The Dynamics of Perspective-taking in Discussions on Socio-technical Issues

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On perspective-taking by engineering students in discussions of socio-technical issues

Introduction

In their work engineers often need to work in teams that include some combination of other engineers, marketing and business executives, sales representatives, clients, government regulators, community members etc. [1], [2]. In many situations, the interests of the different stakeholders might not be aligned [1], [3]. While this is made glaringly obvious in prominent cases such as that of Keystone XL pipeline, off-shore oil drilling, and fracking, conflicts among interests are also present in local projects such as the multiple viewpoints and debates around the construction of a light rail line (Purple Line) in Maryland [4]. Even seemingly "good" ideas such as the production of solar cells for promoting solar energy in lieu of fossil fuel energy can place the interests of different communities in conflict such as balancing one community's increased demand for alternative energy sources with the negative impact of the toxic by-products from production of solar cells on another community [5]. If engineers are charged with holding "paramount the safety, health, and welfare of the public," (per the National Society of Professional Engineers' Code of Ethics for Engineers), it raises ethical dilemmas in terms of who counts as "the public" and how engineers should think about balancing these conflicting interests for different publics. Ethical considerations in these situations demand that engineers be able to take on the perspective of those who are different from them to seek solutions [6]–[8] that do not marginalize some communities at the expense of others. For example, engineers from USA might be required to understand the perspective of local communities in China who are dealing with the negative impact of toxic waste from solar cell manufacturing plants so that USA's alternative energy needs don't end up trumping the needs of another community for access to clean air, water, and soil. Thus perspective-taking is at the heart of many engineering ethics dilemmas [7]. In the lack of such perspective-taking, it is much more likely that the interests of those who have lesser access to conventional means of power will again get marginalized, and it is also likely that the solutions that emerge will be brittle - in the sense of being out of harmony with the local context and thus over time being discarded, or disused [9].

Within engineering ethics education, while there have been efforts to design course experiences that encourage perspective-taking [6], relatively less attention has been paid to research on the dynamics of perspective-taking by engineering students. In this paper, we seek to add to this literature. We present excerpts from a discussion on the social, economic, and environmental impact of waste management in Delhi as a result of technology transfer under the Kyoto Protocol. Through our analysis we aim to show that (i) conversational analysis tools can be helpful for understanding perspective-taking and (ii) perspective-taking is entangled with students' epistemic and moral stances towards a situation and (iii) often, perspective-taking can be limited and partial.

Background Literature

Some of the early work in perspective taking was done by psychologists such as Kohlberg who were interested in understanding human behavior and moral development. For Kohlberg [10], perspective taking, to be able to understand and assess another's cognition, emotions, and motivations, was integral to moral development. A lot of this early work focused on children and on whether children, at various ages, can assess the knowledge that someone else has or look at a scene from someone else's viewpoint [11]–[14]. What emerges from this research is the notion that perspective-taking is not a unitary construct but is multi-dimensional, and can be perceptual, cognitive, or affective.

Within engineering ethics education research, most of the work on perspective-taking has focused on developing tools and environments to engage students in perspective taking [6], [7], [15]–[17]. Practices such as role playing in the context of engineering ethics courses can provide students with opportunities to understand someone else's perspective. Community-based design and service-learning experiences also provide students with opportunities to engage empathetically with stakeholder perspectives [8], [18]. Very limited work has been done in unpacking how engineers engage in perspective-taking in discussions of socio-scientific issues. In the limited work on this, most approaches have been quantitative or stage-based. For example, building on Kolhberg's stages of moral development, Zhu et al. [19] present an instrument to evaluate the sophistication of ethical judgment in engineering. Here, flexible perspective-taking is counted as evidence of the advanced "postconventional" stage of judgment. Jaycox et al. [7] and May & Luth [20] explore whether ethics experiences enable students to engage in greater perspective-taking using survey items to infer perspective-taking. However, there is a paucity of research on understanding the real time conversational dynamics of how engineers or engineering students engage with socio-technical issues, whether and how they consider the perspectives of multiple stakeholders when talking about complex scenarios (such as that of Keystone XL pipeline), and on modeling the socio-cognitive processes underlying their perspective-taking. Questions such as when in classroom dialog we can attribute that a participant is taking on a stakeholder perspective, how to evaluate the quality of that perspective-taking, and what constitutes expertise in greater flexibility with perspective-taking are under-explored. Fine-grained understanding of perspective-taking in classroom dialog can help us provide tools to better facilitate and scaffold it.

In this paper we aim to understand perspective-taking in unfolding conversations about socio-technical issues. Through fine-timescale discourse analysis of a segment of students' conversation about a complex socio-technical issue, we try to explore a methodology for understanding what and whose perspective a person might be taking. Using tools from narrative analysis [21] and participation and stance analysis [22], we tease apart subtle differences in how different students construct their narrative and in the epistemic and moral stances they take, to

argue that they are taking on different perspectives. Specifically, we find that, for each speaker we analyze, (i) there is a coherence between their instrumental, epistemic, and moral stances; and (ii) from this coherence among stances and from other aspects of their utterance emerges a perspective that they can be characterized as having taken—though in partial and limited ways. Two speakers, we conclude, took perspectives that align, in some limited ways, with the perspective of a stakeholder (workers vs. government policy-makers), while the third took a perspective that aligns, in some limited ways, to that of an environmental analyst.

Data Collection and Setting

In Fall 2014, we recruited engineering seniors and graduate students at a Large Public University (LPU) to participate in a series of focus groups on socio-scientific issues. We did initial interviews with volunteer participants to learn more about their interest in specific socio-scientific issues, how they conceptualize their professional responsibility, and to explain to them the logistics of the focus group discussions. Of 11 interviewees, based on their interest in participating in the focus groups and availability schedule, 6 joined to participate in 4 focus group sessions. Each focus group session lasted about 1.5 hours. We video recorded the session from two angles so as to capture the entire group. Additionally, we took an audio recording as backup. Participants were compensated for their time spent in interviews and focus group sessions: $15 for interviews, and $20 for each focus group session.

The focus group discussions were loosely structured. We had a few open-ended prompts that were meant to start a discussion with subsequent directions emerging out of the discussion. At the end of each session (and sometimes, during a session), we made joint decisions as to which direction to pursue. The first session mainly focused on getting the participants to know each other, get them comfortable talking to one another, and some discussion on what socio-scientific issues they care about. From this we narrowed down a few broad areas that the group might be interested in pursuing. This led to creating a shared document on GoogleDocs to decide on a specific topic. Based on the entries there, we chose the topic of waste management in Delhi under the advent of new technologies as part of the Clean Development Mechanism of the Kyoto Protocol. Before the second session, participants were asked to read up two easily available articles on the Clean Development Mechanism from popular media and view a video on the topic of conflict between informal waste workers and corporations around access to waste management in Delhi (http://vimeo.com/32400188). These materials formed the focus for the second session. At the end of the second session, participants were tasked to look up specific articles on the waste management conflict in Delhi and share that with the other participants. The third session then focused on this information that the participants had researched. The fourth and final session focused on trying to tie their discussion of the waste management issue with how they see their roles as engineers, on finding shared ground in their perspectives and articulating outstanding questions, and for feedback on the focus group facilitation and logistics.

In this paper, we focus on the opening discussion on the topic at the second session. We chose the first 20 minutes of the discussion for our analysis in this paper, because it was rich is how participants represented various perspectives. Our focus on fine-grained analysis of the phenomenon of perspective-taking constrains us to shorter segments of the data.

Methodology

Loosely speaking, we understand perspective-taking as being able to take on - cognitively, emotionally, epistemically, and bodily - the experience of someone else in a particular situation. The challenge, we feel, is in operationalizing this notion so as to be able to make claims about what perspective one is taking *in conversation* and about when the speaker's perspective is aligned with another's. An additional complication arises because engineers often find themselves in a situation where all stakeholders are not at the table. For example, in a corporate meeting, perspective-taking could refer to taking on the perspective of other engineers and executives who are present at the meeting, and it could also refer to taking on the perspective of stakeholders such as community organizers and local residents who are not in that room. Methodologically, we need to be able to have tools to be able to speak to the difference in posture, gaze, emotion, and ways of talking associated with taking the perspective of the "other" when that other is and isn't a participant in the conversation.

To address these challenges, we draw on tools of conversation analysis to unpack the utterances of the participants. From conversation analysis [23], we draw on the notion of how for every utterance, the participants are achieving two things: (i) in the narrat*ed* content of their utterance they present how they see the different stakeholders (ii) in their own actions of narrating that content, they position themselves with respect to the events in the narrated story. Through the former, we get a sense of how a particular participant is positioning different stakeholders in the context of the waste management issue in Delhi; through the latter, we get a sense of how a particular participant is positioning themselves in the focus group with respect to knowledge and moral values. To understand how the participants are interactionally positioning the different stakeholders with respect to each other in the narrated events, we draw on some of the tools of narrative analysis as presented by Wortham [21]. Besides, a detailed line by line analysis of the content of the speech and using diagrammatic tools to represent the emerging relationships in the story being told, we also analyze the deeper connotation of the adjectival words and phrases used to refer to the actors in the story. To analyze how the speakers are positioning themselves with respect to knowledge claims and moral values, we draw on the tools of narrative analysis as well as conversation analytic tools used to understand participation stances in joint action [22]. We try to articulate the entangled dynamic of how speakers are arranging the scene of the story for joint attention in the focus group ("instrumental stance"), how they position themselves or others with respect to epistemic veracity of their utterance ("epistemic stance"), what claims they seem to be

making, tacitly or explicitly, about what is morally acceptable or valued ("moral stance"). These two layers together, we think, provide us insight into what perspective a speaker is taking when making an utterance in the context of a discussion on socio-technical issue. Then, we look at how our characterization of the speaker's perspective might align or not align with the possible perspective of some stakeholder in the particular socio-technical issue. In the next section, we present our analysis of the selected utterances in great detail, in lieu of illustrating here how we apply these tools.

Doing this analysis is different from relying on our internal intuitions and lived experiences to infer what perspectives a speaker might be taking. It involves a fine-grained parsing of their speech, sometimes at the grain-size of words. In our analysis, we draw on the narrative analysis and stance analysis tools as appropriate for a particular segment. Since a primary purpose in this paper is to explore the methodology, we have leaned towards laying out the analysis of the unfolding conversation in great detail. This has forced on us the trade-off of not being able to analyze large sections of the data, but a small slice. We are hoping that the thin slice of data would be complemented by the thick analysis that we present.

Analysis

Our selected segment for analysis comes from the second focus group meeting. This was the first time that they were meeting to discuss a concrete socio-technical case study on waste management in Delhi and the conflict between informal waste workers and companies incentivized under the Clean Development Mechanism of the Kyoto Protocol. On the first focus group session (the week before), the conversation had focused on getting the group members to know each other a bit more, setting ground rules, and exploring potential topics to discuss at length. As the participants walked in they started talking impromptu about things on the top of their mind. Simon (all participant names are pseudonyms, conforming to the participants' gender as presented during meetings and later reported on a survey administered after the final focus group meeting) was the first to show up and Ayush and Simon talked for a few minutes about Simon's participation in the Engineering without Borders program that has played a pivotal role in Simon's career trajectory. James, Robbie, and Simon engaged in a brief discussion about LEED certification of buildings (James had worked as a professional civil engineer before joining graduate school) and on metrics for sustainability. After a few minutes, Ayush asked the group to summarize the video as they saw it. There was some initial hesitation on who should start; in this moment, James picked up a water bottle on the table to spin it as a means to pick the first speaker. The bottle ended up pointing at Matt, who had been unable to see the video before the session. Janine, who happened to be sitting right next to Matt quickly said that since Matt cannot, she can start with the summary.

We focus our analysis on the first three speakers, Janine, James, and Simon in the discussion that follows. We want to lay out our analysis of Janine's utterance in some detail to illustrate how we are drawing inferences on perspective-taking.

Janine	All right. So basically what's the issue is in Delhi, you know, it's, um,	1
	it's a big city in India, of course. A lot of people. A lot of trash, and	2
	trash output is increasing, of course, more people. Um, and then	3
	basically there's these informal workers. It's of course poor people	4
	and they dig through the trash and pull out the recyclables and then	5
	they sell those off, and the numbers that they said, it might be biased,	6
	but there was like a good portion. They were reducing a lot of waste.	7
	And of course, they were pretty- I mean, they're getting money off	8
	this, so they're picking like all the stuff they can, and they were good	9
	at it, and what happened was with these projects that were coming	10
	in, these CDMs, is that what it was called-	
Multiple	Um-hmm (Affirmative).	11
Janine	-um, basically the Indian government, they put in- er, local	12
	government, they, um, a big business came in basically to collect	13
	their recyclables instead, and they were being bullies and they were	14
	basically telling these- the [inaudible], that, "Oh, you can't sit by this	15
	dumpster. This is our stuff. You can't have this basically." They were	16
	kind of fighting over it. It was like turf wars over recyclables, but	17
	that's how they made their income, and then the impoverished	18
	people were saying, "Oh, like we were doing this first. We were	19
	better at it. They weren't doing a good job at it. You're taking money	20
	away from us," and that was- and basically the companies are	21
	getting incentives to do this, and the government was kind of closing	22
	the door on the impoverished people, it seemed like, so. That was-	23
	any else- any other input on it?	

Three major actors emerge in Janine's narrative: the informal workers, the corporations, and the government. The informal workers draw their livelihood by collecting and sorting the trash generated by the city residents. Their income is threatened by the arrival of private corporations incentivized by the government. The descriptors Janine uses to reference these actors give insight into how she evaluates their roles and relationship in the waste management narrative. Other minor actors appear in her utterance, such as Delhi residents (who generate the trash) and the

CDM mechanism underlying the government's actions, but these actors don't occupy prime space in her storytelling.

Janine repeatedly emphasizes the poverty of the informal waste-workers, describing them as "poor people" and "impoverished people." Given that money and power are linked, the poverty of the informal workers places them at a disadvantage, but also invites a sense of pity and sympathy with their plight. In contrast, the corporations are described as "big business," a term that has a specific connotation in the context of the US economy, but is being leveraged in the context of the Indian economy. These terms could also hook into, not explicitly, some "populist" narratives, likely familiar to the participants in this conversation, around how big business (supported by government subsidies) can harm the livelihood of small-scale entrepreneurs and workers. The repeated use on these terms indicates Janine's emphasis on the relationship between the informal workers and the corporations. This descriptor brings greater pathos to the narrative of informal workers losing their jobs: these aren't CEOs who are terminated with golden parachutes, but people, already poor, whose source of income is further being harmed by the arrival of corporations.

Janine also explicitly evaluates the work of informal waste-workers, mentioning multiple times that they are doing a good job. This reflects the view taken in the video, but the highlighting and the repetition of this in the utterance is Janine's. The evaluation happens through two devices: (i) Janine as the speaker tells the other participants that the informal workers were good (line 5-9), and (ii) Janine acts as the voice of the informal workers, quoting them (line 18-20). This also serves as an evaluation of the companies, who emerge in Janine's utterance as being worse the poor trash-pickers with respect to sorting recyclables; this comparison is mostly implicit expect in one place ("we are better at it").

In Janine's storytelling, the poverty of the informal workers is connected to their being good at the job. Here, and also later in the conversation, Janine mentions that the informal workers are making money through collecting and sorting trash, and this is why they are good at it ("they are reducing a lot of waste. and of course they are pretty, I mean. they are making money off of this. so they are picking off all they can and they're, they are good at it.").

There is another, related way in which Janine depicts and evaluates the relationship between the informal workers and the corporations: the corporation as "bullies" and the informal workers as bullied. The label "bullies" connotes unfairness and abuse of power. There is almost a school-yard conflict character to her depiction as she talks about "turf wars over recyclables." The differential muscle of the bullied and the bully is highlighted in the way she voices these two actors. The voice of the corporation, "oh! you can't sit by the dumpster" seems more aligned with ordering. In comparison, the voice of the informal workers, "you are taking money away from us" almost seems as if the trash-pickers are petitioning the government.

In summary, in Janine's narrative, the companies emerge as rich, profit-driven, politically connected entities (getting government incentives) who do a job poorly but oppress the people who can do it job well. The informal workers, on the other hand, emerge as people who are poor, whose livelihoods are threatened even as they provide a higher quality of service with respect to trash management. In her utterance, the informal workers are depicted as bullied by the corporations and disenfranchisement by the companies and the government. In characterizing the companies using the negative-connotative label of "bullies" in the "turf wars over recyclables" Janine positions herself as a critic of the company's actions and sympathetic to the cause of the informal waste-workers. The roles of the actors and their relationships as depicted in the perspective that Janine takes are shown in figure 1.
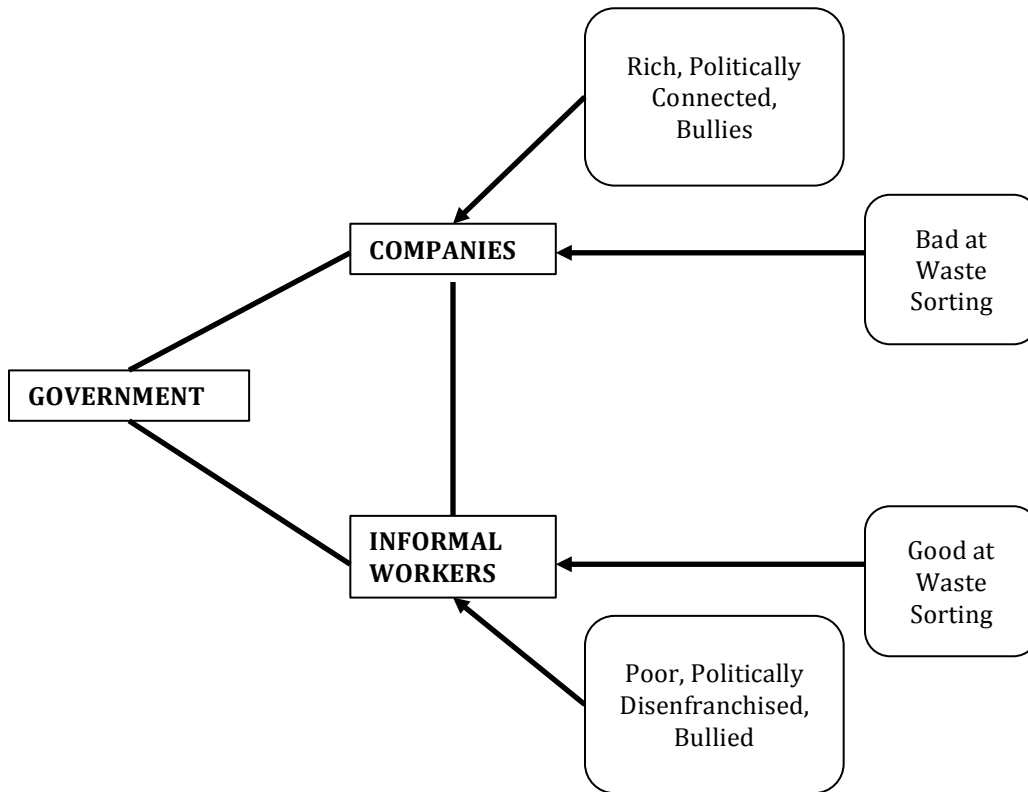

Figure 1: A diagrammatic depiction of the relationships set up by Janine

So far, we have analyzed the content of Janine's speech using some of the tools of narrative analysis. Next we draw on Goodwin's participation and stance framework to further parse Janine's utterance.

Janine starts with, "So basically what's the issue is…" and proceeds to utter noun phrases, "Lots of people," "lots of trash," in what we see as a stance, instrumentally, of laying the scene for the

participants, so that the group can have a shared view of the situation. This initial portion of her utterance functions to describe the scene in which her main narrative plays out. As she proceeds, she starts finishing her sentences, laying out not just the actors but describing their actions and interactions.

In the beginning, at least, she is taking an epistemic stance that positions her with respect to the group as authoritatively conveying knowledge that was presented in the video, but exerting agency in how she selects and structures that knowledge (instead of shooting for a neutral summary). Specifically, she takes the epistemic stance that knowledge about the relationships between the waste pickers and the other actors is crucial for making sense of the scenario. We see a slight shift in this epistemic stance in lines 6-7 when she acknowledges the potential for bias. In showing that she is cognizant of this potential, tacitly she positions her own self as unbiased in her recounting of the events, which could lend greater credibility to her framing of events as she returns to summarizing them (line 7).

And as we argued above, the manner in which she "arranges" the different actors highlights the economic plight of the informal waste-workers as well as their prowess at sorting recyclables. But this instrumentality is not limited to the actors in her utterance; it also serves to embed the focus group participants in a scene. When talking about the work of the informal waste-workers and how good they are at it, her gestures mirror the actions of the informal workers as they pick through the trash. As she quotes the companies and the informal waste workers, she takes on that persona in gestures and facial expressions. In some sense, these reenactment-like portrayals bring the actors into the focus group in a more real way. This is what we are calling the *embeddedness* of her stance. This embedded stance, which invites identification with the waste pickers and dis-identification with the "bully" corporations, coheres with and may even reinforce her epistemic stance of highlighting knowledge of the relationship between waste pickers and other actors (most notably, corporations) in understanding the scenario. As we argue later, this embedded stance stands in contrast with the instrumental stance of the other speakers. In summary, Janine's instrumental stance is coordinated with a moral stance in which she judges the corporations as "bullies" oppressing those less powerful/privileged; an epistemic stance in which she makes central knowledge of the relationships between the waste workers and other actors; and an embedded stance, in which she brings the actors into the focus group space through verbal and physical re-enactment, highlighting the relationship between the actors.

Following Janine, James talks about comparing the environmental impact of waste management as conducted by corporations versus informal workers, and he talks about bias in the video.

| James | They looked at- they did a comparison, uh, between like how much- h- h- how many greenhouse gases were potentially being, um, not, ss- you know, used due to the, to the, you know, the draft workers, uh, doing, doing what they do | 24 25 26 |

	and it was, you know, sub- it was substantial. First, it was this- so that the- the waste management company that had the contract, what they're doing with the, with it is, with the trash is they incinerate it, um, and it spews out all sorts of nasty stuff. I mean, you're incinerating plastic and so forth, and, uh, but they incinerate it and, and generate a little bit of electricity with that, and so with the CDM credit plus government subsidies plus the little bit of electricity that they sell, they're- that's their income stream, um, and who knows if it's sustainable or- I- I- They [video] implied that it wasn't sustainable, but, again, you know, that was coming- it was coming from a certain, you know- viewpoint, so.	27 28 29 30 31 32 33 34 35

James, like Janine, is impassioned and animated. In his utterance, the principal concern is environmental stewardship. He portrays the companies as irresponsible in incinerating trash, a negative appraisal represented in the words "spews out all sorts of nasty stuff." In contrast to the "substantial" positive impact of the informal waste pickers, the electricity generated by the corporations was only "a little bit." He raises doubts on corporations' claims of sustainability— "who knows if it's sustainable"—using a claim made in the video for support ("they implied that it wasn't sustainable", 33-34) but balances that by suggesting the video might be biased (Lines 34-35). James thus positions himself as an evaluator, both of the video itself and of the environmental impact of the corporations' actions.

We also notice the difference of language between James and Janine. While Janine's utterance was marked by everyday words and quotations from waste workers, James uses technical terms such as "greenhouse gases" and "sustainable." Like Janine, James reaches a negative evaluation of the company, but it's based on sustainability, not on their relationship with the waste-workers or the government.

James' utterance also re-structures the role of different actors in relation to one another, an instrumental stance that invites the focus group participants to look at the relationships mainly from an environmental impact perspective. Figure 2 shows the relationships as re-constructed in James' utterance. The main actors in his utterance are the companies and the informal workers, with the video makers and the government emerging as secondary actors. But their roles are all discussed in relation to environmental impact. The informal workers are seen as making a substantial good impact on the environment, while the companies are seen as making a net negative impact on the environment. Environmental impact becomes the metric by which the informal workers and companies are compared. These claims about relative environmental impact are mediated by the notion that the video might be "coming from a certain viewpoint," referring to potential bias.
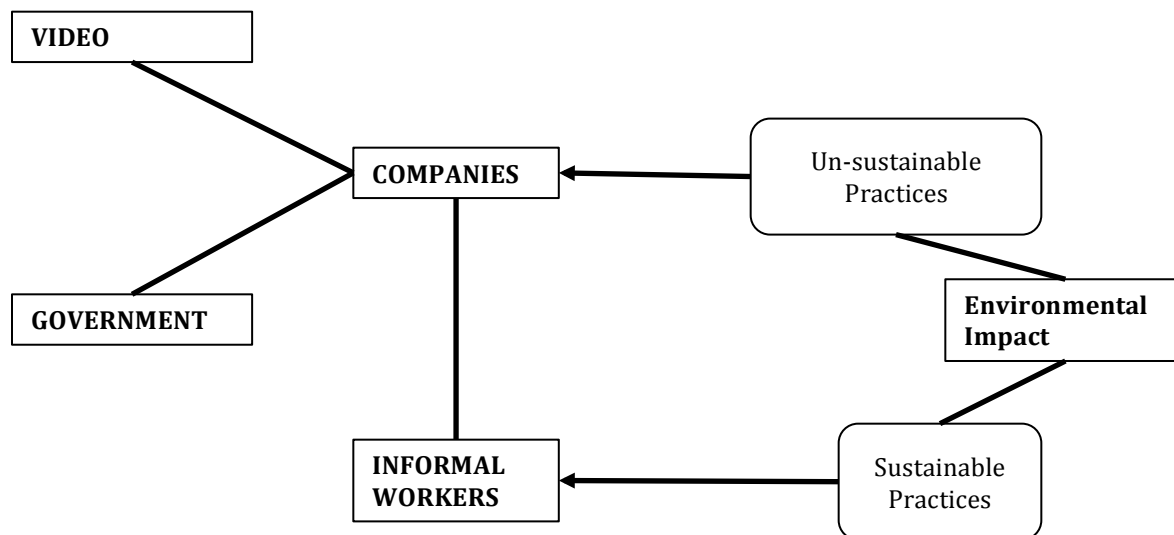
Figure 2: A diagrammatic depiction of the relationships set up by James

The government here has a much smaller role, in comparison to Janine's utterance, mentioned only as an adjectival qualifier to the subsidies received by the companies. Notably, James' utterance does not reference the economic plight of the informal waste workers, or directly to the interactions between the companies and the informal workers, which characterized Janine's utterance.

With respect to stance, thus we see James' instrumental stance as achieving different objectives than Janine's, allowing for a look at the situation through an environmental lens rather than an economic lens. Epistemically, James at times takes the stance of the video as the source of knowledge ("they did a comparison"), appeals to participants' common sense as the source ("I mean, you're incinerating plastic and so forth") in other places, and yet other places he seems to question the knowledge presented in the video. Overall, his epistemic stance is one of seeking objectivity, drawing on whatever knowledge sources will best contribute to this—rather than privileging knowledge of worker-corporation relationships, as Janine does. With respect to embeddedness, we see James' stances as more distant: his instrumental stance invites more of a bird's eye view with respect to the different actors, in contrast to Janine whose physical posture and gestures embedded focus group participants more closely with the actors. The epistemic consequences of this distance are that the knowledge that is considered relevant in understanding the issue is one of environmental impact, also reflected in James' referencing of "greenhouse gases" and "sustainability". Finally, in terms of moral stance, James implicitly defines the moral "good" as minimizing negative environmental impacts, whereas Janine focuses on unfairness towards the waste pickers.

Following up on James' remark, Simon adds a counterpoint to Janine's and James' support of informal waste workers plight in this scenario, pivoting it on the issue of environmental impact:

Simon	Does anyone know if, um, they do the incinerations anyway, because I know, at	36
	least in Sub-Saharan Africa, um, trash-burning is a big thing and whether it's	37
	organized by a corporation, the government or it's just, you know, use of	38
	families burning trash in the backyard, it's going to happen regardless, so I	39
	know the video was kind of biased in the way that they were kind of supporting	40
	the impoverished, this organization was, like this group of people that, uh,	41
	recycled, collected trash for a living, um, but, I mean, if, you know, if	42
	incineration's going to happen anyway, and the government's trying to	43
	[00:30:00], I guess, going to get some energy out of it or, you know, trying to	44
	spin it in a more controlled manner-	45

Simon tries to strengthen the notion of the video being biased by bringing up the example from sub-Saharan Africa (this was not in the video). Simon's argument counters James': If the trash collected by the informal waste workers is burned anyways but without generating any useable energy, then the company's actions are an improvement over the past state since they are more systematic and produce some energy. In Simon's argument, the "little bit of electricity" that James' references as a negative evaluation of the corporation's actions becomes a positive evaluation ("going to get some energy out of it" line #44). Simon's statements reflect his positioning with respect to the argument : "more controlled" lends greater value to the centralized means of trash collection. While all three raise the specter of bias, Janine and James ultimately argue in ways that seems to legitimize the rag pickers position, while Simon's argument legitimizes the companies and the government. Simon's argument allows him to be skeptical of the claims made in support of informal waste workers in the video and echoed by James and Janine in the group.

In lines #43-45, Simon referenced the government as an actor. Unlike Janine who characterized the government as disenfranchising ("closing the door on") the poor people and incentivizing the companies (the latter characterizing also referenced by James), Simon portrays the government as working with the intent of adding some systematicity and energy production. In explaining what the government might be trying to do, Simon effectively attaches positive value to systematicity and energy production. Since the government's actions were to incentivize the companies, he is implicitly saying that the government likely construed waste management via the informal waste workers as an uncontrolled and environmentally damaging process, challenging James' argument (James' response to Simon confirms that he too interpreted Simon as challenging his argument).

Simon's utterance also restructured the roles and relationships among different actors, as depicted in figure 3. Like James, Simon initially pivots his argument on environmental impact,

rather than on the livelihood of informal waste workers. In the initial portion of his argument, the companies and informal waste workers are both seen as creating negative environmental impact by incinerating trash. We also notice this in line #41, when Simon corrects himself ("kind of supporting the impoverished, this organization was, like this group of people that, uh, recycled, collected trash for a living"), moving away from the label "impoverished" that Janine used. Instead, his utterance equalizes the roles of the companies and the organization of informal waste workers: both are trying to collect trash and use that to generate money.
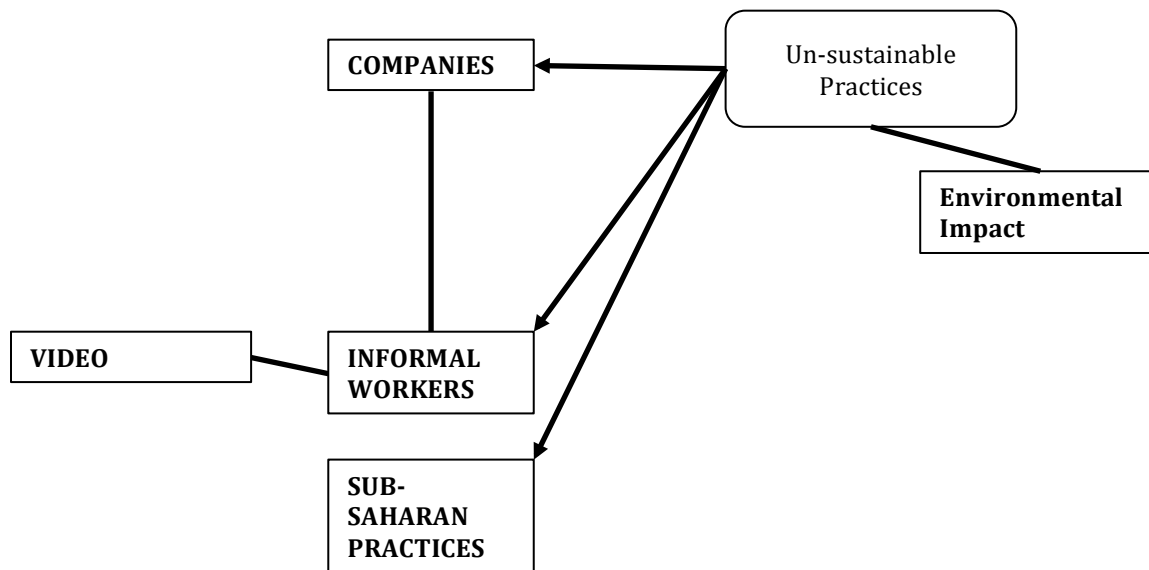
Figure 3: A diagrammatic depiction of relationships set up by Simon in the first part of his utterance

In the second half of his utterance, through Simon's argument for valuing organization and control which can lead to energy product even through incineration, the companies emerge as better than the informal workers with respect to environmental impact. This is depicted in figure 4, where the positions of the informal workers and companies are reversed on the axis of environmental impact, as compared to figures 2 and 3. The relationship of the bias in the video is also changed from that in James' utterance, now attached more directly to informal workers and emphasizing their negative position with respect to environmental impact. Additionally, we depict the government as a strong actor in this figure, since Simon's attribution of control and energy production purposes to the government is central to mediating the shift of the companies from being bad for the environment to being better.
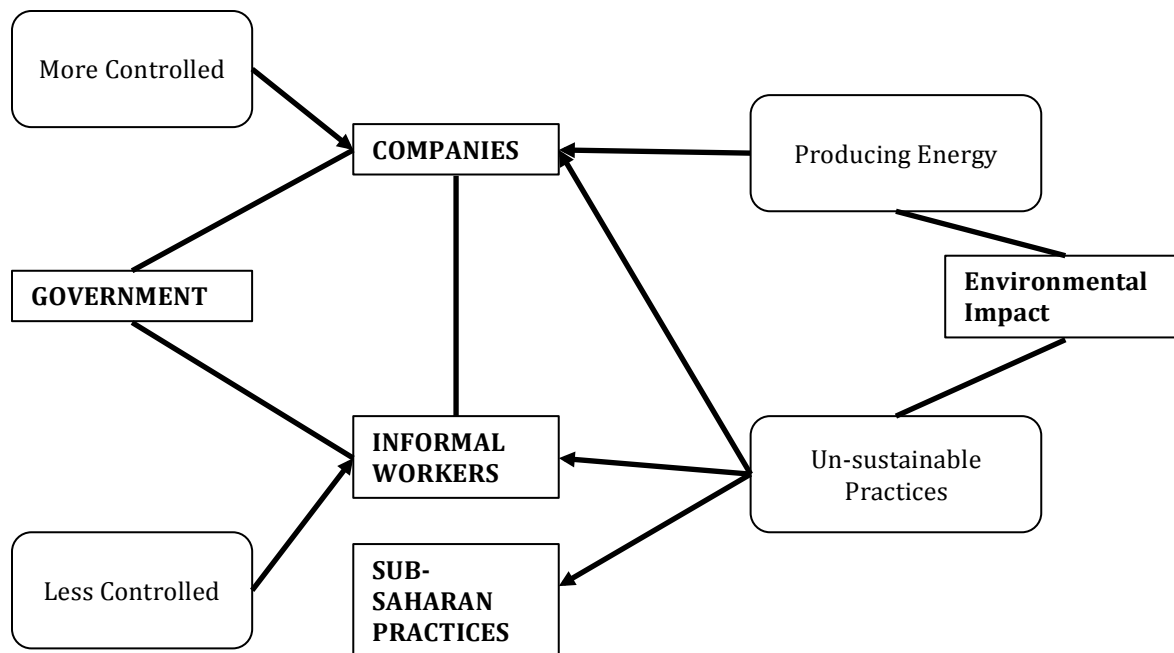
Figure 4: A diagrammatic depiction of relationships set up by Simon in the second part of his utterance

With respect to the instrumental stance, Simon introduces new actors, people in sub-Saharan Africa and the trash burning practices in that region, and uses them to reorganize how the other actors (the informal waste workers, the companies, and the government) are positioned with respect to each other and their environmental impact. Epistemically, Simon, in this initial portion, positions himself as an authoritative source of knowledge on trash disposal in sub-Saharan Africa, that wasn't presented in the video could also be relevant to the discussion. This is coordinated with additional epistemic moves. First, he raises a query for the group to consider, if they know whether the trash would have been burned anyway after the informal waste workers collected it. But moments later, he turns this question into a statement, ("it's going to happen regardless", line #39), which then functions to undermine the claims made in the video. Sandwiched in between this shift is the introduction of information he knows ("I know") on practices in sub-Saharan Africa. His utterance also embodies a moral stance of valuing control and systematicity, which arises in the context of sub-Saharan Africa and then becomes the final piece in his argument. There is a sense of distancing in how Simon engages with the issue. He is laid back on his chair, and his tone isn't animated, it's very matter of fact. This distance is also reflected in his valuing the environmental concern and even more prominently, in the bird's eye view of the globe imposing practices in sub-Saharan Africa on Delhi, painting Delhi, an urban metropolis, with the same brush as sub-saharan africa, which encompasses multiple countries (with varying socio-political-economic-geographic-urbanization statuses overall). This distanced stance does not demand a close inspection of the relevant differences in the two places: In each of those countries of sub-Saharan Africa, we will find cities, villages, and other settings in which people inhabit. Delhi, in comparison is a metropolis (one city in a single country) - the scale of

diversity along any dimension is quite different. The places have different social, political and cultural histories. Their relationship to trash itself might be quite different. But Simon's utterance stereotypes the developing world, categorizing sub-Saharan Africa with Delhi, reminiscent of narratives in the US in grouping third world countries together without particular attention to specifics. Using this analogy, Simon drives harder the point of bias in the video: what we see Janine as undermining, and James as acknowledging, gained more weight in Simon's utterance.

Acknowledging Simon's point, James concedes that the video does not do a "dollars and cents comparison" between the environmental impact of waste disposal as done by the informal waste workers and by the corporation. The conversation for the next couple minutes focuses on whether the video or articles had information on how waste was being treated before the corporations came in, and the time period over which these two different operations (corporations versus informal workers) have been operating.

On making claims about perspective-taking and its implications for the design of learning environments

We now want to turn to whether we can make claims about perspective-taking based on this analysis. As we noted before, in this paper, we are restricting ourselves to exploring whether and how stakeholder claims are taken up by engineering students in conversation. As such, we will not comment on whether and how students are taking up one another's perspectives.

We see Janine as constructing relationships between the different actors and taking up epistemic and moral stances that highlight the economic plight of the workers. Her stances embed her more closely into the situation than the other speakers. In contrast, James and Simon are more distant. James and Simon both emphasize environmental impact as a moral stance without mentioning the economic plight of the informal workers, and that value plays a role in how they rhetorically structure the relationships among stakeholders. For Simon, the additional value of control and systematicity becomes voiced as the potential intent of the government.

Thus in some ways, we feel that Janine, in pivoting around the concerns of the waste workers, is taking a perspective that is in some ways aligned with the perspective of the informal workers on this issue. James is taking a perspective that is aligned in some ways with that of an environmental analyst. And Simon is taking on a perspective that represents, in some ways, both the environment and that of a government actor or policy-maker.

However, we want to be cautious with these claims, because in each case we find the perspective-taking severely limited and partial. In pivoting on the economic concerns of the waste workers, they are also, perhaps inadvertently, flattened into a single dimension, characterized by their economic status. For one to *really take on their perspective* on this issue,

might mean to understand the socio-political history of their relationship with this work, the social structures that shape those relationships, the myriad ways in which informal workers might experience that relationship, how they perceive the threats to their livelihood, and how their relationships with entities across economic divides and political power have evolved for their collective community and for individuals in the community, and how their relationships with other segments and strata of the society might shape the stances one might observe, to name a few aspects. Similarly, Simon's utterance does not explore or invite a responder to explore the plethora of constraints, local and international politics, and the various political, industrial, regulatory, and other networks that a policy maker might need to navigate in thinking about this issue. Stronger claims about perspective taking, we think, would require speakers to make visible these additional actors and their relationships, and bring out the multiple, at times contradictory, epistemic and/or moral stances that actors embedded in these scenarios take.

However, we don't mean to make any argument that our participants are deficient in any way in their ability to take perspectives. Our claims are more attached to how these few minutes of conversation played out. And with the understanding that the facilitators or the materials provided did not necessarily invite the participants to take on the stakeholder perspectives in these rich embedded ways as we note above. Another possibility is that sometimes, as conversations unfold, they might make complex, narratives that start out more single-dimensioned. It is also possible that the participants are still trying on some of the ideas and seeing how the others in the group respond to it. Maybe laying out a stakeholder perspective in a rich embedded way requires a lot of time and conversational politeness requires one to cede speaking space to another after a bit of time. We think the most likely reasons behind our claim of partial and limited perspective-taking are more social interactional in nature and we are not making any claims about engineering students' "ability" to take on perspectives.

Our preliminary analysis as we collected this data, however, did prompt us to consider how we can create more opportunities for more meaningful, affectively-salient, and embedded perspective-taking. For example, in the next set of focus groups, when discussing the impact on consumers of aggressive predictive analytic practices by companies, we created active listening exercises for participants to practice engaging more deeply with what another participant was saying, and story-telling exercises that would embed participants more closely into the rich, complex, and contradictory constraints faced by a stakeholder.

Even though the data slice we pick is small, we think we can, however, make some speculations towards design principles for engineering ethics learning environments that invite perspective-taking in deep rich ways. First thing we notice is how case studies in engineering often serve the purpose of highlighting single issue engineering ethics, highlighting a particular code of ethics, or a single tenet of responsibility or liability. In part, this is due to classroom time constraints where often 30-60 minutes are allocated to a case study discussion and, in part, this is due to the

demands of the curriculum. We feel that engineering ethics courses would be better served in spending multiple sessions teasing apart the various dimensions of a single case and that we need to make space in the curriculum to enable the design of such learning experiences that can span longer times.

Methodologies for unpacking perspective-taking in real time conversations can contribute to understanding perspective-taking and collaboration in team-based design activities, in addition to helping researchers develop more detailed analysis of engineering ethics conversations. This paper hopes to contribute towards this aim.

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