Neurodivergent Legitimacy in Computing Spaces

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For computing to serve humanity, computing spaces must be safe for all individuals. While prior work has surfaced how hegemonic racial and gendered expectations manifest in computing, it has only indirectly attended to expectations surrounding neurodivergence. As computing stereotypes largely align with stereotypes of some neurodivergent individuals, we investigated whether computing legitimized neurodivergent traits over neuronormative ones. We conducted semi-structured interviews with 21 students, faculty, and industry professionals, sampling both neurodivergent-identifying and non-neurodivergent-identifying participants. We found that computing legitimized hyper-focus, deep "special" interests, and high organization, and that fitting these expectations was frequently required for persistence. Some neurodivergent-identifying participants felt that computing provided refuge from societal neuronormative expectations, though one's sense of refuge depended on sufficiently fitting computing's neurodivergent expectations. We offer reflections on inclusion and belonging efforts within computing, as well as directions for future work that attends to individuals' neurodivergent identities.

CCS Concepts: • **Social and Professional Topics** → **Computing Education**;

Additional Key Words and Phrases: normativity, neurodiversity, Autism, ADHD, inclusion

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1 Introduction

For computing to be a discipline in service of humanity, all individuals must be able to feel that the discipline is a space for them. To this end, it is critical that those who practice the discipline of computing—within this work, post-secondary pedagogical spaces that emphasize **software engineering (SWE)**, **computer science (CS)**, and programming, as well as SWE and CS professionals—feel that they belong [1], that computing spaces are personally relevant [2], and that their presence within these spaces is not incidental or temporary, but rather situated within their existing personhood [3]. In one sense, creating a discipline in service of humanity involves reauthoring and reconstituting these existing computing spaces; in another sense, this work requires supplanting dominant narratives that shape newcomers' affinity to computing [4, 5]. To make space for all computing learners to feel that their whole identity is legitimate without compromise in computing (i.e., a rightful presence) [3], prior work extensively notes the role of stereotypes and perceptions in newcomers' decisions to pursue study in CS [6–8].

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However, while prior work has given direct attention to gender [9–11], race [12, 13], and the intersections between these [14, 15], prior work has only indirectly attended to neurodivergence within computing spaces [16] and intersections between neurodivergence and other axes of oppression [17]. Similar to narratives that deconstruct how race and gender shape power relations and marginalized individuals [18–20], neurodiversity paradigms [21] look to deconstruct the mechanisms that privilege certain ways of thinking and being over others, and assert the existence of neurodivergent individuals—those whose neurology operates outside normative expectation—and neurological variation as historic and biological facts [22–25]. Primarily, neurodiversity narratives have built from autism advocacy [26, 27], but recent scholarship [28, 29] and advocacy [30] look to broaden "neurodivergent" to other pathologized forms of neurodivergence (e.g., dyslexia, Tourette's syndrome, **Attention-Deficit/Hyperactivity Disorder (ADHD)**, **Obsessive-Compulsive Disorder (OCD)**, and communication disorders), and beyond neurodivergence as an identity solely held by White, upper-class boys.[1]

While neurodiversity narratives on a societal scope are explicit about which neurotypes are privileged over others [23, 24, 33–35], narratives surrounding neurotypes in computing are often implicit. Historically, dominant narratives [4] purported that one's programming ability was innate, rather than a learned skill [36], and potential programmers were diagnostically identified by their interest in problem-solving activities and their disinterest in people [37]. Similarly, recent discourses have emphasized the so-called "geek gene" [38], that those who succeed in computing have a "different internal wiring" than most in the population [39]. While the basis for intrinsic computing ability, either "different internal wiring" or a "geek gene," has been shown primarily to be instructor bias [40] and no test has successfully measured programming aptitude [41], the core of this belief seems to point at an inherent cognitive difference in computer scientists relative to the general population. This belief is waning [42], but prior work has found that computing is stereotypically perceived as a socially isolated practice, performed by White and Asian men who are obsessed with computers and lack interpersonal skills [7–9, 43]. However, to our knowledge, no prior work has examined neurotype legitimacy: how these stereotypes, beliefs, and narratives privilege certain cognitive differences, neurotypes and reward specific expressions of these neurotypes.

Therefore, using neurotypes as one's personal sense of their own neurodivergence[2] and neurotype expressions as the ways in which one's neurotype is presented,[3] we ask the following research questions:

—What neurotype expressions are legitimized in computing spaces?
—How do members of computing spaces relate their own experiences to these legitimized neurotype expressions?

Given the lack of prior work examining the legitimacy of neurotype expressions in computing, we chose to center our investigation on legitimacy across neurotypes. We incidentally attend to intersections between neurodivergence, race, and gender, but leave specific intersectional examinations as a focus for future work.

[1] A dedicated deconstruction of structural inequities within the medical system is well-beyond the scope of this work (though we offer pieces in Section 2.1). As with many other non-normative conditions, neurodivergent identities are given an official credence far more often to individuals who already hold structural power [17, 31, 32].
[2] Linguistically, prior work has utilized "neurotypes" to differentiate between autistic and non-autistic individuals, we broaden the term to include individuals who identify as neurodivergent—for instance, individuals that identify as having ADHD or have been diagnosed as ADHD—noting that, as with many other aspects of identity, one's neurotype is not a static construct, nor is the neurotype expression perceived by others.
[3] We point to discourses between gender identity and gender expression as an analogue.

2 Prior Work

As any landscape of oppression contains both those that are dominant and those that are dominated [44–46], the history of neurodivergence constitutes a fraught and complex space. The primary goal in this work is not to give a history of the ways that scholars and the academy have treated and continue to treat neurodivergent individuals as less than human: those resources already exist [e.g., 29, 35, 47, 48]. Rather, our goal is to utilize prior work for methodological guidance and to avoid well-worn paths of subjugation and manipulation.

2.1 Neurodiversity

Historically, work investigating interactions between neurodivergent people and society falls under disability studies. Similar to work within feminist studies that examines experiences of those marginalized due to their gender, or work within critical race theory that examines experiences of those marginalized due to their race, disability studies examines the experiences of those marginalized due to their ability. Critiquing "medical" models of disability that center an individual's physical condition, prior work articulates a "social" model that presents societal and structural factors as more central to the marginalization experienced by disabled people than one's embodied status [49, 50]. For instance, while medical models of disability frequently center biological and physical differences (*impairments*, when viewed negatively), social models typically focus on the forms of systemic oppression that manifest against those who are seen as impaired, and the ways that individuals are *dis-abled* through marginalization. Prior work seeking to improve the lives of disabled people[4] through medical models has typically been individualistic and focused on "fixing" an impairment; providing screen readers that enable computer use for those with impaired vision, or by developing cochlear implants for those with impaired hearing, as an example [51]. In contrast, prior work primarily utilizing social models [49, 50] has focused on systemic change over individual change; for instance, pushing for legislation that requires that public spaces be made accessible [52]. Social models of disability and subsequent postmodern and justice-centric models emphasize power imbalances between those with disabilities and those without, seeking to center the self-determination and agency of disabled people in deciding which courses of action are best suited to them.

Conceptually, the neurodiversity movement [21, 27] builds upon disability studies to question whether cognitive disabilities result from innate qualities of an individual, or from the structural harm experienced by moving through spaces designed for dominant neurotypes [23, 25]. Neurodiversity paradigms build from critiques of neurological normativity [53, 54] which frame psychiatric pathology and deficit-centric pathological framings (e.g., the Diagnostic and Statistical Manual of Mental Disorders [55]) as a mechanism for policing deviations from neuronormative expectations [56, 57], holding, as a central premise, that variation in neurological function is a natural component of human variation. Critiquing existing neurological medical models that utilize deficit-framings to pathologize variation, many proponents of neurodiversity paradigms do not view neurodivergence as an impairment. Rather, utilizing social models of disability, some argue that neurological variation is only a disability within a society that does not make space for those that fail to adhere to established norms [47]. Many neurodivergent individuals[5] do not view these norms as fact, but rather as a socio-political standard that creates power imbalances across neurotypes, imbalances that the neurodiversity movement seek to equalize [28].

[4]Used broadly; scholarship, activism, innovation, and policy decisions.
[5]While prior work emphasizes person-first language, some neurodivergent people reject it, arguing that they should not be required to remind people of their humanness [58–60].

Because existing neurotypes have primarily been defined through the medical model, the language used to define neurotypes tends to position difference as deficit. For instance, autism is officially defined as a "triad of impairments": deficits in social-emotional reciprocity, communication, and developing/maintaining/understanding relationships [55]. Much of prior autism theory has been dominated by "Theory of Mind" discourses: that autistic people lack a mechanism for modeling others as distinct from themselves, leading to a total lack of empathy and understanding [61]. Interventions centering the medical model often view these deficits as a disorder that requires a medical cure [30], but many neurodiversity advocates note that these "deficits" largely result from a mismatch between modes of communication and expression. Critiquing deficit-centric diagnoses, recent work notes that rapport between matched neurotypes (i.e., two autistic people or two non-autistic people) is rated significantly higher by participants and observers [62], and indicating that listening with verbal responses seems less important in interactions between autistic people [63]. Recent work also challenges "Theory of Mind" discourses, noting that prior work correlating empathy deficits and autism was largely based on cognitive tests that lack ecological validity, and that more ecologically valid measures have shown no empathy differences between autistic students and their non-autistic peers [64]. Current theory posits the "double-empathy" problem, that individuals with different neurotypes (autistic and non-autistic) will mutually struggle to understand each other [65], over prevailing associations between autism and communication deficits.

For all the epistemological issues with present diagnoses, a diagnosis is often still necessary to obtain institutional support, and receiving a diagnosis is an imperfect and fraught process. Autism diagnoses, in part, depend on behavioral deficits in social communication and interaction [55], and whether one fulfills this criterion is a largely arbitrary [26] and cultural decision [34], based on behavioral inventories that may trigger a patient or clinicians' own stereotypes of autism [26, 66] rather than an individual's experiences [67]. As neurodivergence stereotypes tend to favor those with otherwise dominant identities, namely, wealthy White boys [17, 33, 58, 68, 69], those that fail to fit these stereotypes are far less likely to receive a diagnosis [33, 70, 71] or to have their experiences seen as legitimate [66]. Further work has examined diagnostic measurements themselves and found them deeply pathological, commercialized, and "infected with Western colonial arrogance" [69, 72]. Moreover, symptomatic overlap between autism [55], Borderline Personality Disorder [73], Post-Traumatic Stress Symptoms [74–77], abuse and neglect [78], and ADHD [79, 80] create additional confounds that are left to the disposition of the diagnostic purveyor.

As existing diagnostic measures are framed in deficit [55], and stereotypes of neurodivergence are largely negative [33, 66, 81], many neurodivergent individuals are concerned with the stigmatization associated with their diagnosis or their behaviors. One's neurotype is often an invisible identity [82], thus those with non-normative neurotypes frequently engage in *masking* and *camouflaging*, consciously and unconsciously concealing neurodivergent presentations in order to avoid the stigma inherent in visibility [33, 83, 84]. Those who are neurodivergent are often placed in a double-bind [85]: either mask and experience the turmoil of a fractured self [58, 86], or present fully and experience the stigmatization that results from deviation [58, 87]. Over time, masking can result in a loss of self-concept and identity [33] and masking has been shown to predict lifetime suicidality [86], leading to 72% of autistic adults having contemplated suicide at some point [88] with the rates of suicide attempts among autistic adults triple those within the general population [84, 89]. As of this writing, masking tends to be more pervasive in individuals socialized as women [70], as well as individuals marginalized due to their race [17, 47]. Generally though, difficulties in obtaining a diagnosis, the problematic nature of neurodivergent diagnoses, the stigmas associated with neurodivergence, negative stereotypes of neurodivergent people, and the propensity for individuals to mask neurodivergent behavior (both consciously and unconsciously) lead prior work to suggest suspected rates of neurodivergence much higher than those reported by official diagnoses [17, 31, 47, 70].

2.2 Neurodivergence within Computing

Within scholarship centering technical innovation, prior work attending to neurotypes has primarily utilized the "corrective" lens of medical models [16], frequently seeking to shape neurodivergent individuals' behavior toward neuronormative expressions [29, 90], subordinating the needs of neurodivergent individuals in favor of the needs of caregivers, families, therapists, and teachers [48, 91], and discrediting and delegitimzing neurodivergent scholars [92]. Regarding social spaces of learning, prior work has found that computing is stereotypically perceived as a socially isolated practice performed by White and Asian men who are obsessed with computers and lack interpersonal skills [7–9, 43], which match the gendered, racial, and behavioral stereotypes of autistic people [58, 81]. Journalistic narratives connecting autism and computing are widely prevalent [32, 35, 93], and scholarly work has found that young adults diagnosed with autism are more likely to major in **Science, Technology, Engineering, and Mathematics (STEM)** generally and computing specifically [94]. Prior work has also found that a majority of autistic youth were reported to spend most of their time alone with screen-based media [95], aligning with prevailing perceptions of computing [8]. Though scholarly work tends to (a) utilize diagnostic measures without problematizing them [e.g., 87, 96], (b) sample from those who have already obtained a diagnosis without problematizing the means by which one obtains a diagnosis [e.g., 97], (c) utilize the medical model's "helping" model toward neurodivergent individuals [e.g., 98], or (d) stereotypically compare autistic individuals to computers [99], one can surmise some degree of alignment between the expectations imposed within computing spaces and "normative" autistic traits, as framed through diagnostic measures.

Given this, it is possible that individuals who fit societal assumptions and expectations of neuronormativity mask their neurotype expression to fit within computing spaces. Prior work has theorized about what would constitute a developmental or neurological disorder if, for instance, all 20 million autistic people were in one space [22]. Even without monolithic framings of autism, we might hypothesize about separate spaces collectively constructed by primarily neurodivergent individuals, away from neuronormative expectations [100]. However, as those that seek to leave conventional society can carry the imprint and policing of normative expectations into their separate space [101], we might expect norms of neurotypic policing to continue into this separate space, even among those who are openly autistic [17]. As those primarily permitted to claim both neurodivergent and computing identities are wealthy White boys, it is likely that this policing would uniquely burden those marginalized due to their race, gender, or class. Aside from those that leave computing due to lack of alignment with stereotypes, prior work has yet to wrestle with how discrepancies between one's neurotype, the neurodivergent expressions of others in computing, and the neurotypes and neurotype expressions legitimized in computing affect participation and belonging. Similar to the experiences of autistic individuals in neuronormative spaces, we might expect neuronormative individuals to mask and cover their neurotypic expression to fit expectations within computing.

3 Method

The astute reader is likely experiencing a pressing ennui: neurodiversity research is an inherently fraught subject that requires both care and humility. Broadly, it is critical that any research examining oppression and marginalization partners with (and, ideally, is lead by) those whose lived experience is situated within that oppression, and that no work is done about communities experiencing marginalization without members of those communities as stakeholders in the work [102–106]. To clarify: the first author of this work is autistic, the second a committed ally and PhD advisor for the first at the time of this work. We begin by offering our positionality.

First Author. When I entered computing spaces, I identified as a White, heterosexual, able-bodied, nerdy cis boy who was excited about video games and always had access to education;[6] the stereotypes and perceptions of computer scientists fit well enough that I had the privilege of ignoring them. I wasn't obsessed with computers, but I found joy in Vim, an unfathomably intricate tool with no other purpose than to edit text and thousands of options to be tuned to the user's preference. I have access to oral speech, but struggled to speak often enough that my parents doubted that I would be able to maintain any sort of conversation. I have rarely had more than a few friends, but I found deep affinity and community in computing, more so than nearly any space I've existed within. I am about as privileged as an autistic person can be, but I've learned to avoid explicitly describing myself that way, lest who I am or what I say be discredited or dismissed entirely [92]. Hans Asperger wrote that "Once one has learnt to pay attention to the characteristic manifestations of autism, one realizes that they are not at all rare."[7] I embarked on this project from a passionate curiosity [108], seeking to witness others' experiences in one of the few places that I have called home. However, I recognized that my history might lead me to project narratives onto others' experiences, thus I sought to temper my bias with others' perspectives, both in design and analysis. My experiences, both of privilege and oppression, are certainly not shared with all neurodivergent individuals, but through this work, I hold the care I necessarily developed from surviving in a world that did not allow me to exist as I am.

Second Author. My experiences in computing have been highly differentiated. Playing with code alone in my youth, I found its embrace of logic a bit silly and foreign, but saw its utility, and found joy in using this utility to make things that would bring others joy, particularly close friends and family. In this personal setting, computing was a form of play, art, and making, just as were the other media important in my life, including pencil illustrations, music, sound, and animation. Computing was also a convenient way for me to ignore my gender non-conformance, which, growing up in the 1980s, felt like something I both had to ignore and suppress in order to be safe and accepted. I found programming to be an excellent way to ignore my body. When I entered a post-secondary CS space, I expected to find others like me, but was surprised to find that very few were like me. Whereas I often saw computing as a means to an end, I perceived that many saw it as an end in itself. I was not sure if that was a difference in values, personalities, or minds. In parallel, I did weekly respite care with families with autistic children throughout college, and I saw many parallels between how the youth I cared for communicated and saw the world and how my peers in CS did. But I did not see those in myself, which often made me feel othered in CS. I came to this project from a stance of allyship, curiosity, and advocacy.

Our research questions centered perceptions of neurodivergence, and given the lack of prior work in this space, we intended a qualitative interview study across a few population strata to glean a breadth of perspectives in an otherwise unfamiliar domain. However, we required a mechanism for surfacing participants' perceptions. Although one mechanism would be to utilize existing diagnostic measures [55, 109], given the problematic nature of these pathological framings (see Section 2.1), we felt that exclusively utilizing existing measures would likely perpetuate medical models of neurodivergence. Thus, given a lack of suitable instruments or frameworks for facilitating conversations about neurodiversity, we sought to create a method for surfacing perceptions primarily informed by critical neurodivergence studies [32, 47, 68] and narratives from neurodivergent-identifying people,[8] using existing diagnostic measures [55] as a supplement.

[6]Clearly, this has changed—at the time of this writing, I identify as white, non-binary, trans, autistic and queer.

[7]We are aware of Asperger's Nazi affiliation, we follow Silberman's view [35] that critiquing the complex and twisted morality of individuals within "The Grey Zone" [107] is, at best, a murky and nebulous task.

[8]Drawn from several neurodivergent forums and subreddits: /r/autismtranslated, /r/autism, /r/autismmemes, /r/adhd, /r/adhdmemes, /r/neurodiversity, WrongPlanet.net and others.

From our analysis of existing literature and narratives, we construed neurodivergence as a series of axes. For instance, diagnostic criteria for both autism and ADHD delineate differences in attention, so we constructed an axis with one end tending toward hyper-focus (i.e., struggling to switch away from a single task) and hypo-focus (i.e., struggling to maintain focus on a single task), though in our view and from our experience, individuals are rarely defined by a single point along such an axis. Similarly, some ADHD narratives describe nourishment from messy, highly stimulating spaces, which directly opposed narratives from autistic people who sought contextual organization to reduce extraneous stimulation. We crafted axes emphasizing breadth (i.e., including any neurodivergent traits that could be positioned as a framing), then excluded several based on their lack of relevance to computing specifically (e.g., seasonal affect), their overlap with other axes (e.g., autism's purported "tendency to systematize" [110] fit within our framing of *details and systems*), and axes that are no longer accurate with respect to prior work (e.g., recent work has demonstrated communication deficits among autistic individuals are largely the result of a neurotype mismatch [62, 63, 65]), leaving the axes in Table 1. Prior literature and narratives also noted the deep joy and satisfaction experienced by neurodivergent people around topics of interest [55, 111, 112] (*interests* in Table 1), but as existing narratives did not describe a suitable converse to this, we opted to ask participants how they related to topics of interest, rather than represent with an axis.

We do not claim that this construal of neurodivergence is an instrument, framework, or theory, rather we sought to create a reflective mechanism that was accessible to both neurodivergent-identifying participants with deep expertise and non-neurodivergent participants lacking expertise. As with design probes [113] or cultural probes [114], our intent was to frame a potentially inaccessible conversation and catalyze insight that would otherwise be unavailable. From this work, our experience supports that limited use. However, as this framing had the potential to prime participants toward specific insights, we sought to only utilize the axes when necessary by (1) providing clarifications only when specifically requested, (2) avoiding the axes altogether when participants had sufficient expertise around neurodivergence (two participants), (3) modifying the axes when a participant felt that another construct better suited their experience (one participant), and (4) omitting participants' axes drawings from analysis altogether. Specific to the last, we note that these diagrams did not offer any additional information beyond the richness of participant transcripts, and we were concerned that their inclusion may lead future researchers to quantify qualitative data [115].

After developing these axes, we utilized them in pilots, quickly realizing that (1) each participant only had expertise in a subset of the axes, (2) this expertise was generally based around personal experience, and (3) considerable rapport and a grounding in a specific computing space were necessary for many participants to give substantive answers around the axes. Given this need to situate within a participant's expertise, we opted for semi-structured interviews, crafting a protocol (Table 2) to serve these objectives. Interviews began with a discussion of a participant's history of participation in computing, their perception of those spaces, and their affinity with others in computing (or lack thereof). Typically, participants mentioned a few of our axes during this discussion, if they did not, we emphasized that this work was examining neurodiversity in computing and asked what that meant to them, as well as reflections around that topic. After spending about half the interview discussing neurodivergence and computing broadly, we worked with participants to create an artifact for each axis mentioned.

Each axis was presented as a bell curve (see Figure 1).[9] For each, we labeled the extremes *in situ*, opting for playful euphemisms (e.g., "single-task yay") over pathologizing terminology

[9]Bell curves were a familiar representation for our participants, and prior work notes the distribution of autistic traits as bell curve [127], though when introducing any axis we noted that the specific distribution was unknown.

Table 1. Axes of Neurodivergence, Designed as a Reflective Tool

Axis	Hypo-Extreme	Hyper-Extreme	Discussed with
Attention	Easy to switch tasks, struggling to maintain focus on a single task [55]; *"Multi-Task yay!"*	Easy to maintain focus on a single task, hard to deviate focus from that task to, e.g. attend to basic needs (hyper-focus) [47, 72, 79, 116, 117]; *"Single-Task Yay!"*	P5, P6, P22, P28, P33, P36, P48, P54
Interests	Not represented with an axis	Not represented with an axis	P15, P22, P23, P27, P28, P33, P40, P48, P99
Organization	Preferring disorganization, organized spaces feel overly sterile and impersonal (some explanation from [47]); *"Organization Boo!"*	Preferring organization, order, and cleanliness, disorganized spaces feel messy and overwhelming [47, 118] (related to "visual clutter" in [47]), also tied to executive function [72, 119]; *"Organization Yay!"*	P5, P6, P12, P23, P73
Details and Systems	Easy and exciting to think about minutia and intricate details, thinking "big picture" is overwhelming or uninteresting (bottom-up processing, see [47, 120]); *"Details Yay!"*	Easy and exciting to think about how structures fit together, approaching details is challenging or boring [55]; *"Systems Yay!"*	P15, P47, P67
Routines	Routines are nourishing and necessary; novelty, spontaneity, and breaking routines might be especially uncomfortable ("normative" autism [55]); *"Same Thing Yay!"*	Novelty and spontaneity are nourishing and necessary, struggles to maintaining routines; *"Novelty Yay!"*	P22, P33, P48
Speech	Rarely speaking, preferring other modalities of communication, echolalia [55] (see etymology of autism); *"Speaking Boo!"*	Interrupting others, voicing answers before a question is completed, lecturing is easy, turn-taking is challenging (see infodumping) [47, 55, 111]; *"Speaking Yay!"*	P40, P47, P99
Feelings	Feeling differently, emotional response to event comes much later, sometimes not having the "right" emotional response in some setting, perceived as lacking empathy [55–122]; *"Feelings?"*	Struggling to not pick up on others' feelings, struggling to not internalize the emotional perturbations of others [47, 121]; *"Feelings!"*	P27, P72, P73
Sensory	Stim-seeking: frequent fidgeting, easy to filter out sensory input, enjoying cacophonies of sounds and being surrounded by sensory input [47, 123, 124]; *"Filtering Yay"*	Stim-sensitive: filtering out sensory input is challenging, loud noises/harsh lighting might cause distress, deep comfort from some sensations [125, 126]; *"Sensory Yay!"*	P28, P67, P72

Labels used with participants are in italics. We cite sources used for grounding and inspiration.

(e.g., "hyper-focus"), as stigmatization and oppression seemed to increase toward an extreme. We then asked participants to label themselves, their perception of the distribution of others in computing, and their perception of those legitimized within computing (i.e., those who not only survived, but thrived within computing). Participants could label with a single point, several points, a range, or a distribution; we emphasized that one's neurotype is shaped through prior behavioral reinforcement [128], one's trauma history [74, 75, 129], and self-regulatory strategies [128], and that one's understanding of one's neurotype, and others' neurotype expressions can change over time [130]. We encouraged participants to push back if either the axis or the extremes failed to match their own conceptions, and we adjusted to accommodate requests however we could. As the construal of neurodivergence we developed was intended only as a conversational tool, we focused on the congruence or contrast that participants experienced between their neurotype and their perception of others' neurotype expressions in computing spaces over participants' specific placement.

We designed our interview to be conducted in English and multi-modal: participants less inclined or able to participate in a synchronous interview could participate through an e-mail exchange,

Table 2. Interview Protocol

Consent	*You have consent and agency in this space, and that's a continual process, you can leave at any time, you don't have to be nice about it. I'd also like this to be enjoyable, if you're bored, uninterested, or don't feel like you're getting anything out of this, that's really helpful to hear.*
Data usage	*No one will know who you are but me, analysis will be shared with the research team, and we may quote you in a future publication.*
Definitions	*This work is examining neurodivergence: all brains are gorgeous, but they're not all treated that way, and we don't have great conceptions of how they're different. We're situating into computing spaces; spaces where computing is the primary practice—typical spaces like CS degree programs and industry jobs, but also coding bootcamps, after-school classes, any space where folks are primarily practicing computing.*
Intro	*Can you tell me a bit about yourself? Can you tell me about the computing spaces that you've been in? What were other folks in those space like? Were there ways you were expected to be in that space?*
Optional	*In the survey we sent out, you said you (identified as neurodivergent), can you tell me more about that?*
Axis	*We don't know much about how brains are different, and it's a bit reductionist, but let's say that folks are distributed on a bell curve. Most folks would be in the center because that's how bell curves work, but also, society tends to smush folks toward what's considered normal.*
Example with attention	*Some folks are really, really good at focusing on one task, and really struggle to switch away from that task, let's call them "single-task yay." Conversely, some folks are really, really good at switching between tasks, but really struggle to maintain focus on a single task. That doesn't mean that they don't get anything done, it might just mean that they're rotating between several tasks throughout the day instead of exclusively focusing on one. And, most folks aren't just one point on this, we can regulate ourselves, we might feel differently day to day, and all is affected by how we were socialized, trauma experiences, and frequently changes over time. Does that make sense?*
Placing self	*I'm curious where you are on this. It can be a single point, a series of points, a range, a distribution curve, really whatever fits you best.*
Follow-up	*I'm seeing that you're somewhere between..., am I understanding you?*
Perception	*I'm not looking for objective truth, just how you see the spaces that you're in. I'm wondering if you draw how you see other folks in computing spaces are along this? (then, follow-up to check understanding)*
Legitimacy	*So, there's how everyone here, and then there's the folks that not only survive but thrive, folks that have never had to question whether or not they fit in computing spaces. Where would you place them on this? (follow-up to check understanding)*
Comparison	*Ask how difference (if any) between self-perception and perception of others feels, and how the difference between self-perception and perception of legitimacy feels.*

though no participants selected this option. To avoid participant discomfort, the first author openly identified as neurodivergent broadly within our recruiting survey, but only disclosed the label "autistic" if participants asked or disclosed their own neurodivergence. This selective disclosure of an invisible identity [82] was our attempt to balance the benefits to participants with neurodivergent identities [131] against the threat of delegitimization upon disclosure.

Typically, work investigating power relationships would seek to uplift perspectives of those marginalized within the relationship, as perspectives of those dominant within the relationship are likely pervasive. However, though stereotypes and journalistic accounts of dominant neurotypes in computing point toward legitimization of "normative" autistic traits, the lack of prior scholarship requires a degree of skepticism toward these narratives. We sought both neurodivergent-identifying

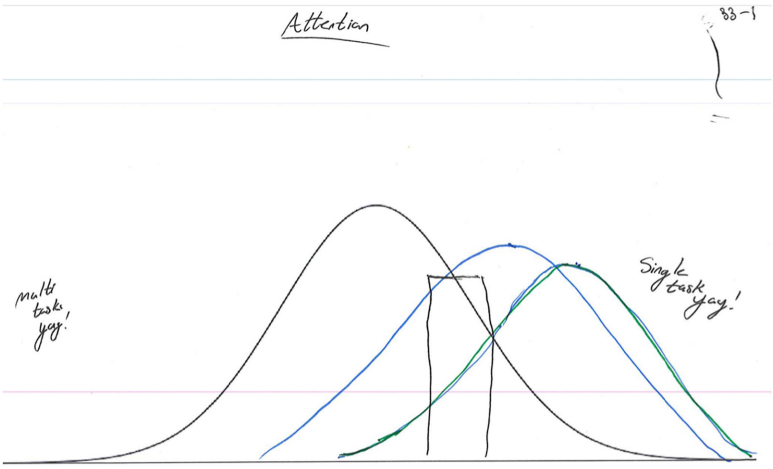

Fig. 1. An attention axis from an interview. We began with a blank bell curve and noted that individual neurodivergence varied around attention and that the distribution likely modeled a bell curve. We then labeled the extremes ("single-task yay" and "multi-task yay"), with the explanations in Table 1. We asked participants to label themselves first (a black rectangle somewhat toward "single-task yay"), then how they perceived others in computing spaces (a blue curve centered further toward "single-task yay" than the bell curve), and how they perceived those legitimized within computing spaces (a green bell curve, even further toward "single-task yay"). Afterward, we asked participants how the contrast between themselves and others felt.

and non-neurodivergent-identifying members of computing as participants, and recruited students, industry professionals, and faculty. As diagnoses are an inherently problematic criterion for selection, we opted to let participants self-identify as neurodivergent in our recruiting survey. We excluded participants who had been members of a computing space for less than a year, otherwise, we sought to gather a diverse range of perspectives across the strata above. We sought Institutional Review Board approval before contacting any participants, and this work was given an exemption,[10] though we treated participant disclosures as non-sensitive health information regardless.

We focused our recruiting within two spaces: the CS department at our institution and industry positions within the region surrounding our institution. We recruited through posts to slack channels, e-mail lists, and social media, recruiting both neurodivergent and non-neurodivergent participants from each of the three population strata (see Appendix A). Our recruitment survey asked about participants' neurodivergence status, and unfortunately, there was a stark lack of interest from non-neurodivergent industry participants. However, given that non-neurodivergent individuals generally lack expertise around neurotypic expressions [17, 23, 65, 66], we felt that we had sufficient coverage from our existing participant set. To include more participants and to protect anonymity, we relaxed our institution-specific criterion for faculty and students (some students and faculty had recently left our institution), but we did not send out recruiting calls beyond our institution.

From these recruitment efforts, 38 individuals completed our screening survey. We reached out to every eligible participant to sign up for an interview slot, 21 individuals chose to participate, and participants chose their own numeric identifiers. We report demographics in the aggregate to protect participants from identification. In terms of gender, nine participants identified as men, eight as women, two as non-binary, and two participants identified as either "agender woman" or "woman-ish." We did not ask for participants' sexuality or transgender status, though two participants

[10]That is, still governed under our university's human subjects research policies, but viewed as low-risk to participants.

identified as transgender, five as queer, and two as questioning during our interviews. In terms of ethnicity, seven identified as Asian, Asian American, Taiwanese-American, or Vietnamese, six identified as White/Caucasian/Northern European, four as Jewish, one as Filipino, two as Indian or South Asian, one as "Middle Eastern with light sprinkles of Malaysian and other heritages," and one as Persian. To ensure that both non-neurodivergent and neurodivergent participants were included, our screening survey asked participants' neurodivergence status: six participants had obtained ADHD diagnoses or identified as ADHD, two suspected they might have ADHD or were questioning, three obtained autism diagnoses or identified as autistic, two suspected they might have autism or might be autistic, one noted that "Slow Cognitive Tempo" fit, and one identified as having OCD. Our interviews were intended to last an hour; in practice, interviews were between 23 and 84 minutes, with an average of 53 minutes, and 18.5 hours of data were collected in total.

While our institution is generally tolerant, disclosing invisible identities is inherently risky, especially identities that overlap with health records. To protect participant identities and neurodivergent statuses, we chose to have the first author exclusively run interviews, clean transcripts, and analyze the entire dataset. The first author began the analysis by correcting automated transcripts and removing participant identifiers, performed concurrently with interviews. They noted emergent themes between participants while conducting interviews, and after the interviews were completed, they read each transcript to refamiliarize themselves with the data and create a set of initial codes. Coding followed thematic analysis techniques [132] while stratifying across the axes discussed. As some participants were comfortable articulating their experience without scaffolds, not every interview utilized the axes, and some axes were utilized more than others. The data were first inductively coded for participants' identification within an axis, perceptions of neurotype expression prevalence and legitimacy, and participants' relationship between identification and their perception of computing, emphasizing semantic meaning over interpretation. Then, the data were deductively coded for themes aligned with prior literature (e.g., masking, belonging, stereotypes, labels of self-description) and inductively coded for emergent themes, merging, modifying, and removing codes to clarify themes. We emphasize that our goal was to generate claims for future research rather than verify the objectivity of our own claims, the latter would require multiple coders and inter-rater reliability [133].

Methodologically, this maximized coherence between data collection and analysis, in line with recent work [58], but risked a greater potential for bias in our results. To mitigate this bias, the first author provided the second author with a majority of the transcripts (16 out of 21, 76%)[11] after these themes were developed to perform a critical read. The second author read this subset, noting themes within each theoretical frame developed by the first author. They then looked for context and contrast between what the first author reported and their own notes. As participants' axes drawings were not treated as data, the second author did not have access to these, but the interview context was sufficiently clear from the transcript. While the second author read the first author's interpretations before accessing participant transcripts, which may have influenced their view of the data, they approached analysis with an explicit goal of disproving claims made by the first author. Both authors then met to discuss contrasts and resolve disputes between interpretations; disputes were strictly based around context that could be added for clarity, or contrasting participant voices that weren't present. No interpretations were fundamentally challenged, but several points of nuance were added to offer greater context and participant voice, and the final themes represent a grounded consensus between both authors. We also member-checked both the final themes and quotations with participants; all that responded and had capacity to review the results (9 out of 21)

[11]Some participants did not respond to our request, some had existing relationships with the second author and feared deanonymization, even with a redacted transcript.

validated the themes and a few (2) provided missing context and corrections so that the results better fit their experience.

4 Results

Given well-established stereotypes surrounding neurotype expressions in computing (Section 2.2) and that readers' stereotypes were likely triggered by the title of this work, readers with prevailing biases might be drawn to view those legitimized in computing, or the traits that those individuals exhibit, as "autistic." However, rather than utilize problematic diagnostic lenses of interpretation that give little space to attend to experiential nuance and remain ripe for misinterpretation, we set aside diagnostic language in favor of more fluid granularities. With that, this work contributes three findings: (1) *Legitimacy*: that computing spaces legitimize a particular and narrow pocket of neurodivergence, that lies outside of neuronormative expectations, (2) *Masking*: that those outside this pocket, neuronormative and neurodivergent, masked their neurotype expressions to fit expectations within computing, and (3) *Refuge*: for those legitimized, computing spaces were spaces of refuge against broader societal delegitimization. We frame these findings first through the subset of the axes for which there was a clear demonstration of legitimacy within the data we collected (in service of RQ1), and subsequently through participants' broader experience, referring to participants by their chosen numerical identifier (e.g., P-18), and by utilizing participants' own language for neurodivergence when possible, centering agency around diagnoses (i.e., "obtained a diagnosis" rather than "diagnosed as"). Again, we do not consider the axes to be a validated framework, we present through them as a way of giving voice to cross-sections of experience, understanding that these sections both overlap and do not constitute a whole. Notably, neurodivergent-identifying or otherwise, many participants noted that it was easier to notice aspects of neurodivergence in others that they viewed as a deficit for themselves.

4.1 Interests

One aspect of neurodiversity addressed by conventional diagnostics [55], emergent literature [47], and personal narratives from neurodivergent people are *special interests*: topics of deep passion and nourishment. Special interests are traditionally associated with autism [55], but this criterion has been problematized [47] to where special interests should be considered as aspect of neurodivergence more broadly. As individuals within computing are stereotypically perceived to be singularly obsessed with computers [7–9, 43], a lens of neurodivergent special interests was warranted.

4.1.1 Legitimacy. Throughout our interviews, participants largely agreed that computing legitimized individuals who held computing as a special interest and measured their own interest in computing against the standard of special interests. Computing interests were expected to be exclusive; every participant that noted personal interests outside of computing felt that those interests couldn't be brought into computing. P-15, a student who did not disclose any neurodivergence, identified that this stereotype forced them to change how they presented themselves:

> *It feels like it's there, like, a stereotype that you have to fit into to be part of the space. And so, when I'm outside, like, I have a lot of different interests. Like, I play the piano, and I like watching different kinds of shows…like, I don't do like programming or anything for fun. That's like a strict, like, work/school kind of thing. So when I'm in the computing space, I feel like I have to display myself as being interested in computing and like, yeah, like it kind of goes back to like, proving that I'm belonging kind of thing. Um, and so it feels like- like some sort of like context switch that when I'm in a computing space, I feel the need to act more interested towards computing in a way*

or act more, like, computing focused? Even when it's, like, a social scenario versus a actual, like, computing typical kinda situation. (P-15)

After hearing this, we shared a description of masking and asked if that fit their experience, to which they responded:

Exactly, it feels like you have to…perform to make people recognize or accept you. (P-15)

Another student who had obtained an ADHD diagnosis identified several existing special interests in their life. However, they felt imposter syndrome in computing, unsure if they actually liked CS because their interest in computing wasn't a special interest for them:

Particularly in music theory things…I can just, like, sit there and go on for hours about that. But I can't do that with CS. It's like, I can't- like, I feel like I can't go on about CS but maybe it's like, only specific to- like, when I'm around other CS people. But may- I have noticed that if people don't know things about CS, I can do it. And I- it might just be that like, like a subconscious thing of other people know more than me, so I don't want it- I don't want to go on about it. (P-28)

4.1.2 Masking. While P-28 felt that their interest in CS was insufficient, others masked legitimized interests in computing. Two faculty members, P-99 and P-67, noted that aspects of their interests fit within computing, but were concerned about the harm that might come from reflecting those stereotypes, opting to hide that aspect of themselves. One mentioned an interest in video games:

But I rarely try to bring that up in computing because of the stereotypes that we think about with, like, all CS people are gamers. As a teacher, I don't want to reflect that stereotype. So that's- sometimes I have to hide that, because I think that's actually better overall (P-99)

Indeed, most participants who discussed interests felt that special interests were canon, noting how conversations seemed to always turn toward some computing career topic (P-12), that course staff sharing non-CS interests broke expectations (P-33), and that non-computing interests were legitimized based on their proximity to "traditional" computing (e.g., favoring Rubik's cubes over artistic shading (P-22)). Participants felt that interest masking was prevalent: one faculty felt that most students' interest in computing was derived from the field's career prospects, rather than an intrinsic interest in computing:

I feel like a lot of students don't have a genuine interest in being here…I can't remember the last time I've had a conversation with a student about an interesting idea or that we're talking about something in class…It's all "I lost this point. Can you tell me why I lost this point?" and all of this, just, meaningless stuff. (P-99)

Furthermore, some participants connected industry expectations to have computing side projects to special interests; P-99 noted that students' engagement in side projects was often performative:

They don't actually care about the calculator they wrote in Haskell. They wrote it, because they thought it made the resume look better. (P-99)

One student who suspected they were autistic noted that while they didn't find themselves masking socially in computing, they felt they had to mask non-normative career pursuits (P-11), and an industry participant corroborated the need for side projects to get a job, reinforcing the legitimization of a deep interest in computing:

Like, it's not uncommon to go into interviews and [be asked] 'Oh, well tell us about some of your side projects.' Well, I don't have any side projects, because this isn't my hobby. And that's seen as

> *like a negative. And so there's like, a lack of separation there that happens. That yeah…my job isn't everything to me. (P-27)*

These experiences were primarily within CS; participants also noted that non-CS computing spaces required less masking due to the diversity of career goals present (P-12, P-22).

4.1.3 Refuge. The majority of participants felt a lack of fit computing's legitimization of special interests, but a few shared experiences of refuge. Many narratives around special interests emphasize the need to tone down, or otherwise mask one's interests, lest they be perceived as weird or annoying [47]. However, within computing, these interests were uniquely encouraged. P-48, who identified as autistic, shared a contrast between computing and societal spaces:

> *So in most cases I am myself in a computing space. Sometimes you need to tone it down for other people. Like they don't care what a binary tree is…But I found that the reason [computing] is a shelter is I am able to finish my sentence. And I don't get the air in the room from the other person that thinks I am from another planet. (P-48)*

Others recalled so much initial excitement around computing that they were reading textbooks for fun, despite hating reading (P-47), or that they still, after decades in the field, found themselves "*laying on a beach on a so-called vacation with a textbook for fun*" (P-23).

4.2 Attention

Individuals within computing are largely stereotyped as preferring solitary spaces free of distraction, coding for hours at a time, skipping meals and forgetting to sleep, all of which aligns with narratives around "hyper-focus." Hyper-focus is diagnostically associated with both ADHD and autism and associated with "task inertia" or "activation energy": starting a task can be challenging, but once "the ball gets rolling," individuals struggle to stop until a task is complete [47].

4.2.1 Legitimacy. Participants generally agreed that computing legitimized neurotype expressions prone to hyper-focus, succinctly put as "*Coders are some hyper fixating pieces of shit*" by an industry participant who obtained an ADHD diagnosis (P-6). Furthermore, hyper-focus was purported as a necessity, from an industry participant who identified as neurodivergent:

> *What's important to an enterprise is, is this work. Because if you can think really clearly about a problem, you can completely alter, the chance of success and the ability to navigate risk of an enterprise. There's no amount of people you can throw at a problem and no amount of process that you can create that's a substitute for a person, or a small group of people, working really deeply on a- on a problem. And this is the this is what justifies the big bucks. (P-36)*

Many participants resonated with descriptions of hyper-focus, identifying with our description upon hearing it. Hyper-focus was rarely viewed negatively; participants described hyper-focus as "*like inhabiting a cozy room…but it's entirely abstract*" (P-36) and others sought to make their work space cozier and more amenable to hyper-focus (P-84), though one student who identified as autistic noted that "*above a certain point, you get into trouble*" (P-48). Similarly, a student who identified as ADHD felt that they could multi-task on many things, but they needed singular-focus for coding (P-28). Participants' experience of hyper-focus was closely tied to topics of interest, especially special interests. One student who suspected that they had ADHD identified as someone who, with enough topic-interest or deadline pressure would "*be absorbed in a single task*" and would "*skip meals and not shower and be a hermit*" (P-33). When we described hyper-focus as *"single-task yay,"* they offered:

I think the expectation, and the sort of, like, the cultural expectation, which is interacting with my perception, is that if you are in CS, you pretty much have no life, and you just sit at a desk all day long and go with the "single-task yay" idea. On a more practical, realistic level. I think CS students multitask a lot. But I think they prefer to single task, they prefer to just get lost in that one program they've been debugging for three days. (P-33)

4.2.2 Masking. Broadly, hyper-focus was described as inherent to problem-solving within computing, and participants who found hyper-focus less accessible critiqued the ableist expectations and requirements to exist in computing. An industry participant recalled their undergraduate exam experiences that required code-tracing through a recursive function:

For some people, like, they can really bang it out and focus on it. Some people, like, they're not bad, it just might take them longer. And so one of the things that came up at some point, which is like, are we really, like, doing a disservice to some people by kind of demanding that they do this in a really short period of time, when it's just like, not…when it's attentively very challenging, especially during an exam? And that for me a little bit reinforces the like, people being more [towards hyper-focus]. I guess, I would imagine people who are more [towards hyper-focus] having an easier experience on a question like that. (P-22)

Expectations of hyper-focus extended outside of introductory assessment: one faculty member who identified as "*definitely ADHD*" easily hyper-focused on tasks of interests (coding for 14 hours straight during the week before our interview), but struggled to maintain focus on "boring" tasks (e.g., reading papers, or attending meetings). Alongside hyper-focus, maintaining focus on "boring tasks" was required to persist in computing. They recounted their experiences in faculty meetings describing graduate exams requirements:

So, by the time, you know, you've passed [the doctoral qualifying exam], you should be able to, you know, sit through a talk at a major conference and understand everything. And I heard a similar- similar quote about papers. And I'm like, you know, what if you get distracted, and go off and do something else for a few days, and then you don't remember what happened on page six, because like…you can always pull up the page six and look at it. And it's like it, it just never entered their mind that that people work so differently from them. But I think it's obvious to me because I come in from the other side of things. (P-5)

For them, persisting in computing required both hyper-focus and an ability to "focus on boring things," and that both were so deeply legitimized that, at every stage of the process to becoming faculty, those who couldn't fit computing's expectations for attention were filtered out.

In college, I think there were enough people who were different, and then even through grad school, but like grad school and the pandemic, like several of my ADHD friends dropped out, a lot of them weren't diagnosed yet. They got diagnosed after they dropped out, or they got, you know, fired by their advisors or whatever. I think what bothers me, I think a lot of people, with the way my brain works, are attracted to research and can be really good researchers. And so you end up with over representation at the beginning, followed by dropping off, dropping off, dropping off until it's like, I would guess underrepresented by this point if you're at the, like, especially at the faculty level, and that- that really bothers me. Because it's just- it's just so unnecessary. (P-5)

4.2.3 Refuge. However, similar to special interests, computing's legitimization of hyper-focus offered unique affordances unavailable within society broadly. For one industry participant who identified as autistic, computing's legitimization of hyper-focus was historic:

I think computing comes from a very, like, interesting background, and that for a long time, like it was a space for folks with like a hyper focus, to be able to, like flourish in that when it didn't flourish in like social situations, or, you know, in other areas of their life. And like, we continue to reward that. (P-27)

Another industry participant who obtained an ADHD diagnosis remarked that individuals legitimized in computing were particularly susceptible to "nerd sniping" [134], but that this wasn't inherently bad:

I think back to some like stereotypes about people who it's just like, they seem very apt to get on one topic, and then spend a long time going after that topic. And like, like, I feel like that's in part like a stereotype in computing that's bad, but also like a legitimate experience for people who are like, neurodivergent in the space. (P-22)

4.3 Organization

We are unaware of prior scholarship that clarifies stereotypes around organization, though requiring organization to reduce stimulation and aid executive function is established within neurodivergent narratives [47], and some ADHD-identifying individuals attribute organizational struggles to their neurodivergence.

4.3.1 Legitimacy. One participant noted that computing people "*like efficiency and organization…more than the average bear*" (P-6), but most participants that discussed organization noted that computing work inherently required organization and that disorganized thought was delegitimized. One faculty member noted that "*we're literally taught to organize code and think hierarchically about the world*" (P-23), and recalled prior experiences hating tasks that required high organization (e.g., mathematical proofs), but eventually conformed to organizational expectations:

[laughs] you need to conform to work with other people. And you cannot contribute to a code base, if you're not willing to write organized code. And if you refuse to fit in, to a system that other people have agreed to work in, that's not going to go very well. And I imagine yeah…it'd be impossible to continue, I think, if you refuse to accept that structure…You can change the structure, but you need to conform at some point. (P-23)

Another faculty member also viewed organization as inherent to computing's culture of abstraction:

All the reading I've been doing with, like, cultures and infrastructures of abstraction, you're talking about this idea encoded in the field is like, we have to organize things in order to build bigger things. (P-73)

4.3.2 Masking. Given organizational expectations within computing, participants who identified toward "organization boo" struggled within computing. One industry participant who obtained a childhood ADHD diagnosis felt that organization was required to persist and, not having that, they survived because of their work ethic (P-54). Additionally, a student felt that they needed to mask their organizational struggles:

I think like, I definitely struggle on my day to day job as a researcher as a result of some of my, like, ADHD symptoms. And so I've had previous experiences where I had research mentors be like, "Oh, you need to go faster.". Like, I don't know how to tell him like, Yo, like, I just really cannot…it feels like moving a mountain. And I think there is this, like, lack of openness or, like, knowing what I can say to people makes it really hard for me to be, like, so the reason why I'm

not performing up to my own standard, to your standards, because like, honestly, I just really struggle with like executive function sometimes. (P-47)

Similar to Attention, participants also noted that while computing norms skew toward organization, too much organization might not be valued (P-23) and might interfere with industry priorities to ship software (P-6), though one student who identified as "organization yay" felt that one's level of organization didn't matter in computing (P-12).

4.3.3 Refuge. While we did not find that computing spaces uniquely offered refuge to organizational neurotype expressions, one participant felt that their degree of organization was very validated (P-73) and another noted how their affinity for hyper-focus compensated for their organizational struggles:

So I've creating my own set of tools for a very long time. So it's like, oh, I need to be organized, Well, that's not a fucking thing for me, right? I didn't even graduate high school. I haven't been to college a day in my life. And I worked at COMPANY for 20 years. Why? Well, it's probably because of my work ethic. It's it's a double edged sword, but it's a superpower. Like, I remember clearly people at work were like, oh, we can't figure it out, well, let's just look at it tomorrow. And I'm like, no, no. I'll just stare at it for four- three or four days...like, if I'm interested in something, I see that as a differentiator, because I can stay focused, you know, like, I don't need sleep, like meals just fall by the wayside. (P-54)

4.4 Beyond the Axes

We originally crafted axes of neurodivergence as a tool to catalyze a richer conversation with participants with less expertise, but many participants had enough expertise that the axes were unnecessary, and it was sufficient to talk broadly around computing and neurodivergence. We discuss their perspectives below.

4.4.1 Computing as a Refuge. For many neurodivergent participants, computing spaces offered shelter from societal delegitimization of their neurodivergence. One faculty member who obtained an ADHD diagnosis described their experience working at a big tech company:

I think a lot of the culture is designed around neurodiversity honestly like, the free food. That's just like, you don't even have to think about it, you just go and show up and get some food and then go back. All the meetings are like 30 minutes by default...and like the communication style that they default to is like, kind of like all tiptoeing around rejection sensitivities[12] [laughs] Yeah, I think it looks to me like a bunch of like neurodivergent people just designed this maybe without knowing what they were doing [laughs] Which is kind of maybe refreshing. (P-5)

Several participants also described the flexibility offered in computing as friendly to neurodivergence; one industry participant (P-27), for instance, described their "*uneven attention*" (some days with "*zero productivity*" and some days "*productive on a tear*") within the flexibility that computing offered[13]:

I mean, I've talked about leaving computing, but in some ways, I'm like, this feels like the only thing that I could do because it's so flexible...[on] a day where like, the news sucks or something and I'm like, I don't want to do stuff today, like, you know, in any other job really, you can't really

[12]Rejection Sensitivity Dysphoria is characterized by severe emotional pain following a rejection or failure and estimated to affect 99% of adults and adolescents with ADHD [135].

[13]We include this data here, rather than in Section 4.2, as this participant was refuged by computing's expectations, but not specifically by the *hyper-focus* expected within computing spaces.

say that. So [computing's] so competitive and I'm not competitive, but at the same time, it's like, could I do anything else with the way that my, like, attention span works? (P-27)

Two autistic-identifying participants, though, were particularly grateful for the existence of computing (P-48, P-84). For one, after their family lost everything financially, one student became the breadwinner, making websites for small businesses to sustain themselves as an immigrant and eventually a refugee (P-48). They often struggled relating to family members and other individuals broadly, but found precious connections in computing:

This- this is a safe space…I'm getting emotional as I'm talking. It's not just that it's a place for like, we have shiny computers and we do crazy things. It's- it's a lot of people who have, I guess, this yearning for absolutes, but at the same time, they can talk at a specific frequency and, you know, let others communicate (P-48)

Another described childhood experiences waiting for computer time at the public library to work on their websites (P-84). Computing gave a unique space for them to exist and thrive, even with otherwise marginalized identities:

I have only the best feelings about computing. This despite all of the kind of, you know, being an immigrant or being like a girl or whatever, like it wasn't necessarily easy, but like, I have always felt understood and loved and like- like I could contribute and, like, connect meaningfully with people around things. And it was like always, like, a space of curiosity and, like, immense power. Like, it was like literally, the limiting factor is what I can imagine. (P-84)

4.4.2 Intersectional Inclusion. While we would typically be wary of giving an entire section to a single participant, both P-84's experiences (coding from a young age) and identity (trans, non-binary, autistic) gave them a unique perspective on the field that, to our knowledge, has yet to be made visible within scholarship. For them, computing was an artistic practice that accommodated their autistic identity, and they viewed the prototypical coding "basement" as an autistic refuge where they could explore while having their needs respected.

As a creative endeavor, [computing] is autistic in a way that other creative endeavors aren't…I go to creative coding [spaces], I'm like, Y'all are great. I love you. I love this for you. But I need to not be here. Because all y'all are resonating on a different wavelength. And, like, this is actually not for me, and like, I understand that you feel gate-kept from my basement, and I'm very sorry for that. But I feel gate-kept from here. But I'm not going to tell you about that. Right? (P-84)

Their established position within computing gave them many opportunities for mentorship, often encouraging other femme-identifying individuals to remain in computing careers, even if they felt that coding might not be the best fit. Throughout our interview, they recounted several points in their careers where men in positions of power told them "you are not a coder" and were adamantly against replicating that harm in their mentoring relationships, but, if asked for advice, they would occasionally recommend that individuals avoid coding specifically, but explore computing generally:

I have a sense within five minutes of talking to somebody. And so far, it has not been wrong, even though I feel like I have taken it in grace, which is you are not a coder. And the thing is, I know how it feels to hear that. I will not ever say that. But the thing is, it's true.…They just don't seem robust to a certain kind of frustration. This was the autistic thing, like, I can't put the idea down, right? Like, it's a whole discipline to learn how to put an idea down. (P-84)

P-84 originally came to computing identifying as a woman, and involved themselves in a variety of STEM outreach activities for women throughout their career. While our interview focused on

their neurodivergence, their gender identity was inseparable from their autistic identity, and so we made space for that discussion as well:

> *For me being a "woman in STEM" is not really about internal experience of gender; it's an appointed position. When someone, often a man who holds a position of power and is trying to be nice, comes up to you at a networking event and says, "so, how does it feel to be the only girl/woman in the room/workshop/etc?", then you are a "woman in STEM." It's often a well-intentioned thing, and that makes it worse, because then you feel the need to play along like it is well-intentioned, so you can maintain the relationship, and keep this ally an ally. The playing-along is particularly difficult for neurodivergent people, extending beyond micro-aggression[14] into a persistent energy sink. (P-84)*

Given this intersectional interplay, and their prior involvement in outreach efforts, they were critical of efforts to expand CS inclusion:

> *A lot of women go into computing, because there is an effort to include more women in STEM. But that results in a lot of people really holding on by their teeth to these roles that are A) frustrating because the work is intrinsically frustrating. But B) frustrating because when many organizations fear feminine competence and competent femininity, and fail to take feminine voices seriously. And if a person can't even find solace in the work it is very stressful. For me, watching people dissolve in that stress is horrible…In retrospect, I worry that a lot of outreach, which I did in undergrad and grad was deeply counterproductive, because it would get people who actually are not happy with the work. We did get also a lot of autistic students who wouldn't have been diagnosed with anything because there's a big problem generally in recognizing autism in people assigned female at birth. So there's a lot of good that came from it as well, but it's not good when it makes some people hang on to careers that don't work for them, when they stay in them to prove that they can, even though the work itself brings them no joy. (P-84)*

5 Discussion

We contribute three findings: (1) *Legitimacy*: that computing spaces legitimize a particular and narrow pocket of neurodivergence that lies outside of neuronormative expectations, (2) *Masking*: that neuronormative and neurodivergent individuals outside this pocket masked their neurotype expressions to fit expectations within computing, and (3) *Refuge*: for those legitimized, computing spaces were spaces of refuge against broader societal delegitimization. Across the axes presented in this work, computing spaces legitimized hyper-focus, special interests, and high organization, gate-keeping participants who failed to meet these neurodivergent expectations, and forcing both neuronormative and neurodivergent participants to mask their neurotype expressions to fit in. We note some alignment between legitimized neurotype expressions and computing stereotypes,[15] however, much nuance exists: computing is not the only space that legitimizes and rewards neurodivergent expressions (neurodivergent expressions are rewarded everywhere from sales to artistry [47]) and stereotypic alignment is not a requirement for entry into a space. Nevertheless, our results demonstrate some cohesion between neurotype expressions within computing (as perceived and experienced by our participants) and diagnostic profiles of "normative" autism (a socially

[14]For clarity, those with dominant identities can make statements, as above, that both emphasize one's marginalization and, as receiving such a statement is far from a commitment to allyship, frequently demand performing politeness or gratitude, or shuttering one's resentment to avoid escalating a situation. This performance additionally requires neurodivergent individuals to mask their expressions to fit the situations' expectations.

[15]Though, we would argue that "lacking interpersonal skills" is more likely the result of a mismatch between neurotypes or communication preferences [65].

constructed and arbitrary standard that few autistic people meet completely and many non-autistic people meet partially [71]).

We also found that, despite participating in egregious hegemonic oppression and repression, those legitimized within computing may have aspects of identity that are marginalized outside of computing. We see a possible parallel to first-wave feminist movements that advocated for justice for those marginalized along some aspects of identity (namely, cis-gender and gender-conforming women), but not others marginalized due to their race, class, sexuality, or ability. In doing so, these movements became spaces of both justice and violence, where justice was only accessible to the those least marginalized. Within computing, we found that some neurodivergent expressions were legitimized and found unique refuge from societal expectations, but this legitimization was narrow, minoritizing those who expressed neurodivergence outside this legitimization. This need not be inherent—computing culture should certainly change—but efforts to change computing culture may encounter fears that one's only shelter is being eroded. While other neurodivergent-dominant spaces surely exist, for many of us, computing is the only space, or perhaps the first space where we did not need to bend our backs to be understood.

This work also raises implications for inclusion efforts within computing. For decades, stereotypes of what it means to be a computer scientist (often with a neurotypic implication) have been demonstrated to discourage minoritized individuals from participation [8, 9]. These stereotypes are not canon, but for some they might signal a rare safe space for self-expression. Furthermore, prior work emphasizes that many aspects of computing's cultural toxicity seeks to "other" those who are not seen as within it, as those within position themselves as oppressed and othered within society broadly [136]. What might inclusion efforts look like that also seek to maintain this kernel of safety? Efforts that, for instance, solely look to dismantle and rebuild might break the aspects of computing that create refuge for individuals that need it (e.g., "the basement" for P-84), and efforts lacking a neurotypic lens might eliminate neurodivergent safety in favor of inclusion, only to produce computer scientists that "can't even find solace in the work." Many hackathons and makerspaces, for instance, have sought to address structural inequities by creating new space that center community-orientations and inclusion rather than work to alter existing, culturally dominant spaces [46]; we emphasize that these separate spaces benefit inclusion efforts, but do little to address the harm that dominant computing spaces inflict on the world—both approaches are needed.

We emphasize, however, that this work is exploratory, and while we encourage reflection on existing priorities and identities, more scholarship is desperately needed. Returning to the epistemological quagmire that surrounds any work centering neurodivergence (Section 2.1), we have little language that concretely describes how individual neurotypes differ from each other. As of this writing, existing scholarly language is largely pathological, though undergoing a steady deconstruction through the work of neurodivergent scholars and allies. The language that we utilized in this work (Table 1) is surely imperfect and was not intended to be an objective, replicable instrument, but achieved our goals of surfacing specific neurotypic perceptions and being accessible to both neurodivergent-identifying participants with deep expertise and non-neurodivergent participants lacking expertise. Furthermore, as we had no interests in enforcing any pathology, we emphasized individuals' identification and perceptions of others in this work and construed a fuzzy conception of computing culture from there.

However, notions of culture in this work were inextricable from broader U.S. cultural contexts that tend to pathologize neurodivergence. This work also did not directly address the intersections of marginalization experiences by racialized neurodivergent people; more work that uplifts these experiences, especially in computing, is deeply needed. Concretely though, many participants noted the ableist nature of timed assessments, programming interviews, and other educational structures

that delegitimized aspects of their neurodivergence. We do not think any more scholarship is required to prove their pain.

Future work need not be without guide; we discovered several insights from this scholarship. We offer that the neurotypic framings that we describe here need not be utilized within future scholarship; psychology literature may develop more rigorous framings than what we attempted here. Additionally, while this lens required emotional availability on the part of the researcher to navigate insecurity, shame, and trauma, we found rich data from this lens of investigation, especially when examining aspects of neurodivergence for which participants had expertise. Furthermore, given the neurodivergent expectations that we describe through this work, we would implore those within computing to examine and deconstruct both how aspects of their neurodivergence have fit hegemonic structures, conferring systemic power, and also how those expectations may have led their delegitimized expressions to be masked. The lack of intersection between neurotypic expectations within computing spaces and those within society broadly that we found makes clear: no one is exempt from this work, and all are needed to bring about a just world [137].

More work is needed to unravel computing and societal neurotypic expectations, but we would advise that future scholars proceed with immense caution. As with other disability and inclusion work, much neurodivergence scholarship has chosen to ignore the voices of those that the work purports to help. Prior work that addresses neurodiversity has no shortage of violence; we note that at the time of this writing electric shocks are still considered a medically necessary "treatment" for autism [138], and Applied Behavioral Analysis is both well-utilized as an autistic "cure" and covered by insurance, despite sharing techniques and origins with conversion therapy [35, 139] and causing Post-Traumatic Stress Disorder in about half the individuals that the technique purports to treat [128]. The fact that our work lay outside the precipitous realm of treatment made it no less problematic: this required an inordinate amount of care. One participant, for instance, disclosed their neurodivergence as part of an interview, and said that we were the first person to know, outside of their spouse, and others shared experiences of violence and shame within and outside of computing spaces. We are here for passionate reasons [140]: we would strongly recommend that those who chose to engage neurodivergent individuals within their work incorporate crip [141] and neuroqueer [142] perspectives that center the expertise, voices, and visions of neurodivergent individuals and refuse to perpetuate epistemic marginalization [24], or consider alternative paths of scholarship.

Our hope is that computing becomes a space for all learners to grow both as technologists and as individuals. There is much dismantling to do, surely, but we wonder what can be kept of the basement, the computer lab, and all the other undoubtedly problematic spaces that some of us still call home.

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A Recruiting Materials

Below is the recruiting statement sent to students, similar statements were used for faculty and industry professionals. Identifying information has been omitted. The Google Form we used collected contact information, demographics, and degree information so we could confirm that potential participants met our inclusion criteria.

> Broadly, I want the act of learning CS to be something that's deeply inclusive, something that folks don't need to compromise their identity to participate in. I want spaces for folks to learn CS where everyone can learn more about themselves, but also spaces where everyone can bring who they are, now, and feel like they belong. As it stands, there's a whole host of ways that computing spaces seek to exclude students; right now I'm focusing on neurotypes (ways of thinking and being, cognitive profiles) and how folks experience their neurotype fitting or not fitting in these spaces. As part of this work, I'm looking for students' experiences of their own neurotype in computing spaces (that's y'all!). It's entirely ok if you don't have the deepest sense of your own neurotype; we'll work through it as we go.
>
> Ideally, this would be an hour-long conversation, but I'm happy to schedule whatever time works for you (even if it's just 30 minutes). This also doesn't need to happen now! I know that end-of-semester time is precious, and I'm happy to talk after the semester's over. We'd talk about your experiences in computing spaces broadly, in (our institution) specifically, how you see your neurotype right now, and how you perceive others. My hope is that you'll come away with a better understanding of yourself, the spaces that you're in, and just how different brains can be.
>
> I'll note, since we'd be talking about who you are and how you fit/don't fit, this definitely has the potential to be a hard conversation. I take full responsibility for this space: if you want to have this conversation, I'm so happy to be supportive however I can. This is likely a sensitive space professionally as well, so, if we end up talking, no one will know who you are but me, not even my advisor.
>
> I'm looking to represent some breadth of perspectives. I'm sure that y'all have a wide breadth of experiences in computing spaces; I'm looking to focus on folks who fit one (or more) of these bullets:
>
> —You've always felt that computing spaces fit you, maybe this is where you first really made friends, made connections; I'd love to hear more about what it felt like to arrive here.

—You've felt like you need to be a different person inside of computing spaces and outside of them. Part of you fits in computing, but there's a good chunk of you that doesn't, and reconciling those is challenging.
—You've considered leaving computing because there just weren't enough people that felt like "your people," and you've struggled to accept that.
—You identify as neurodivergent (I identify this way myself). Or, you don't, but it's something that you've wondered about for yourself.

I'll note that folks in (institution) have widely varying experiences; if one of these resonates with you, there might not be anyone else that shares that experience.

Fill out this form if you're interested! I know it's a bit impersonal, but everything gets really messy using other mechanisms; it should be less than 5 minutes to fill out (do let me know if it takes longer than that). If you have any questions or anything that you'd like to change/need to change so that this conversation feels more comfortable, send me an e-mail! Again, if this is too busy of a time, I'm happy to chat after the semester's over.

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