also include a limb that is shorter than usual), as well as post-amputation phantoms. About 18% of congenitally limb-deficient people report phantom sensation (Melzack et al., 1997; Saadah & Melzack, 1994; Weinstein et al., 1964). Findings across various studies on post-amputation phantom experiences reflect that 33–85% of amputees report phantom presence (Ahmed et al., 2017; Parkes, 1973; Sherman & Sherman, 1983).

To date, there are only a handful of studies on trans phantoms, but the import of their results are significant, as they suggest that trans phantoms are more prevalent than limb-deficient aplasic phantoms. In a study conducted by Case and Ramachandran (2012), 21 of 32 bigender[2] participants reported experiencing trans phantoms, and, in a later study, which expanded their work to a notably larger sample size of 73 bigender participants, 71% of participants reported experiencing trans phantoms (Case et al., 2019). Similarly, Ramachandran and McGeoch (2007) found that 62% of trans men, in a sample of 29, endorsed lifelong experiences of phantom penis presence. Based on data collected in their interviews, Ramachandran and McGeoch (2007) also argue for the idea of a "hard-wired" (Ramachandran & McGeoch, 2007, p. 1003) body image. They describe how durable trans phantoms are, even in spite of there being no visual affirmation of them, as well as much cultural opposition to the trans person's experience. Ramachandran and McGeoch (2007) assert that the persistence of the phantom indicates that the phantom experience is deeply embedded.

While Ramachandran and McGeoch's (2007) findings are compelling, there are significant methodological limitations to their study that bear noting. First, they did not ask trans women participants if they experienced a phantom vagina, or phantom breasts, but, rather, asked them about post-vaginoplasty phantom sensation, in order to draw a comparison to cisgender men who had undergone penectomies, which is an amputation procedure. This is problematic for several reasons, chiefly because amputation surgery is very different from the surgical approach taken for vaginoplasty. Vaginoplasty, commonly performed as a penile inversion, keeps much of the person's anatomy in play, rather than removing it. In the

case of a penile inversion, the penile nerves are not severed, and the dorsal penile nerve, for example, innervates the neoclitoris (Li et al., 2021). Furthermore, the experience of an amputee phantom differs from that of aplasic phantoms, the latter of which more closely aligns with trans phantoms. An amputee has lived experience with the given body part before it is removed, whereas an aplasic phantom perceiver has never had lived experience with the body part, yet still perceives the deficiency. Ramachandran and McGeoch's (2007) oversight could have occurred for many reasons, including general limitations at the time of their study, and/or biases that cisgender researchers can have, when attempting research with trans subjects.

Overall, these prior studies signal that there is, in fact, a trans phantom phenomenon, yet quantitative research in this arena has been almost nil since the completion of these studies. It also appears that trans phantoms are more prevalent than aplasic phantoms, but the sample sizes used in prior studies on trans phantoms were so small that it can be difficult to ascertain their validity. With this in mind, our goal was to develop a study that would identify the salient features and prevalence of the trans phantom phenomenon in a large sample of TGD people.

Methodology

Our study was approved by the Institutional Review Board of School of Visual Arts in 2020. We developed a brief online questionnaire, which was made available to participants through Qualtrics. The questionnaire[3] included multiple-choice questions (some of which were restricted to a single response, while others prompted participants to, "Select all that apply"), as well as open-ended, short-answer questions. A number of questions utilized a combined format, wherein certain multiple-choice answers were accompanied by a blank field, which participants could use to provide us with additional information, should they so choose. We surveyed embodiment in subjects who experienced their gender across the transgender and nonbinary spectrum. Our recruitment material advertised a study related to embodiment in TGD people, without mention of phantoms, in order to not skew the sample. Recruitment occurred primarily through virtual and digital means, since the survey was conducted during the COVID-19 pandemic. Participants were all 18 years of age or older, and were recruited through convenience and snowball sampling, via direct outreach to nonprofit organizations, treatment centers, trans health professionals, trans academics, listservs, social media, and private Facebook groups for TGNB community members. Consent to participate was obtained at the start of the questionnaire.

Items in the questionnaire focused on how, and what subjects felt within their bodies, across several domains of activity. These included subjective experiences of interoceptive sensitivity (hunger, the need to go to the bathroom, breath, temperature, and pain), which were presented as "Yes/No" questions, such as, "Do you notice when you are hungry?" Phantom sensation was assessed across gendered body parts, which encompassed genitals (vagina, penis, and scrotum), non-gendered body parts[4] (lips, hips, and thighs), and secondary sex-characteristics (breasts, and hips). Trans phantoms were operationalized as gendered, bodily-felt sensations of body parts that the subject was not born with; these sensations were purposely contextualized as being extensions of existing body parts, or body parts the subject was not born with, as opposed to a desire, or need for that body part, which many TGD people who had not had the experience of a phantom would endorse. In our investigation of the phantom body parts, we were specifically targeting interoceptive, and/or proprioceptive[5] sensations. We asked (1) if a phantom was present, (2) what the length of time was that the phantom had been present, and (3) if there was erotic sensation associated with the phantom. Additionally, the survey included questions relating to activities that involve the body. Lists of physical activities, and mindfulness activities, such as playing sports, yoga, and meditation, were provided, and participants were asked to select all that apply. Such questions were included for two reasons. The first was to test for correlations between engaging in activities that connect a person to their body, and phantom perception. The second was to

support construction of a survey that would avoid being perceived as directly targeting phantom prevalence. Though the findings yielded by these questions were not significant, we included them in what was assessed as our results, because of their potential to provide a more comprehensive understanding of the relationship between physical activity, and phantom sensation.

Ultimately, our sample was comprised of 1,446 individuals, ranging from 18 to 81 years of age, and hailing from across North America, Europe, and Australia. These were participants who had both completed the survey, and were deemed appropriate for inclusion in our study, according to their survey responses (meaning, they reported experiencing the bodily sensation of a gendered body part that was not present at birth). Table 1 shows the demographic characteristics of the sample, specifically focusing on age, race and ethnicity, sex assigned at birth, and gender identity. Participants were primarily under 50 years of age, self-identified as Caucasian/White, and masculine of center, and were assigned "Female" at birth.

Table 1. Demographic characteristics of (N = 1,446) participants aged 18 to 81 years, 2020: Trans phantom study.

Variable	Number (%)
Age	
18–29	646 (44.2)
30–39	327 (22.4)
40–49	162 (11.1)
50–59	90 (6.2)
60–69	49 (3.3)
70–79	11 (0.7)
80–89	1 (0.1)
Race/Ethnicity	
Caucasian/White	1286 (88.1)
African American/Black	59 (4.0)
American Indian/Native American	60 (4.1)
Asian Pacific Islander	73 (5.0)
Latinx/Hispanic	106 (7.3)
Middle Eastern/MENA	3 (0.2)
Multiracial	1 (0.1)
Prefer not to say	29 (1.8)
Other	72 (5.0)
Sex assigned at birth (Biological Sex)	
Female (AFAB)	1072 (73.4)
Male (AMAB)	344 (23.6)
Intersex	7 (0.5)
Other	8 (0.5)
Prefer not to say	20 (1.4)
Gender identity	
Transgender woman	265 (18.2)
Transgender man	626 (42.9)
Transexual woman	52 (3.6)
Transexual man	85 (5.8)
Cisgender woman	20 (1.4)
Cisgender man	16 (1.1)
Gender nonconforming	233 (16.0)
Intersex	22 (1.5)
Nonbinary	544 (37.3)
Agender	88 (6.0)
Gender fluid	123 (8.4)
Other	261 (17.9)
Prefer not to say	1 (0.1)

Note. Totals for "Race/Ethnicity" and "Gender identity" are each greater than 1,446, due to participants endorsing multiple identities within each category.

Table 2. Endorsement of phantom sensation by sex assigned at birth (N = 1,446).

Sex assigned at birth	Yes	No	Total
Female	545 (51%)	524 (49%)	1069
Male	133 (38.8%)	210 (61.2%)	343
Intersex	4 (57.1%)	3 (4.3%)	7
Other	16 (59.2%	11 (40.7%)	27
Total	698	748	1446

Results

Six hundred ninety-eight subjects, across a range of TGD identities, reported experiencing the sensation of a trans phantom (perceived gendered body part that the participant was not born with), which was approximately 50% of the subjects (Table 2). Endorsements of a specific gendered body part that was anatomically associated with a respondent's sex assigned at birth were not considered to meet criteria for that particular phantom, since that respondent had likely developed that body part at one time (as in the case of AFAB subjects reporting phantom breasts, or a phantom vagina), or, alternatively, may have interpreted our question as being in reference to post-operative phantoms. The breakdown of trans phantoms was as follows (Table 3): Nine reported, "Lips"; forty-eight reported, "Breasts"; ninety-one reported, "Vagina"; thirty-three reported, "Hips"; four hundred fifty-eight reported, "Penis"; one hundred seven reported, "Testicles"; and seventy-two reported, "Other." Some respondents had experienced more than one phantom. Combined, 818 trans phantoms were experienced across our sample of 698 subjects. Lips, hips, and thighs were included as body parts investigated in the survey, since they can be regarded as being masculine, or feminine qualities, even though they are not always considered to be secondary sex characteristics. These masculine, and feminine qualities usually have a size-related relationship to gender; for example, larger hips are often associated with femininity in the same way that larger breasts can be associated with femininity. Separating the endorsements for each type of trans phantom by respondents' sex assigned at birth provided us with a

Table 3. Location of phantom sensation by sex assigned at birth (N = 698).

Location of phantom	Sex assigned at birth				
Body part	AFAB	AMAB	Intersex	Other	Total
Lips	2	7	0	0	**9**
Breasts	24	**48**	0	0	72
Vagina	49	**91**	2	0	142
Hips/thighs	11	21	0	1	**33**
Penis	**458**	5	5	10	475
Testicles	**107**	3	2	4	116
Other	50	18	3	1	**72**
Total	701	193	12	16	919

Note. Numbers that appear in bold indicate responses that were considered to meet criteria for a gendered *phantom* body part; endorsements of gendered body parts that were anatomically associated with a respondent's sex assigned at birth were not considered to meet criteria, as described in Methodology.

deeper understanding of phantom prevalence. Our reasoning for focusing on sex assigned at birth was not to privilege sex assigned at birth over a person's affirmed gender, but, rather, to allow us to focus on the *anatomical* aspect of phantoms. To obtain this information, one of the questions we posed asked, "What was your sex assigned at birth?" which was followed by five answer options, from which participants could choose. These options were: "Female," "Male," "Intersex," "Other (please specify):" and, "I prefer not to say." Of the 344 subjects who were AMAB—who identified across the transfeminine spectrum or as a nonbinary gender identity—48 (approximately 14%) reported experiencing phantom breasts, 91 (26.5%) endorsed experiencing a phantom vagina, and 21 (6.1%) reported experiencing phantom hips. Of the 1,072 subjects who were AFAB, 458 (40.59%) reported experiencing a phantom penis, and 107 (10%) endorsed phantom testicles. Those who endorsed phantom testicles may or may not have also experienced a phantom penis.

There was a high rate of reported phantom breasts, 66.7% of which came from those who were AMAB (n = 48). As previously explained, reports of phantom breasts made by subjects who were AFAB were not considered to meet criteria for trans phantom breasts, since these subjects most likely developed breasts at one time, or may have interpreted our question as referring to post-operative phantoms. The same applied to phantom vaginas; subjects reporting a phantom vagina were found to be 64.1% AMAB (n = 91), 2% Intersex, and 34.5% AFAB.

The occurrence of AMAB subjects endorsing masculine-gendered phantoms was far reduced from that of AFAB subjects endorsing feminine-gendered phantoms. Of the subjects who endorsed a phantom penis, only 1.1% were AMAB; the remainder were 96.4% AFAB (n = 458), 0.4% Intersex, 0.6% Other, and 1.5% preferred not to say. Of the subjects who reported phantom testicles, only 2.6% were AMAB; the remainder were 92.2% AFAB (n = 107), 1.7% Intersex, 0.9% Other, and 2.6% preferred not to say. Subjects reporting phantom hips were 63.6% AMAB (n = 21), 33.3% AFAB, and 3% preferred not to say—a breakdown similar to that of phantom breasts, as well as phantom vaginas. Only nine subjects reported experiencing phantom lips, the majority of whom were AMAB (77.8%).

We characterized the final phantom type investigated in our survey as, "Other." This multiple-choice option was accompanied by a blank space, on which participants could provide more specificity, or supplemental information, should they so choose. Unfortunately, few took the opportunity to utilize this field, yielding minimal specifics that we hope will be illuminated by findings from future studies. Of the respondents who did endorse the phantom type called, "Other," 69.4% were AFAB, 25% were AMAB, 4.2% were "Other," and 1.4% preferred not to say.

When organizing phantom presence according to subjects' self-reported gender identities, our findings indicate two things: Many subjects identified across multiple identities, and subjects who identified as nonbinary experienced phantoms at a similar rate to those who identified within the masculine-feminine spectrum of gender identities.

Erotic sensation

Our data indicated that if a phantom is present, it is more likely than not to have erotic sensation (Table 4). Erotic sensation was reported by 77% (n = 7) of subjects who experienced phantom lips; 74.6% (n = 53) of subjects who experienced phantom breasts; 88% (n = 125) of subjects who experienced phantom vaginas; 81.8% (n = 27) of subjects who experienced phantom hips; 85.8% (n = 407) of subjects who experienced phantom penises; 87.9% (n = 102) of subjects experiencing phantom testicles; and 69% (n = 50) of subjects who experienced "Other" phantoms.

Table 4. Endorsement of erotic sensation in phantom experience by location (N = 698).

Location of phantom	Yes	No	Total
Lips	7 (77.8%)	2 (22.2%)	9
Breasts	53 (74.6%)	18 (25.3%)	71
Vagina	125 (88%)	17 (12%)	142
Hips/thighs	27 (81.8%)	6 (18.2%)	33
Penis	407 (85.9%)	67 (14.1%)	474
Testicles	102 (87.9%)	14 (12.1%)	116
Other	50 (69.4%)	22 (30.6%)	72
Total	771 (84.1%)	146 (15.9%)	917

Note. Percentages are rounded up.

Longevity and persistence of phantom perception

We were also interested in learning about the ages at which subjects first experienced a phantom presence, as well as the circumstances that surrounded it. As we know from early research on aplasic phantoms, awareness may begin in early childhood, and is not necessarily lifelong (Weinstein & Sersen, 1961). As such, we included survey questions that were intended to capture age of onset for subjects' phantom presence, and the circumstances that surrounded subjects' initial awareness of it. One such question was, "How long have you felt it?" This was followed by six multiple-choice answers, from which participants could choose. These were: "As long as I can remember," "Since adolescence," "In relation to a sexual experience," "After hormone treatment," "After surgery," and "Other." Three of these options produced similarly high rates of response from AFAB participants (n = 535), which were, "As long as I can remember" (23%; n = 125), "Since adolescence" (24.6%; n = 132), and "In relation to a sexual experience" (24.8%; n = 133). Rates of response for the remaining AFAB participants were, "After hormone treatment (14%; n = 75), "After surgery" (1%; n = 7), and "Other" (11.78%; n = 63). The distribution of responses by AMAB subjects (n = 130) resembled that of the AFAB participants: 23.8% (n = 31) of respondents selected, "As long as I can remember"; 28% (n = 37) selected, "Since adolescence"; 15% (n = 20) selected, "In relation to a sexual experience"; 21.5% (n = 28) selected, "After hormone treatment"; 2% (n = 3) selected, "After surgery"; and 8% (n = 11) selected, "Other."

Interoception

Interoceptive sensitivity is variable across individuals, and includes sensitivity, accuracy, and awareness. Participant responses to our interoceptive measures indicated that phantom perceivers were just as likely to have interoceptive sensitivity as non-perceivers. We asked participants if they notice when they are out of breath, cold, hungry, or need to use the bathroom. However, these were binary-choice questions (offering strictly, "Yes," and, "No," answer choices), and so yielded a ceiling effect—a major flaw in the design. The endorsement of each was within the 96.3–96.4% range.

We also asked participants to rate their sensitivity to pain, posing the question, "How sensitive are you to pain?" followed by five answer options, from which participants could choose. These were: "Extremely sensitive," "More sensitive than others," "About average," "Not as sensitive as others," and "Not sensitive." We hypothesized that phantom perceivers would have greater interoceptive sensitivity than non-perceivers, but our data did not support this; findings suggested no difference in sensitivity levels between the two groups. Overall, our data reflected that participants in the overall sample endorsed less sensitivity to pain, compared to other respondents.

Activities

Data produced from our inquiry into physical activities was unremarkable, and yielded no real insights. Specifically, some of the items asked about whether participants engaged in sports, yoga, martial arts, dance, and individual and/or group meditative practices. Other items focused on attentional focus related to daily living activities, such as eating and using the restroom. While these findings may be due, in part, to how we worded the questions, it could also reflect simply the participants' own awareness, and understanding of the connection between their phantom experience, in relation to physical activities.

Discussion

Limb-deficient phantoms have been more easily understood than aplastic phantoms, by those who do not experience them, since the visual absence of something that was once visually present is apparent, straightforward, and unambiguous. Ciscentrism can impact the perception of trans phantoms by the medical, and mental health

communities, since, through that lens, what may be felt to a person to be missing from their body was at no time visually detectible. However, it is imperative that medical and mental healthcare providers believe what our patients, and research participants communicate to us about their own perceptions. Even in our modest study, there is clear evidence that illuminates trans phantoms as being a common experience for many TGD people.

As we have outlined, we found that, of the 344 subjects who were AMAB, and who identified across the transfeminine spectrum, or as a nonbinary gender identity, approximately 14% reported experiencing phantom breasts, and 26.5% endorsed experiencing a phantom vagina. Additionally, 40% of transmasculine and nonbinary people who were AFAB (n = 1,072) reported experiencing phantom penis presence. The existence of phantom penises was substantiated in roughly half of transmasculine individuals. Though this finding was lower than that of Ramachandran and McGeoch's 2007 study, which was that 62% (n = 29) of trans men experience phantom penis presence, it was by only a small margin. These results are significant, since they support the existence of this phenomenon in TGD people. A clear differentiating factor in these two studies, however, is that our sample included a range of transmasculine-, and nonbinary-identified people, while Ramachandran and McGeoch's (2007) study appeared to recruit only people who were described as "female-to-male transsexuals."

The fact that erotic sensation was more frequently experienced in our subjects' phantoms implies that sensations beyond, or in addition to, presence itself can be felt in trans phantoms. Given these findings, future work should focus on investigating experiences of pain, pressure, placement, intensity, and other sensations that could potentially be associated with phantoms. When we expand on this work in the future, we will include more sensitive, and detailed questions, regarding embodied activity, to better capture the relationship between physical activity, and phantoms. In reflecting upon our collected data, we realized that it would have been worthwhile to have asked not only about erotic sensation, but also about varying levels of physical sensation, which we plan to adjust for future surveys. Evidence of erotic sensation in phantoms suggests that further research into the sexual function, and usefulness of phantoms in the sex lives of trans phantom perceivers, and that of their partners, would be of value.

The wording, "After surgery," left some unfortunate room for interpretation when asking about the onset of phantom perception. While our aim was to learn whether the emergence of a subject's trans phantom occurred after the subject underwent gender-affirming surgery (for example, if a subject's phantom penis emerged post-phalloplasty), the wording, "After surgery," could also be understood to mean an amputation-related surgery. Furthermore, there may be a correlation between longevity, and first sexual experience, though this level of specificity was not investigated.

We recognize that our sample was weighted more heavily toward transmasculine-identified individuals, than any other gender identity. If we undertake another survey-based study, we will dedicate more recruitment efforts to outreach to the transfeminine community, to diversify our sample. It is worth noting that our study was conducted during the height of the COVID-19 pandemic, which significantly limited the recruitment strategies and methods that were available to us. For this reason, our sample was also overwhelmingly White. Future studies should engage in more targeted outreach to communities of color to avoid overrepresentation of majority groups.

Nevertheless, it is evident from the results produced by our sample that phantoms can occur in anyone, regardless of affirmed identity—trans phantom presence is not a binary gendered experience. Our results also lend evidence to theories that bodily gendered aspects of the self are not uniform, but, rather, highly personal (DuBois, Puckett, & Langer, 2022; Langer, 2019; 2022). James (1887) articulated, during a time of early understanding of phantom body parts, that, while phantoms were a phenomenon that was common among amputees, their composition was unique to the individual. This may explain why not all people who experience a phantom penis also experience phantom testicles.

Our results hold various implications for research, and clinical endeavors. A deeper phenomenological, psychological, and neurological definition of trans phantoms can give rise not only to a greater understanding of the nature of

phantoms, in general, but also to clinical interventions that will improve the lives of TGD people. What effect do phantoms have on an individual's understanding of their gender identity? What effect do phantoms have on sexual functioning? Are medical, and mental health providers talking with their patients about this phenomenon? These are just some of the questions we believe should be answered, and which we hope to shed light on in our own ongoing research, which is being conducted as a phenomenological interview study with transmasculine people, who have phantom penises.

Our study was led by TGD researchers with years of clinical experience working with TGD people in psychotherapy and research projects. It is important to underscore that cisgender researchers often lack sufficient connections to, and understanding of, the lived experience of the TGD community, and neglect to include TGD community members in their study's design, and methodological process. This is important in order to prevent potential microaggressions that could arise due to power differentials between the researchers and the participants. Furthermore, poorly designed research in TGD populations can include bias, and inflict direct harm. Inclusion of diverse perspectives is necessary for rigorous research, in general, and is especially necessary for studies that aim to examine experiences of embodiment in a population that has been historically misunderstood, and pathologized. Our team has diverse gendered experiences and varying degrees of connection to the TGD community. We feel that a variety of personal, professional, academic, and community engagement contributes to the inclusion of more specificity, and accuracy in hypotheses, recruitment, and methods, when researchers are connected to the community, and the community trusts that the researchers' interest is in service of them, not rooted in curiosity about them. It is our firm position that studies with, and about the TGD community should benefit the TGD community.

Conclusion

Trans phantoms exist across all TGD identities, and sexes assigned at birth, and our results illustrate that the presence of a trans phantom is far from uncommon. Though trans phantoms are not ubiquitous, they are a telling feature of TGD individuals' gender embodiment. And, while trans phantoms may not, and should not, be considered a requirement for recognition of TGD identities, they may be a meaningful aspect of a person's experience.

With this in mind, we feel that further inquiry is needed to fully understand the dimensions of trans phantoms. These may include utilizing an individual's phantom in enhancing their embodiment, and/or sexual functioning, and granting consideration to the phantom's place in transition-related interventions. Such inquiry will not only advance the research of phantom phenomena, in general, but also have far-reaching clinical implications that can improve TGD people's lives.

Notes

1. Such resolution can be accomplished through three means: (1) Brain signaling that creates changes in the body, in order to restore homeostasis, (2) prediction-updating that occurs in the brain, or (3) external action.
2. Bigender in this study refers to a subset of bigender individuals who experienced alternation in their gender.
3. The full survey is available by request to the corresponding author. Please also note that this is not a validated measure.
4. Though *anatomically* non-gendered, these particular body parts have, within historical, and present-day cultural contexts, been imbued with gendered associations, according to appearance (e.g., fuller lips are considered more feminine), which is why they were included.
5. Interoception is the perception of the body from the inside. Proprioception is the perception of the body in space, related to position, and movement.

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None of the authors have any competing interests to disclose.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Statement of human rights

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Statement on the welfare of animals

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