The Amazon Effect: A Case Study of Corporate Influence on Student Macro-Ethical Reasoning

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1 - Introduction

As the field of engineering faces looming societal issues, it becomes particularly important to foster more "holistic engineers" with systems-thinking skills and an understanding of the macro-ethical impacts of their work [1] (macro-ethics here referring to the collective social responsibility of engineers as a profession, as opposed to micro-ethics, which concern activities within the profession [2]). However, college students studying engineering in the United States exhibit a decline in concern for public welfare over the course of their education [3] as well as a tendency to orient to micro-ethical issues over macro-ethical issues [4]. Scholars attribute these trends to ideologies pervasive in engineering spaces, such as depoliticization of engineering practice, technocracy, and meritocracy [3], [5]. While Cech [3] argues these status quo ideologies in engineering are maintained by a "culture of disengagement" that decreases interest in public welfare, Radoff et al. [6] find indications that additional factors contribute to engaged students' reproduction of such ideologies. They find, for example, instances of students in reproducing dehumanizing narratives regarding low-income communities, despite their enrollment in a voluntary program premised on cultivating socially responsible STEM professionals [6]. This finding suggests that even students who remain "engaged" to some degree can reproduce status quo ideologies which Cech attributes to disengagement [3].

One explanation as to why a macro-ethically "engaged" student may fail to attend to the social aspects of design follows a deficit narrative: a lack of knowledge or ability. We see this assumption in comparisons of students' and experts' design processes, where the areas in which students behave differently than experts are interpreted as areas that require additional instruction on how to behave more like the experts [8]. This presupposition of students' lacking knowledge or skills, however, backgrounds contextual or interactional factors. Philip et al. [9] challenges such assumptions in their analysis of a classroom discussion on the ethics of drone warfare, which exemplifies students' convergence to American nationalism, but with the framing that this convergence is interactionally created, rather than the result of individual students' stable, dogmatic beliefs. However, because their analysis is limited to the scope of a single class discussion, the extent to which students' performance is situated in said class remains unclear.

In this paper, we attempt to understand the ways in which students reproduce ideologies dominant in engineering, as well as the situated nature of students' ideological orientations in collaborative work. We consider a case study focus group from Radoff et al. [6] where students reasoned through a hypothetical design scenario about a grocery store. We show how, despite many opportunities where problematic status-quo narratives are momentarily challenged, the students generally reject the challenges, not by arguing against them, but by positioning them outside the scope of their work. Further, we show how these moments of rejection are tightly coupled with attempts to emulate the multinational technology company Amazon. Finally, we use additional data to illustrate the situatedness of one student's performance, and theorize the influence of Amazon as a "strange attractor" in this student's situated reasoning.

2 - Theoretical Orientation

2.1 - Ideology and Learning

Slaton and others have spoken to the dominant ideologies in U.S. engineering that its education inherents–namely, a technocratic ideology that deprioritizes social considerations of technical work (depoliticization), devalues "social" skills and knowledge relative to technical ones (technical/social dualism), and positions existing social inequality as fair, just, and inevitable (meritocracy) [3], [5]. These technocratic ideologies inform common assumptions (e.g., the unproblematic goodness of technological advancement, or the singular qualification of technical experts to inform technological development) by constraining engineers' socio-technical imaginaries, or their particular senses of self, relation to others, and acceptable norms which, once adapted, are taken "as natural, the only vision of social life possible" [7]. In this way, technocratic ideologies obscure the profound entanglement of technology with systems of oppression (e.g., capitalism or white supremacy) [10]. For example, the increasing influence of for-profit, private organizations in the field of engineering promotes managerialism, which naturalizes dehumanizing practices by constructing human relationships as "inputs and outputs… increasing organizational efficiencies by minimizing inputs and maximizing outputs" [11], [12]. This understanding of ideology as a barrier to sociotechnical reasoning is consistent with the presiding interpretation of ideology in the Learning Sciences, where the term is commonly used to evoke a stable set of beliefs that constrain learning [13]-[21].

Stuart Hall [22], however, offers an alternative to ideology being simple dogmatic attitudes with his conception of ideology as collective systems of unarticulated assumptions used to make sense of the world in a way that is "fragmentary, disjointed, and episodic". Philip et al. [9] draw parallels between Hall's emphasis on the dynamic, interactional nature of ideology and Roseberry et al.'s [18] definition of learning as "heterogeneous meaning-making", in which the variation between understandings coming into contact interactionally facilitates new, extended, and adapted, understandings. In doing so, they develop a framework to further understand the role of ideology in learning through changes in the range of ideological stances salient to reasoning in a shared activity [9]. They define *ideological convergence* as the "the narrowing of the field of ideological stances that are salient and seen as useful as individuals participating in a joint activity", and *ideological divergence* as the corresponding expanding of ideological stances. They note ideological convergence is not less desirable than ideological divergence, but draw attention to the distinction between ideological convergence that synthesizes an exploration of participants' heterogeneous stances (which facilitates learning) and ideological convergence that is arrived at before such exploration (which constrains learning). For our analysis, we use this definition of ideological convergence/divergence, as well as Philip et al. [9]'s operative definition of ideology as any sensemaking that "stabilizes, challenges, and/or transforms the distribution of material and symbolic resources in society".

2.2 - Ideological Frames of Reasoning: "Narrow" vs. "Expansive"

The central findings in Radoff et al. [6] were patterned sets of co-occurring themes. In analyzing the full set of 12 focus groups from which we draw this paper's case study, they used these co-occurring themes to illustrate a distinction between ideologically "narrow" and "expansive" stances students can occupy in the design process. These themes are (1) types of solutions, (2) how the store context is modeled, (3) how qualities of actors and their needs are constructed, and (4) values used to evaluate solutions or approaches. We summarize their distinctions in Table 1.

Table 1: Analytical Framework from Radoff et al. 2022

	Narrow	**Expansive**
Solution type:	Uncritical consideration of technocentric solutions	Critical consideration of a range of a range of socio-technical solutions
Store context:	Modeling store as a big-box store or mega-corporation	Layering in authentic details in modeling the grocery store
Construction of people:	Dehumanizing/deficit-based construction of actors	Complex, asset based of actors and their relationships
Values:	Centering values of profit and efficiency	Centering values such as human rights and public welfare

To generalize each stance with the definition of ideology in [9], a reasoning in a "narrow" stance *stabilizes* the dominant technocratic ideology in US engineering (see Section 1 and 2.1). Conversely, an "expansive" stance *challenges* or *transforms* the dominant ideology, for example, by orienting instead to a human-centered and context informed approach. As examples: students in a narrow frame may come up with the solution of installing self-checkout machines (solution type), use Target as an example (store context), voice concerns about security in a low income neighborhood (construction of people), and prioritize the store's financial bottom line (values). Alternatively, students in an expansive frame may design a way to order groceries with digital and analog options (solution type), refer to personal experiences working in retail or living in different communities (store context), attend to the needs of a variety of stakeholders (construction of people), and foreground public health or employee rights in the design (values).

The four themes that define each stance are not distinct dimensions, so much as a set of interconnected aspects of reasoning that can be mutually supportive. For example, an ideological stance centering efficiency as a value may couple more tightly with narratives that construct employees as cogs in a machine. We center our analysis on the dimension of store context, and exemplify how students modeling solutions on mega corporations results in designs that inherit other problematic aspects of the "narrow" framework. Importantly, we note that these frames are not stable or belief-like, and focus on how students disrupt or maintain frames in this work.

2.3 - Amazon

Amazon.com, Inc. (or simply "Amazon") is a multinational technology company that, at time of writing, is the United States' second-largest private employer and the world's largest online retailer [23]. Established in 1994 as an online bookseller, Amazon has since expanded into a generalized e-commerce platform, extending its services to include the world's largest cloud computing platform, a range of personal devices, and an entertainment company [24]. Amazon's market dominance is driven by Amazon Prime, a paid subscription plan whose central service is guaranteed two-day delivery on an extensive range of goods [25]. In addition to its products and online services, Amazon has increased its physical footprint with outposts such as Amazon Go (a convenience store chain with a cashierless setup, where customers are automatically charged for what they carry out) and Amazon Hub Lockers (unattended pick-up stations that customers can use to receive Amazon orders). This physical footprint has been further enlarged by the acquisition of brick and mortar stores, such as the upscale supermarket chain Whole Foods Market. Notably, Amazon has attracted criticism for a range of ethically questionable practices and actions [26]-[30]. In light of the data in this work, we explicate three of these critiques.

First: the labor abuses that have occured within the hundreds of large warehouses (or "fulfillment centers") globally, from which Amazon manages its supply chain and distribution [31], [32]. An exposé found that between 2013 and 2018, emergency services responded to calls from Amazon warehouses regarding suicidal employees 189 times across 46 warehouses [33]. Workers in the report cited high-pressure, dangerous working conditions, excessive surveillance, and required social isolation for their suicidality, with one former employee describing a warehouse as "this isolating colony of hell where people having breakdowns is a regular occurrence" [33].

Second: the significant strides Amazon is making towards the development and implementation of labor automation. This direction is visible in the already mentioned Amazon Go and Amazon Hub Lockers, which center on technologic substitutes for tasks otherwise done by employees (e.g., cashiers), as well as in the manufacturing and utilization of robotic labor in fulfillment centers alongside human workers [34]. While this push towards automation is not inherently unethical, we note that, in the current absence of policy legislating otherwise, widespread automation is likely not to remedy, but exacerbate wealth and income inequality [35].

Third: the corporate culture of "customer obsession," which Amazon founder, executive chairman, and former CEO Jeff Bezos has cultivated at every level of Amazon operations [36]. While this culture of customer-centricity superficially presents Amazon as prioritizing human-well being and care rather than profit, the emerging debate around data mining and surveillance practices necessary for algorithmic hyper-curation brings this putative social goodness into question [37]. Thus, we highlight the distinction between 'customer' and 'person' made in a broader analysis on the social impacts of Amazon: "[Amazon is] obsessed with the piece of you that is profitable…'Customer obsession' is synonymous with 'exploiting the weaknesses of the human mind to extract as much profitable behavior as possible.'" [38].

2.4 - Mimetics of Success

To make sense of students' ideological stances in different contexts, we consider two means that incentivize performing culturally specific images of success: *isomorphism* and *schoolishness*.

Isomorphism: DiMaggio and Powell [39] note that while in the earlier stages of a field, organizations may exhibit diversity in form and methods, as a field becomes better established, it tends towards homogenization. Importantly, this increased similarity is not necessarily coupled with increased efficiency, and may in fact stymie the adoption of useful, but novel, approaches or ideas. This tendency towards homogenization is *isomorphism*, "a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions" [39]. *Mimetic isomorphism* describes how organizations seek to emulate other organizations that are perceived to be "more legitimate or successful"—a mechanism that can be seen, for example, in a university's engineering department modeling their program after a highly ranked department in the same discipline. This type of isomorphism is particularly prevalent "when goals are ambiguous," leaving only an abstracted notion of success to model after while making decisions. They additionally define a *normative isomorphism* that increases homogeneity between individuals either by means of strict gatekeeping of a profession through narrow, culturally contingent entry points, or "pervasive on-the-job socialization" in the case of professionals who evade these filtering processes. In either case, the result is "a pool of almost interchangeable individuals who… possess a similarity of orientation and disposition that may override variations…that might otherwise shape organizational behavior" [39].

Schoolishness: Bloome et al. [40] coined the term *procedural display* to describe observations of students and teachers going through the motions of a lesson in ways that are potentially divorced from a tangible learning outcome, but valued for their performance of "doing school well". In a study of high school students' scientific argumentation skills, Jiménez-Aleixandre et al. [41] cite procedural display as a central impediment in students ability to reason scientifically. They invoke a distinction between when a student is "doing school" or "doing science" in their analysis; the former aims to fulfill expectations of what it means to be a good student (procedural display), while the latter engages in scientific dialogue or argumentation. For example, in "doing science," students may engage in argumentation about the topic of the lesson (e.g., "I don't agree with a point in your hypothesis because…"), while in "doing school," students may discuss the boundaries or expectations of the lesson (e.g., "How many hypotheses are we supposed to come up with?"). In this way, while "doing school", a student is primarily working towards being perceived as a good student. They further distinguish the two modes by conversation style, with "doing science" exhibiting Lemke's [42] idea of *cross-dialogue*, or conversation directly between students with minimal moderation from a teacher. In contrast, students "doing school" may respond only to teachers' explicit solicitations of student participation. We adopt this construction of "doing school" as opposed to "doing science" in our analysis, and refer to students' participation in procedural displays as performances of *schoolishness*.

3 - Study Context

3.1 - Our Study of The STS Program at the University of Maryland

This study is set in a program sponsored by the A. James Clark School of Engineering at the University of Maryland, College Park, named “Science, Technology and Society” (STS). The program primarily focuses on the intersection between engineering and society and attempts to counteract the technical narrowness of preparation [11] many students encounter within engineering and other STEM programs. The STS program curriculum focuses on cultivating macro-ethical and social justice perspectives to aid students in the study and design of socio-technical systems. While in the two-year program, students take courses designed to provide foundational knowledge and field experiences focused on service learning and community engagement. The program fosters critical understanding and engagement with socio-technical systems through the practice of various systems thinking skills (referred to as the ‘STS Thinker Skills’) [43-44]. These skills encourage students to take a more sociocultural approach to knowledge construction by considering multiple perspectives, questioning the status quo, and noticing the consequences of existing systems and innovations.

This work took place within the context of a larger research study exploring whether and how extended immersion in cultural practices of the STS program supports students’ macro-ethical reasoning about the world and their personal and professional responsibility within it. We followed one cohort of students for the duration of the program and recorded how they adopted and rejected certain STS cultural practices. Data sources include ethnographic observations collected in specific STS courses, video recorded focus group interviews where students collaboratively discuss complex design scenarios, and interviews with participating students about their personal backgrounds and experiences in the STS program.

3.2 - The Grocery Store Focus Group Activity

One of several data sources for our broader study is a set of focus groups. Each group consisted of 2-4 students who, with a supporting facilitator, were given 1 hour to work through a prompt:

> *A small grocery store in a low-income neighborhood has "long lines" and has hired your group to make a plan to solve this problem. The store is following their state and county guidelines for social distancing due to COVID-19, which has just started spreading. Some employees had to quit because of employer policies and/or underlying health conditions. However, even with the state-enforced reduced capacity, the store check-out lines get very long. The remaining employees have even seen customers at the back of the line just putting down their items and leaving the store. Therefore, the store is losing money because of this problem. How might you go about solving it?*

The resulting data forms the basis upon which the framework in Section 2.2 was developed. For a more detailed description of the prompt's development, facilitation approach, and deliberate choice of groupings of students, see Radoff et al. [6].

3.3 - Case Selection

This paper focuses on only one focus group from the previously described set: Arik and Justin, two first-year engineering majors (with Arik additionally majoring in physics). This focus group was chosen as a close case study for two reasons. First, because we were interested in investigating how ideologically narrow frames are sustained. This group most clearly illustrated examples of "fleeting moments of ideological expansion" [9] that are ultimately not sustained, and thus gives ample opportunities to examine how ideological convergence stifles macro-ethical reasoning. Second, this group exhibits a unique emphasis on Amazon throughout the discussion. While several focus groups mentioned an Amazon technology or solution at one point in the conversation, the online market giant was brought up by name several times in this group's conversation. The presence of Amazon as this explicit (and, as we later argue, implicit) "strange attractor" in the focus group offered an opportunity to further understand the role of mega-corporations in students' design reasoning, a major component of a narrow ideological frame in Radoff et al. [6].

We further narrow our case study by foregrounding one student in some aspects of this work. This choice was made after our preliminary analysis, in which we sought to understand how students in the focus group data discursively maintain ideologically narrow frames. In this focus group, we found Arik to be more consistently and clearly stifling the moments of ideological expansion initiated by Justin, that facilitator, and even himself. Later, when we began examining the influence of Amazon on the group's reasoning, we found that nearly all references to the company (explicit or inferred) occurred within the segments we had identified as examples of Arik stifling ideological expansion. Thus, we chose to center Arik in part of our analysis in order to explore this close coupling of stifled moments of ideological expansion and emulation of Amazon.

With the addition of this emergent research question, this paper seeks to answer two questions, the first focused on the collaboration, and the second focused on a single student: **(1) How are this focus group's opportunities for ideological expansion stymied? And (2) why does Amazon serve as a 'strange attractor' within the complex space of Arik's reasoning?** These research questions will henceforth be referred to as 'RQ1' and 'RQ2', respectively.

4. Methods

4.1 - Data Triangulation

Our primary data source is a video/audio recording of a focus group from Radoff et al. [6] with students Arik and Justin. The group was facilitated by this work's 3rd author on April 30, 2021

over Zoom. Both students were freshmen in the University of Marylands's STS program at time of recording, had worked on projects for their STS courses together, and described each other as friends. Their participation in the 1-hour focus group was one of several options available to fulfill a requirement for an STS course. These data will be used to explore both RQ1 and RQ2 by illustrating ideological convergence/divergence, as well as the presence of Amazon in students' reasoning space, respectively.

To further probe RQ2 and understand the situatedness of Arik's focus group performance, we looked to data from another context to determine whether he exhibited similarly narrow ideological reasoning. If he did, the emulation of Amazon could be explained by a lack of intellectual resources for more expansive socio-technical thinking; if he did not, a more sophisticated answer would be needed. To investigate this possibility, we incorporated a recorded interview with Arik into our analysis. This interview would serve as a second context to observe Arik's reasoning and provide a rich opportunity for learning how students' macro-ethical reasoning can be shaped by situational factors. Because we use this data set primarily to identify whether Arik takes alternate stances in different circumstances, we note that its analysis is significantly less fine-grained than that of the focus group data.

The interview was conducted as part of the broader study of STS cultural practices described in Section 3.1. Our team conducted several rounds of interviews with varying sets of students from the STS cohort we are studying. To facilitate the 1-hour long interviews, we utilized semi-structured interview protocols with open-ended questions. Question topics included student experiences in the STS program, emotional and social aspects of the program, and the role of macro-ethical reasoning in engineering. Arik participated in one interview prior to the focus group on February 24, 2021, which was conducted by the same facilitator.

4.2 - Bids For Ideological Expansion

In trying to understand how to support student shifts between the ideologically "narrow" and "expansive" frames identified in Radoff et al. [6], we initially sought to identify "pivots," or moments in the focus groups where students transitioned between frames. Upon reviewing multiple focus group transcripts for such pivots, we found that at times, a student or facilitator would ask a question or make a comment that provided an opportunity to move from a narrow frame to an expansive frame, but ultimately did not result in a shift in the conversation.

To model these moments, we draw on a conception of "bids" from marriage psychology. Gottman and Driver [45] observe that "people [made] what we came to call 'bids for emotional connection' from their partners, and their partners responded by 'turning toward,' 'turning away' or 'turning against' these bids." Adapting this to our analysis, we consider a *bid for ideological expansion* to be a discursive move that a student or facilitator makes that challenges some aspect of ideologically narrow reasoning. Echoing Gottman and Driver's observed responses to bids, our bids can: (a) by being taken up by the group in a way that leads the conversation to a more

expansive frame; (b) be ignored or otherwise not addressed in further conversation; or (c) be actively rejected in some way, such as arguing that a criticism isn't warranted.

We simplify (a) to be a "successful bid", as it allows for greater heterogeneity of ideological stances, and therefore, learning [18], while we consider (b) or (c) to be "failed bids" as they ultimately do not expand the range of ideological stances salient in the discussion. As an example, in a conversation about an app-based solution, a 'successful bid' might look like a student mentioning how their grandparent has difficulty using smartphones, and as a result, the group designs with an analog solution that attends to the needs of the user and supplements the app. If a student were to instead downplay the significance of non-smartphone users and continue with the original idea, or ignore the comment of the first student entirely, we would consider that a "failed bid".

4.3 - Analytic Approach

To answer RQ1, we sought to identify failed bids made in the focus group using discourse analysis methods [46]. Primarily, our methods draw from empirical discourse analysis (EDA), which Hodges et al [47] describes as macro or micro analysis of "the ways in which language and/or texts construct social practices". We additionally draw from critical discourse analysis (CDA), which seeks to understand "the ways in which discourses construct, maintain, and legitimize social inequalities" [48]. Thus, in our first round of analysis, we identified the discursive moves around bids (EDA), and, using Philip et al's [9] definition of ideology as "sensemaking that stabilizes/challenges/transforms the distribution of material and symbolic resources in society" to differentiate bids that were ideological in nature (CDA). This analysis of bids focuses on the ideological stances the group takes on from their iteration.

In conducting this analysis of bids, we began to note the salience of Amazon in the focus group discussion. Using thematic analysis [49], we selected all talk in the transcript that refers to Amazon by name. In addition to explicit namings of Amazon, we noted segments where students' reasoning exemplifies ideas similar to Amazon's methods, based on public and commonly known information about Amazon (summarized in Section 2.3). To not appear over-interpretive of the data, we note that by pointing out instances where students align with the company's ethos, we do not mean to imply students must be subconsciously imitating Amazon; indeed, students undoubtedly have been exposed to similar technologies or practices from other sources. However, we remind the reader that within a CDA interpretation of a text, our analysis is concerned not with the meaning beneath the discourse, but how it functions to, for example, stabilize or challenge social power structures [47]. Therefore, we include in our analysis "implied" references to Amazon through moments exhibiting the "Amazon ethos".

We found that, with the exception of pitching ideas modeled off Amazon in the first ~5 minutes of the focus group, all mentions to Amazon—explicit or inferred—arose within the segments we had selected for showing failed ideological bids. This tight coupling of failed bids for ideological

expansion and references to Amazon led to the definition of RQ2 and the consideration of Arik's interview. As mentioned, the analysis of the interview was less fine-grained than the analysis of the focus groups. In the interview, we looked for evidence of knowledge, experiences, or espoused values that were inconsistent with Arik's ideologically narrow reasoning in the focus group. Evidence of such inconsistency would undermine the proposition that his narrow reasoning in the focus group was due to his lacking resources for alternative reasoning.

Finally, with the hindsight of having observed Arik in a second context (the interview), we returned to the first context (the focus group), to identify any behavior in line with what Jiménez-Aleixandre et al. [41] call "doing school" rather than "doing science". We identified turns of talk that were exemplary and summarized interview-wide characteristics, such as turn taking patterns and total talk time of each participant, that resemble Jiménez-Aleixandre et al.'s [41] "doing school". In the end, we use this evidence of schoolishness in the focus group, along with segments from Arik's interview data, to develop our answer to RQ2.

5 - Findings

Our primary takeaway from this focus group is the significant extent to which the students sustain a narrow ideological frame for its duration, and the continued presence—explicitly or implicitly—of Amazon in the students' thinking while in that frame. After introducing the setup to the conversation, we present key moments that had the potential to interrupt this narrow frame, and importantly, show how Arik rejects these bids for ideological expansion. We then present data from a one-on-one interview with Arik that suggests his narrow performance in the focus group may be situated and context specific by illustrating his values and available intellectual resources around more expansive STS thinking.

5.1 - Focus Group: Setup

The Zoom recording begins with the facilitator setting expectations for the session in the opening turn of talk before reading the prompt presented in Section 3.2 to Arik and Justin. In this setup, the facilitator deprioritizes outcome-oriented goals by sharing the purpose of the activity (to see "how you can think through it [and] bounce ideas off of one another") and explicitly backgrounding potentially anticipated priorities such as timeliness ("you don't have to feel rushed") and finding a single answer ("It's also okay if you don't converge on a specific solution just in the time we're talking"). This emphasis on process over product is somewhat in tension with the formal prompt, which positions students as engineers hired to deliver a solution ("[the store] has hired your group to make a plan to solve the problem"). In this way, the students are presented with multiple roles to orient to as they participate in the activity: the role of a learner, or the role of a contracted engineer.

In the turns of talk immediately after the prompt, Arik initiates a period of idea generation by soliciting Justin for possible solutions to pursue.

Segment 1: *(1:54 - Follows reading of the prompt)*

[L 1.1] Arik: So should we just like kind of start going, or? [**Facilitator** nods and gives a thumbs up] So, yeah I guess what are your initial thoughts, Justin?

[L 1.2] Justin: Well my first thoughts are that there's a lot of options with like, online grocery shopping now, sort of like Amazon and like, that kind of thing. So we can like, make an online website kinda with their items that they have available and—

[L 1.3] Arik: Oh that's true (**Justin:** And like—) they can probably like pre order (**Justin:** Yeah) or something of that sort.

[L 1.4] Justin: And so they can just pre order so it's already paid, so they just come and then it's already like, organized and like you just pick it up and then the people who don't, like, aren't as technologically advanced, they'll just come and shop like normal. So (**Arik:** Okay) that will reduce lines while providing an option for people who don't wanna wait in lines and don't wanna like, risk getting sick to like, get their groceries.

[L 1.5] Arik: My thought is um, well if they said that like employees are quitting because of like the policies or just like, Co-uh, Covid risk and things like that, that means they had the capacity to pay these people, but like, they didn't, so that likely means they have the extra capital to buy sef-self checkout systems so that's one option I was thinking of. And then, so, yeah, um, you could have something where, if you just have like, like the usual grocery store thing where it's like 15 or less items or something of that sort (**Justin:** Yeah) you can go do the self checkout which will allow for like I guess reduced lines without necessarily um, hiring more people.

[L 1.6] Justin: Um, another thing I thought of is uh, there are several like, stores that have like, you check it out *as* you go to the item, so like you take it off of the shelf, you already paid for it.

[L 1.7] Arik: Oh I, yeah, I heard like, (**Justin:** yeah like) Amazon had a thing like that, (**Justin:** Yeah) where you, they kind of like, I don't know how it works, but they like, scan your phone on the way in, and then (**Justin:** Yeah) when you just pick up the stuff, it—

[L 1.8] Justin: Yeah, checks it out—

(Continues into next segment)

From the beginning, we see Amazon's significant influence on the idea space: of the three solutions the students pitch in the first ten turns of talk, two of them (pre-orders and auto-scanning carts) are modeled after Amazon. The third (self-checkout), while not explicitly modeled after Amazon, is premised on automating the jobs of workers, specifically those who

quit due to health considerations. This segment also instantiates the students' consideration of two stakeholder groups (people who are unlikely to use a high-tech solution in L 1.4 and store employees in L 1.5) that will come up throughout the interview.

In this first consideration in L 1.4, Justin identifies a population that is unlikely to use an online ordering system (in this case, assumed technological illiteracy). By saying these people can just "come and shop like normal," Justin positions this population outside of the imagined users of the main solution, relegating them to the backup option of "normal" shopping, which is assumed to function as it always has even after the addition of a new ordering system. In the following turn of talk (L 1.5), Arik constructs employees as a budget line item, interchangeable with a machine if costs permit when he says "if they said that like employees are quitting because of like the policies or…Covid risk and things like that…they have the extra capital to buy sef-self checkout systems".

After the three potential solutions are identified, Arik begins evaluating them:

> ***Segment 2: Solution*** *(3:40 - Follows previous segment)*
>
> **[L 2.1] Arik:** I guess it also, it depends on how much capital the store has to actually spend on (**Justin:** Yeah) integrating these systems, but I'm just gonna assume that because it's in a low income neighborhood it's not necessarily going to be (**Justin:** Yeah) like, you know, it's not going to be like, a very expensive grocery store where, for, for, like, per se, just uh, just off the top of my mind, like, like Whole Foods, for example, is much more expensive than like a lot of other grocery stores so (**Justin:** Yeah) I'm gonna (**Justin:** Yeah) I'm gonna probably say they don't have a ton of capital of the spend, but, (**Justin:** Yeah) I guess it really depends on the costs of those, uh, systems.
>
> **[L 2.2] Justin:** Um, also to go back to like my initial idea, by doing that method you could just have those employees that like, had to quit because of health conditions, they're kind of just like, in the back, stocking or like, they're the ones—
>
> **[L 2.3] Arik:** Yeah that's true they could prepare the orders. (**Justin:** Yeah.) Yeah actually I like that a lot—
>
> **[L 2.4] Justin:** A stock (**Arik:** cause that could—) area instead of the rest of the store.
>
> **[L 2.5] Arik:** Yeah that could actually probably change um, like, who quits or what, and like, make it easier, and potentially have like, rehire these people. (**Justin:** Yeah.) Um so I guess…. there's not a lot of… I guess description, of how much the store has to spend, but assuming it's not a ton I think self checkout or the, um, electronic system you mentioned are the two, or like the pre order system are probably the two ways to go. (**Justin**: yeah) so I guess the question is, which one do we want to do, then. I'm actually leaning towards yours more just because it's, if it is like during, like, like, the pandemic,

then likely it'll be more convenient for customers and you'll probably actually have even more people buying items, because they have less social interaction. (**Justin:** Yeah) So, um, okay. So let's see um, how do we want to—So let's try fleshing it out, then, I guess.

(Arik starts discussing the platform for online ordering)

Arik first considers cost, contrasting the grocery store in the prompt with an "expensive grocery store" (notably, Whole Foods, owned by Amazon) and assuming there isn't much money in the budget for "these systems" (ambiguous which solution/s he's referring to) in L 2.1. In L 2.2, Justin starts to add to his original idea (pre-orders, "sort of like Amazon") the possibility for health-concerned employees to work stock or prepare orders "in the back" in a role reminiscent of Amazon warehouse workers. Arik, after affirming Justin's idea in L 2.3, re-foregrounds the cost ambiguity in L 2.5 and presents the team with a choice between the two ideas he sees as possible within that constraint: self check-out and pre-orders. Without seeking input from Justin, he voices his preference for the latter in the same turn of talk, citing customer convenience and an assumed subsequent increase in business as the justification, and establishes pre-ordering as their chosen solution by prompting the team to "try fleshing it out".

These first minutes of the focus group constitute the entirety of their problem scoping and idea generation; for the remainder of the discussion, Arik and Justin work on developing this "pre-ordering" solution to the prompt. In the following series of segments, we present exemplary cases of failed bids for ideological expansion as Arik and Justin develop this solution, and note that they are only a subset of the bids identified in the text.

5.2 - Focus Group: Failed Bids

We find the first notable failed bid for expansion following a discussion about potentially including a delivery service in the solution. After Justin responds to Arik's suggestion of delivery by citing the challenges of implementing it in a low income neighborhood (e.g., cost, safety concerns), Arik summarizes their solution so far. After stepping through the aspects they've discussed, Arik arrives at the point where orders are picked up, and identifies a potential issue:

Segment 3: *(8:41 - Follows discussion of a delivery option)*

[L 3.1] Arik: And then I guess for a cash only option, like, if the customer only has cash, I'm thinking, they could probably just… [trails off] I guess in this modern day and age that's a very limited amount of people and that will likely just be fine for like the shoppers who come in and buy things… [long pause] Okay, so, yeah I think that's a pretty good solution. Yeah.

(Facilitator introduces a new prompt question)

In this segment, we find the second mention of the group of stakeholders first noted in L 1.4: people who won't use a digital solution (in this case, because "the customer only has cash", as

opposed to not being "technologically advanced"). However, while thinking through this possibility, Arik hits a boundary: rather than considering an alternative solution for customers who would only use cash, he dismisses the importance of this problem ("I guess in this modern day and age that's a very limited amount of people") and relegates non-digital users to the periphery of the design for a second time. In doing this, Arik both opens up the range of ideological considerations in the design space (by presenting an opportunity to attend to the needs of non-digital users with the same care and attention as digital users) and closes it (by minimizing the significance of this stakeholder group, declaring most people will be fine shopping normally, moving on). **Thus, mechanism #1 for rejecting bids for expansion is to reflect and dismiss.**

For the sake of brevity, we paraphrase the next failed bid, initiated by the facilitator's prompt to consider "what might you want to know or learn in order to better understand or solve this problem." Arik responds first: "definitely how much money the store has to spend on the problem," which he explains would determine which solution to pursue. Justin answers the prompt in turn, saying that demographics of the neighborhood (e.g., age distribution) can also help choose a solution, for example, "because if you have older people buying from the store you might not want to go with an electronic route." In response to this opening to once again consider people for whom a high-tech solution won't work (this time, because of assumed age-dependent preferences), the bid is quietly dropped when Arik responds with a brief, "That's a pretty good point" and the group falls into silence for 33 seconds, until the facilitator asks another question. **This exemplifies mechanism #2 for rejecting bids for expansion: affirm and move on.**

The facilitator breaks the silence with a question that introduces another failed bid for expansion:

> **Segment 4:** *(11:41 - Follows previous summarized section)*
>
> **[L 4.1] Facilitator:** What do you think would be the impact—on maybe society, the economics, corporations, owners, workers—if this solution that you came up with was sort of scaled up for use across many stores? ...
>
> **[L 4.2] Justin:** I think one of the impacts would possibly be on workers, because, like, if the electronic route goes well, it works really well and is like, modernized, it may push some more people out of work than initially intended, because you may not need cashiers anymore. And that would, that would fire a lot of employees
>
> **[L 4.3] Arik:** Yeah um, going down the same line, I think also just, so yeah, it would probably most likely make it easier for a lot of people and then, as long as you like, keep the in store option consistent, I don't see much, like, backlash against it. With the actual, like employees losing jobs, I mean, what I would see would happen is, I know a lot of like, low income neighborhoods, they have like, a lack of grocery stores, so if this could be provided as maybe not even like, a full like supermarket but as like a smaller store option, where you can still pre-order your items and then, maybe not say a couple hours

ahead, but like a day ahead and so that way they can ship the items to the store from like a bigger store warehouse, that could make it, actually I think it could make these grocery stores more accessible to a larger population, and in turn, you would lose employees at these bigger stores, but I think those employees would go to these smaller like kind of satellite stores.

(Justin starts discussing social impacts of reduced store interactions)

In L 4.1, the facilitator makes an explicit bid for the students to imagine the impact of hypothetically scaling up their developed solution. Justin begins to expand the conversation in L 4.2 by bringing up the possible harm caused by automating cashier jobs en masse ("that would fire a lot of employees"). However, while Arik begins the next turn of talk by suggesting alignment with Justin on the point of concern for workers ("going down the same line"), he quickly reframes "impact" from Justin's focus on workers to a focus on optics: because there wouldn't be much "backlash" against a solution that would "make it easier for a lot of people", the concern of employees is implicitly deprioritized over customer convenience and public perception.

After the first sentence of L 4.3, Arik begins to construct a theoretical scenario in which the grocery store in the prompt becomes one of many dropoff points for a larger, central warehouse that ships pre-ordered items to its "satellite stores" to be picked up by customers. In this way, he distracts from the concerns of "real" employees (meaning those explicitly mentioned in the focus group prompt) and draws attention to the needs of imagined employees (the workers at the large warehouse who would have to move to the small satellite store). By reframing the context they are using to consider impacts with an idealized warehouse/outpost model (one that is, notably, very similar to Amazon Hub Lockers), the consideration of impacts of the "real" employees are stymied and the opportunity for ideological expansion is concluded. **Thus, mechanism #3 for rejecting bids for expansion is reframing.**

From here, Justin initiates a brief period of brainstorming other impacts, and Arik calls back to the facilitator's question of what else they would like to know by considering whether they should interpret "a small grocery store" as small spatially or a small business. To that, Justin introduces a critical issue in their design: that the storage infrastructure and inventory needed to accommodate customers who use the pre-order system may strain the resources available to accommodate in-person customers. Justin's observation that this "might cause some problems with people who buy in the store" is met with a 12 second silence, eventually broken by the facilitator who notes other potential logistical challenges in the students' design (e.g. with space, inventory, and refrigeration). After another sustained 10 second silence, Justin begins to brainstorm a shelving system that might solve the problem, but is interrupted by Arik, who points out that this problem "already exists in just, normal grocery stores". He continues, saying grocery stores manage inventory by analyzing shopping trends, and that sometimes when a store buys their stock they simply "have to hope it all gets bought out before then". He concludes this

turn of talking by saying “So I think it’s kind of like, that same idea kind of still goes down in the pre-ordering system”. This apparent conclusion to Justin’s inventory concern is followed by yet another sustained silence of 16 seconds before the facilitator moves to a new prompting question.

In these turns of talk, Justin and the facilitator challenge the “normal” in-store shopping fallback that Arik had previously relied on to dismiss his own momentary reflection on the need for a cash-only alternative (in L 3.1) and mitigate the possibility of “backlash” over employee concerns (in L 4.3). And while Justin eventually begins to brainstorm ways to expand their design to account for that problem, Arik responds by repositioning the problem as beyond their scope, since grocery stores probably experience that problem already. In his presuming this problem has already been solved elsewhere, the responsibility for its outcome is positioned on an external actor, rather than the people creating the store’s solutions, and the conversation comes to a stop, with Justin ceasing to develop his amendment to the solution. **This interaction illustrates mechanism #4 for rejecting bids for expansion: defer responsibility.**

After breaking the silence, the facilitator asks the students to consider the STS Thinker Skills (described in Section 3.1) and whether they offer any insight on the design scenario. Justin claims they used the skill *seeking stories about science, technology, and engineering* because they “kind of looked at the Amazon stores”, and Arik suggests they could use the skill *hosting an STS party* to survey the neighborhood and find out how potential customers would respond to their solution. After each student gives their answer, there is a 57 second silence before the facilitator asks a follow up question about another skill, *looking for ethics in artifacts*:

> ***Segment 5:*** *(21:10 - Follows discussion about STS thinker skills)*
>
> **[L 5.1] Facilitator:** I'm curious when it, when it comes to this first one, the like, looking for ethics in artifacts, how do you think that applies to some of the various ideas you all came up with?
>
> **[L 5.2] Arik:** I've been thinking about that one.
>
> **[L 5.3] Justin:** Yeah me too. I think one of the things we have to look at for like, the online thing, if we consider that an artifact, is who is going to use it and who won't use it. Like the ethics behind that, like who it will leave out, in a way, because you can leave out a certain population if they don't have access to Internet or a computer or a phone that they can access these apps…We already talked about this a little bit, just like thinking about how this online grocery store would affect people in the community and how some people might be left out and feel like they're being forced into, like, a new world that they can't be a part of.
>
> **[L 5.4] Arik:** I think we had mentioned though, that we would still have like the regular checkout and grocery stuff (**Justin:** Yeah) which I think actually does provide like, a fair option to the, um, electronic system where, like, yeah, for the people that are left out, it is

a, like, it still provides an easy outlet for them to do their grocery shopping as they would normally, and it would likely have— reduce line sizes, which they would like.

(23 seconds of silence before Justin offers critiques of one of the pitches from Segment 1)

In this exchange, we see perhaps the most clearly articulated bid for ideological expansion from a student of the interview in the fourth and final mention of people who will be "left out" of the pre-ordering solution. In L 5.3, Justin brings up that this group of people, giving specific examples of ways the online ordering system would not work for them (e.g., not having internet connection or access to devices) and emphasizes the need to think about "how this online grocery store would affect people in the community and how some might be left out." In response, Arik again refers to the "regular checkout" fallback in L 5.4 that he had utilized previously, saying that it provides not only "a fair option to the electronic system," but the added benefit of reduced lines, "which they would like." This is met with yet another sustained silence, which Justin breaks after 23 seconds not to continue his consideration of ethics in artifacts in the context of their selected solution, but to apply that thinking to a pitch that hadn't been mentioned since the first few minutes of the focus group, and would not be mentioned again. In effect, Arik has shut down the bid for expansion set up by Justin's identification of a problem by saying they've already solved it—despite the exchange leading up to the previous bid rejection (mechanism #4) that introduced inventory issues with the in-store option that were never addressed. **This exemplifies mechanism #5 for rejecting bids for expansion: declare a problem "solved."**

5.3 - Focus Group: Closing

Following Segment 5, students discuss the ethics of the abandoned pitch Justin brings up in L 1.6 before the facilitator asks about another STS thinker skill (*locating power in systems*). After the students spend a few minutes discussing the types of power a few stakeholders hold, (specifically, the store owner, the IT person who maintains the solution, and the customers), the conversation then comes to another extended pause. At this point, the facilitator addresses the influence of Amazon on the conversation until this point in a prompt:

Segment 6: *(28:27 - Follows an 11 second silence)*

[L 6.1] Facilitator: …I know Amazon has made it like, all of our intuitions about what can be like, brought to us quickly change, but it will be, it would be interesting to think about if a small store like this would have the capacity or the same kind of access to getting goods on a really short turnaround or not. Yeah.

[L 6.2] Justin: I feel like for that thought, they might have to like partner with a corporation that has more power, and more say, which might hurt them a little bit and reduce their power, but at the same time, they'll be able to make more money because they have more customers and they're getting slightly more items that they need.

> **[L 6.3] Arik:** Yeah, guess that the assumption that this is like, a small grocery store and not like, a small business, you can also probably just kind of follow the Amazon model, which is you have like, one, I guess, kind of, warehouse, and then, slash, you could have that, even like, kind of like, a warehouse/grocery, large grocery store and then from that warehouse, you kind of have like a spider web of these small satellite stores that go like up to like a certain distance away and so that way you can just kind of strategically plant these warehouses and have this kind of like area of like, I guess kind of guaranteed delivery where they can get whatever items you need to that store within a day or 24 hours, just because of the distance and that the fact that the warehouse will have like a large stock of everything you need.
>
> *(13 seconds of silence before Justin brings up transportation challenges)*

In L 6.1, the facilitator makes a direct ask of the students to consider in real time the way Amazon is influencing their work, and whether it makes sense to model their grocery store after it. Justin continues the discussion of power preceding this segment by considering corporate partnership as a means for a small grocery store to gain the resources to implement a pre-order solution in L 6.2. Referring to the ambiguity as to whether the "small" in "small grocery store" refers to the size of the space or the business from earlier, Arik, decides to assume the former, and, implicitly, begins to model the store as one small location of a larger network. Given this idealized context, he prescribes following "the Amazon model", and begins to outline the same system of large, central warehouses delivering to small satellite outputs that he earlier proposed in Segment 4, only now with a conscious and articulated reference to Amazon as the blueprint. By doubling down on the imitation of Amazon in L 4.3—citing the unmistakable features of "strategically" located warehouses and delivery points, short windows for guaranteed delivery, and "a large stock of everything you need"—Arik rejects the facilitator's bid to consider the appropriateness of Amazon as a model in this design scenario.

After the 13 second silence following the Segment 6, Justin mentions challenges for transportation and warehouse workers, and he and Facilitator go back and forth on that topic for about five minutes. Justin concludes this thread with a final statement about warehouse worker jobs not being attractive to potential employees, and a 41 second silence follows before the facilitator asks students for final thoughts. Arik responds saying "I really don't have much else to say, I think we went through it pretty well." Justin describes the difficulty of the activity, saying "There are a lot of futuristic possibilities I guess…but they're really more expensive options that may not be applicable to this kind of grocery store". These two responses from Arik and Justin are their final contributions to the discussion, which the facilitator then closes off.

We describe these last few turns of talk of the focus group to exemplify a few aspects of the focus group. First, we note the turn-talking style here that also characterized most of the discussion in this focus group. More so than most other conversations in the full set of 12 focus groups in Radoff et al. [6], the students in this focus group often fell into a pattern that consisted

of (1) the facilitator asking an open-ended question, (2) one student giving an answer to the question, (3) the other student giving a separate answer to the same question, and finally, (4) both students waiting in silence until the facilitator asks another question. Though there were periods of sustained conversation between Arik and Justin, they demonstrated overall less peer-to-peer engagement, a point illustrated by their total speaking times being nearly equal to that of the facilitator (510 seconds for the facilitator, 617 seconds for Arik, and 513 seconds for Justin), unlike focus groups where the facilitator speaks minimally.

Additionally, there is the early, but confident conclusion of the activity: though the group had allotted a full hour for the focus group (and the majority of focus groups took nearly the full hour for their design), this conversation concluded after only 36 minutes. At that point, the facilitator had exhausted the prompting discussion questions used across focus groups and the conversation had already reached several extended-silence dead-ends. Despite these attempts—and the facilitator's introductory disclaimers emphasizing the researcher's interest in students' thought process rather than a quick and simple solution—Arik concludes after only a half hour of discussion of one solution, "I really don't have much else to say", suggesting that he's completed his assumed task, and "I think we went through it pretty well", suggesting that the solution as adequate enough. Thus, rather than orienting to the role of a learner that the facilitator's introduction aimed to cue up at the opening, Arik orients to the role of the professional engineer alluded to in the formal prompt, delivering a solution and assessing his performance as if it's being graded by a teacher or evaluated by an employer. This orientation to the focus group task as a student or professional who's being assessed for ability is evident through all the rejected bids: wherever someone tries to explore issues with their solution (a potential 'incorrectness'), Arik justifies why the solution is, in fact, adequate (thereby restoring the students' 'correctness').

5.4 - Arik's Interview

The one-on-one interview with Arik contains moments that appear to be in tension with his performance in the focus group (which occurred two months later). In one of these moments, Arik responds to a question about communities that are important to him by sharing an experience of designing devices to increase accessibility for people with physical disabilities:

> ***Segment 7:*** *(Interview - 21:24)*
>
> **[L 7.1] Arik:** I'd probably say the maker community…That kind of really shaped the way I think about a lot of things today…I participated in a Make-a-Thon…a 36 hour event where you were just kind of given a prompt for like, a thing you had to build… Our group was assigned to this boy…he had cerebral palsy, and so he was confined to a wheelchair. And so we had a design, basically a shelving system that was voice controlled…whichever shelf calls on kind of moves right in front of him. And then he can kind of pull his wheelchair right under, interact with, with whatever is on it…that kind of

> really just shaped my, like, I guess just thinking process of being able to like, constantly be thinking about like, who you're designing this for and what their priorities are.

Here, Arik proves his ability to design to specific stakeholder needs, and the learned lesson of "constantly…thinking about who you're designing this for and what their priorities are." He further demonstrates having the intellectual resources for such considerations later in the interview, while describing a project from an STS class in which he analyzed a park and website:

> ***Segment 8:*** *(Interview - 39:54)*
>
> **[L 8.1] Arik:** Even something as benign as like, this is just a park, you would think like, oh, well how much can go into that? How much thought can go into that? But it was just kind of to like, illustrate that there's like, still, even something just as simple as a park, there's a ton of different stakeholders in different groups that are both like, benefited or marginalized by it. And like how, um, like, the regulators and different people interact between these places and just how like, every single thing has a ton of different people behind it, both like supporting it or against it, and also just taking care of it.

This segment suggests that, in theory, Arik understands the value of attending to a range of stakeholder needs and, importantly, the possibility for a design that doesn't attend to these diverse needs to marginalize people. In conjunction with Segment 9, this segment demonstrates that Arik: 1) understands the potential for a design to marginalize people, 2) believes in the importance of avoiding such marginalization, and 3) has had experiences where he designed something to the specific needs of a marginalized person.

6 - Discussion

We find in this focus group a textbook example of ideologically narrow student reasoning that, to some extent, emulates a megacorporation with significant presence in shopping and groceries. Moreover, while there were many junctures that began to support more sympathetic consideration of stakeholders marginalized by the students' design (namely, community members for whom an app-based system would not work and employees with health considerations), those opportunities were consistently rejected, reifying the narrow frame. More curious still, Arik—who often closed the bids for ideological expansion in the focus group—spoke at length about the importance of engineers considering the perspectives of many stakeholders in a design in order to avoid marginalization of users (or potential users) in a 1-on-1 interview prior to the focus group. We will discuss these findings in two parts: first looking at *how* the ideologically narrow frame was maintained (RQ1), and second, theorizing as to *why* this was the case, and what Amazon has to do with it (RQ2).

6.1 - The How: Characterizing The Rejection of Bids

Through our first research question (RQ1), we sought to understand the ways in which the focus group's opportunities for ideological expansion were stymied. Through the five examples

presented in Section 5.2, we come to the critical conclusion that bids for ideological expansion are not rejected through argumentation, but are made irrelevant to the conversation at hand through particular discursive moves. Table 2 summarizes the five discursive rejection mechanisms identified in this work, along with fictitious examples that demonstrate how each mechanism could be deployed in response to the identification of a problem in a design:

Table 2: Mechanisms to Reject Bids for Ideological Expansion

#	**Mechanism**	**Example**
1	Reflect and dismiss	"This is a problem, but it's not that important."
2	Affirm and move on	"Yeah, that is a problem. Anyways…"
3	Reframe	"That is a problem, but what if it wasn't?"
4	Defer responsibility	"Someone else will solve this problem."
5	Declare a problem "solved"	"Didn't we already talk about this problem?"

With the exception of mechanism #3 (which was used to reframe the critique that employees would be pushed out of their jobs by semi-automated grocery stores), all of the bid rejections functioned to neutralize the recurring concern that some community members will be marginalized by the adoption of a digitally-based shopping system. This concern was raised in a variety of contexts, for example, to consider customers who don't have access to credit cards (rejection #1), older customers who may have difficulty with a high-tech shopping system (#2), or the general possibility of customers for whom a digital-only solution is not ideal (#4 and #5).

While none of these chances to expand the solution such that it could accommodate these populations was taken up, it is worth noting that the concerns were never actually argued against. At no point does a student disagree with the premise of a criticism; it is never contended that the potential for marginalization does not exist, nor that preventing marginalization is not worthwhile (at least in a general sense). Even in the case of workers who are eventually relegated to theoretical warehouses in an attempt to adopt "the Amazon model" (L 4.3), earlier segments (e.g., L 2.2), illustrate the students did, in fact, try to attend to the health and safety of employees. In these ways, the rejection mechanisms serve not to deny the importance of macro-ethical considerations, but to position those considerations outside of the designer's scope. This is consistent with the disconnect between engineering students' sense of personal and professional responsibility found in Shiff et al. [4]; it is not that students' do not understand the potential for design to do harm, it's that students' do not treat preventing such harm as a part of the job. Indeed, it appears students' expectations of what is "part of the job" drive not only the backgrounding of macro-ethical considerations through these discursive moves, but the foregrounding of status quo values and practices.

6.2 - The Why: Explaining Amazon's "Strange Attractiveness"

To understand why Amazon serves as a "strange attractor" in this focus group and, particularly, in Arik's contributions (RQ2), we first emphasize that the interview data presented in Segments 7-8 constitute robust evidence against an explanation rooted in student deficit. An incomplete assessment of Arik's macro-ethical reasoning based solely on the focus group data may suggest, for example, a lack of adequate systems thinking skills to avoid marginalizing design. However, he demonstrates in his interview the very systems thinking skills lacking in the focus group. His rejection of bids to consider populations potentially marginalized by the group's design seems in direct contrast to his impactful experiences with design work intended for marginalized communities (L 7.1) and his awareness that with "even something just as simple as a park, there's a ton of different stakeholders in different groups that are both like, benefited or marginalized by it" (L 8.1). These two examples were only a subset of the moments in the interview where Arik demonstrated understanding and valuing of STS principles.

This provides a compelling argument to understand Arik's focus group performance as being highly situated. Importantly, we do not want to suggest that the interview reveals some true, objective version of Arik's knowledge or beliefs, but rather that both the focus group and the interview produce situated performances. This is consistent with the central theory of situated cognition, which posits that 'knowing' and 'doing' are inseparable activities due to the situated nature of knowledge, which is bound to contexts [50-52]. Within this model, student reasoning must be conceived as not just a retrieval of stored knowledge, but as something constructed in real time and in relation to a given context—physical, social, cultural, or otherwise. As such, an explanation of this focus group's outcome necessarily involves attention to context.

One factor at play is the educational context of the focus group. The activity itself was an extra-curricular component of a course both students took as a part of their completion of the STS program. Additionally, both students are engineering majors who intend to work as engineers in the future, and this career is simulated in the prompt which presents the scenario as if the hypothetical grocery store "has hired your group." Thus, there are two obvious roles Arik orients to: an engineer, who is expected to successfully produce a solution for a client, and a student, who is expected to successfully complete an activity for a teacher. In introducing the prompt, the facilitator offers a potential third role when she explains the process-focused purpose of the research and emphasizes that they need not converge on a solution quickly. However, the group's following performance appears to reject these cues, for example, by converging on a single solution after only five minutes and concluding the discussion after another 30 minutes (barely half the total allotted time). These aspects of the activity also constitute initial evidence of "doing school" [41], particularly the emphasis on quickly delivering a "correct answer." Further evidence of "doing school" as defined by [41] include the turn taking style described in Section 5.3, where many open-ended facilitator questions would be met with each student giving an independent answer, failing to achieve Lemke's [42] cross-dialogue, where students engage authentically with each other's ideas. This performance of schoolishness, and particularly Arik's

orientation toward it, is concluded and reinforced in his last utterance of the focus group, where, when asked for final thoughts on the activity, he responds with a simple assurance of its completeness: “I think we went through it pretty well.”

If schoolishness motivates Arik to quickly converge on and deliver a correct answer for the assignment, so to speak, it begs the question: why is Amazon the most readily accessible correct answer? From [6], it was common for students in the other focus groups to respond to the initial prompt by suggesting an idea based on a mega-corporation, such as Walmart, Target, or Amazon. Even in the focus group examined in this paper, it is initially Justin who mentions Amazon in L 1.3. However, Arik’s deference to Amazon and its practices not only in his initial brainstorming of ideas, but throughout the remainder of his design reasoning, stands out as uniquely significant. We see this in his prioritizing customer convenience as the deciding factor in 2.4; the mental double-take when he first considers non-digital users in L 3.1; the reframing of employee concerns as a matter of “backlash” L 4.3; and the explicit call to "follow the Amazon model" in 6.3, to name just a few key examples.

In one sense, this modeling seems almost irrational; “a small grocery store in a low income neighborhood” likely has little in common with Amazon, and a solution that works for one may not work for the other. When we think, however, in terms of isomorphism and the dominant conceptions of “success” in engineering, Arik’s modeling begins to make sense: if the “assignment” that he is schoolishly trying to succeed in tasks him with taking on the role of an engineer, it is internally logical (and highly socially motivated) to reproduce a “proven” example of success. It seems not to matter, then, that the grocery store in the prompt and Amazon have little in common beyond the general area of commerce; Amazon simply existing as the most successful example of commerce in the US make it an ideal target of isomorphic mimicry in order to demonstrate expertise. In order to uncritically mimic Amazon in this way, Arik must strip away features of context (e.g., accessibility needs in a low-income neighborhood), and as a result, inherits the corporation’s priorities—namely, profitability and efficiency.

To summarize using the dimensions of the “narrow” stance defined in Radoff et al. [6]: in modeling the grocery store after Amazon (store context), the reasoning space is limited to technocentric interventions utilized by Amazon (solution type), inherits those solutions aims of efficiency and profitability (values), and results in a design that requires relegating the concerns of marginalized stakeholders to the periphery (construction of people). In this way, following Amazon’s example stabilizes other aspects of ideologically narrow reasoning. Thus, the contrast between Arik’s situated macro-ethical reasoning in the focus group and in the interview makes sense: the assignment asked students to ‘play’ engineers, and imitation of one of the most profitable and powerful companies in the world—notably, one that has such a significant footprint in the commerce sector—was readily available as an expedient way to succeed in that role. Arik need not personally be a fan of Amazon nor reinforce similar values; by simply fulfilling the roles of “student” and “engineer,” his deference to and defense of Amazon’s

methods becomes logical in its context, and the ideological impact on his design naturally follows.

6.3 - Implications

There are a range of pedagogical implications made by this case study. As mentioned before, the focus groups' bids for ideological expansion are not pushed back on with robust argumentation of knowledge; they're discursively rendered irrelevant. Thus, an understanding of the ways students discursively maintain ideologically narrow frames can enable facilitators to more effectively challenge them in similar collaborative activities. For example, the ways in which critiques were neutralized in the focus group could inform "talk moves" that educators can use in similar discussions to make problematic logics or assumptions more visible.

An additional lesson to be learned from Arik specifically is that as educators, we cannot make assumptions about how students will reason based on their espoused values, and vice versa. This is particularly important when studying the role of ideology in learning. Much like Hall's [22] characterization of ideology as "fragment, disjointed and episodic," our findings suggest that students' macro-ethical reasoning is similarly dynamic, manifesting differently in different interactions and contexts. Thus, if educators and education researchers are to effectively support the development of ethical engineers, it is necessary that we consider more than just the content of their ethics courses, and draw attention to external factors that shape their macro-ethical reasoning.

Finally, while removing the influence of such external factors is clearly outside the realm of influence for individual engineering departments, we emphasize that promoting alternative representations of success that challenge technocratic ideologies tacit in the field is not. Thus, we recommend to leaders and administrators of departments to think critically about the ways in which they do (or, critically, do not) inform students' developing professional values and understanding of their future role. For students to become engineers that can attend to the complexities of, for example, class, race, or gender, we must support them in moving beyond the narrow mode we see in this focus group: creating a one-size-fits- all solutions that are cost efficient for large corporations, but problematic for marginalized communities.

6.4 - Future Work

This study opens up the possibility for a range of future analyses. One such avenue would be to develop a more rigorous analysis for bids with more fine-grained discourse analysis methods and an increased attention to the interactional emergence of ideology. We also hope to expand our analysis to a larger data set by applying it to the full set of 12 focus groups from Radoff et al. [6]. With this broader data set, we hope to both identify additional mechanisms for rejecting bids and characterize successful bids. Finally, with a larger data set and more robust analysis, we hope to ultimately construct a more theoretically complete model of bids for ideological expansion.

7 - Conclusion

In this paper, we sought to understand the ways in which students reproduce the status-quo ideologies pervasive in engineering education, as well as the situated nature of students' ideological orientations. Using a focus group from Radoff et al. [6], we characterize moments where students, reasoning through a hypothetical design scenario, reject opportunities to expand the ideologically narrow frame they maintain for the majority of the interview. Critically, they do this not by arguing against critiques, but by positioning them outside the scope of their work. Additionally, we show how these rejections—as well as the initial brainstorming of solutions at the beginning of the conversation— are heavily influenced by Amazon. To illustrate that these often Amazon-emulating rejections are not an indication of students' lack of knowledge or reasoning skills, we present data from an interview with the student who leads the majority of the rejections (Arik) that show him exhibiting expansive macro-ethical reasoning that contrasts significantly with focus group performance. Thus, we argue that Arik's reliance on Amazon and refusal of bids for expansion are due not to a deficit, but to a complex network of factors, including discursive moves, available ideological frameworks, and contextual incentives towards particular images of success. We discuss how this network of concepts—and particularly, the role of Amazon within them—together create Arik's situated performance of ideological narrowness.

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