

Logistics as Care and Control: An Investigation into the UNICEF Supply Division

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ABSTRACT

This paper investigates emerging practices and infrastructures in global humanitarian relief to argue for *logistics* as an essential but often neglected component of ICTD and broader HCI work. Logistics – the artful coordination of human and material flows – leverages scholarship on “coordination,” “articulation” and “infrastructure” to provide insight into the complex role of new IT systems (and HCI as a field) in the global circulation of goods and relations. Drawing on fieldwork with the UNICEF Supply Division, we argue that contemporary logistics operates simultaneously as a form of *care* and *control*. We demonstrate that logisticians at Supply traverse messy and dynamic information and material infrastructures, and that effective logistical work must marry and bridge these worlds. Our work extends ICTD and postcolonial computing research by casting light on the nature, experience and ambivalence of the global flows that enable and support HCI work in development and postcolonial settings.

Author Keywords

Logistics; international development; ICTD; theory; infrastructure; ethnography.

INTRODUCTION

A growing body of HCI work aims to understand and describe the role of technology in development and design technologies to improve lives, often under the label of Information and Communication Technology for Development, or ‘ICTD.’ Working across sectors ranging from education [23] and agriculture [7] to health [3], this work has sought to identify and overcome (typically through mechanisms of design) global development challenges ranging from poverty, hunger, and chronic under-employment to equity, political participation and infectious disease. Studies in the field have identified how new information technologies can improve economic and social indicators [15] and erode socio-cultural barriers to information for vulnerable groups [21]. Other HCI scholars have begun to critically examine the discipline’s role in designing technologies

for a global user base, including in international development and postcolonial settings. Irani et al. [12] have called for a “postcolonial computing” research program that engages centrally with questions of “power, authority, legitimacy, participation and intelligibility in the context of cultural encounter.” Williams et al. [39] and Lindtner et al. [18] have shown how better understanding of “transnational imaginations” [39] and “appropriation” [18] can inform all stages of design, from problem framing to the construction of appropriate tools. Ahmed et al. [1] have shown how asymmetrical power dynamics may shape and limit the experiences of mobility available to low-income and marginalized groups in the Global South. Taylor [35] cautions HCI to use care when applying familiar tropes of networks, difference, and complexity to describe and make sense of seemingly “out there” places.

This paper extends HCI research by casting light on the nature, experience and ambivalence of the global flows that enable and support HCI work in ICTD and postcolonial computing settings. In particular, it draws empirical and theoretical attention to the HCI problem of *logistics*: roughly, the artful coordination of human and material flows, as practiced at the global scales the field is increasingly called upon to engage. It addresses the forms of planning and situated action [34] required to manage the shifting flows of objects, people and knowledge that collectively constitute HCI experience and impact in the world. It describes challenges attending the construction of *logistical zones*, within which flows may be made to happen smoothly and easily (though always selectively and rarely without cost). It also describes the problems that emerge when logistics “walks out the door” and is required to traverse landscapes that are organized along multiple and discrepant lines. Logistics matters to HCI for two central reasons. First, IT tools are critical (and increasingly so) to each step of a logistical flow, from the monitoring of the movement of goods to the financial transactions between suppliers, carriers and distributors to warehouse management. Second, logistics is a key component of successful global technology dissemination efforts, either in the commercial technology sector or in the public or not-for-profit distribution of technology for social impact. Our work on logistics draws on and extends classic HCI concepts of “coordination” [28], “articulation” [32] and “infrastructure” [29] as well as a growing body of work on logistics in the social science and business literatures (some of it emanating

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indeed from the logistics industry itself). We argue that logistics represents a special kind of infrastructure central to the processes of circulation bringing HCI to life in the world, and that the field's increasingly global remit requires better and more artful engagement with the nature and challenge of logistical work. Drawing on Foucauldian notions of "pastoral power" and more recent feminist scholarship on care, we also argue that logistics operates simultaneously as *care* and *control*, in ways that may challenge and complicate HCI's engagements in the global computing space.

Our arguments are based on ongoing fieldwork with the UNICEF Supply Division which offers insight into the centrality and complexity of logistical work in the contemporary development field. UNICEF is a United Nations program that provides long-term humanitarian and developmental assistance to children and mothers and works with over 100 governments. UNICEF Supply, based in Copenhagen, serves as a distributing agency for items ranging from vaccines and antiretroviral medicines to nutritional supplements and educational supplies. The supplies made up 10,000 shipments and were valued at \$3.4 billion in 2014, up from \$505 million in 2000. The Supply Division prides itself on getting goods to the most unreachable, in the most trying of circumstances. While Supply staff admire and hope to emulate the rigor, integration and control brought to logistics in the private sector, they also note their difference with such organizations, marked by the organization's core humanitarian mandate, and the particularly challenging contexts the organization is required to engage.

The paper that follows begins by reviewing HCI theories of coordination, articulation and infrastructure, then moves to sociological and anthropological work that takes a critical look at the contemporary logistics industry and finishes with insights from Foucauldian and more recent feminist scholarship on care. We then describe the primary findings from our fieldwork, focusing on the development and implementation of two new IT tools at UNICEF Supply. In our discussion, we will reflect on the limits and possibilities of care at a distance, the globalizing effect of dynamic logistical infrastructures and the possibilities of logistics as a new domain of HCI work.

LITERATURE REVIEW

Coordination, Articulation and Infrastructure

Our concept of logistics builds on past theoretical understandings of globally dispersed work in CSCW and HCI, namely "coordination" [28], "articulation" [27, 31, 32] and "infrastructure" [29]. *Coordination* captures the varied ways that dispersed workers align individual components of cooperative activities. The concept draws on Strauss's concept of *articulation*, the division and re-integration of different tasks (or 'joints') in a project [32], or "the work that gets things back 'on track' in the face of the unexpected" [31, p10]. Much coordination and articulation

work is invisible to those not doing it [31]. As Star and Strauss note, there is not always benefit in rendering these tasks visible; however, putting names to these processes has been important in illuminating the sometimes obscured effort and skill that go into effective collaboration. In most coordinated projects in everyday life, articulation can happen through normal interpersonal communication skills. In many large-scale projects, including global logistical projects, articulation takes on "an order of complexity where our everyday social and communication skills are far from sufficient" [28, p159] and task division needs to be more formally established. To manage this complexity, *coordination mechanisms* integrate artifacts (timetables, checklists and so on) upon which protocols (classification schemes, standard operating processes, etc.) are fixed. Coordination mechanisms play a crucial role in logistical work, working as a map ("a weak stipulation"), a script (a "strong stipulation") [28] or displaced entirely by informal workarounds.

Infrastructure ties these dispersed work processes to the materiality of the built world. Star and Ruhleder, in a seminal study, define the characteristics of infrastructure and describe its role in geographically dispersed coordination [29]. Infrastructures exist as technical and social as well as global and local artifacts. As technical and global artifacts, they embody standards and have reach beyond a single event or project. As social and local artifacts, they "link with conventions of practice," and in this way both shape and are shaped by local contexts of practice. Current scholars have extended the definition and application of infrastructure to other contexts. Jackson et al. [13] challenge popular assumptions of infrastructure as always "planned, orderly, and mechanical" [13, p.i] and show how different approaches might reshape ideas about large-scale infrastructures in fields ranging from technology design to science policy. Edwards develops the notion of *infrastructural globalism*, the development of an infrastructure for the purpose of global goals, and describes the roles of these "permanent shared" infrastructures in global governance institutions [9]. Other scholars have explored the role of standards in global systems, showing how global data collection practice is a mix of finding 'standard' and 'work-around' data [24] and establishing standards across varied sites is a creative process [14]. Vertesi has argued that actors often work creatively to connect between multiple, non-conforming infrastructures, giving rise to connected but *seamful spaces* [38].

Critical Logistics and Global Collaboration

These classic theoretical concepts apply directly to contemporary logistics, which connects disparate parts of the globe together through intricate coordination work, relying on electronic data interchange and increasingly integrated infrastructures of multi-modal transport and warehousing. Large mega-logistics companies, which include both logistics firms like UPS and retailers who have brought logistics functions in-house, like Walmart, have

grown into major players in the global economy, leading some to point to a ‘revolution’ in the logistics industry in the past quarter century [5, 6, 8]. The expansion of logistics technologies such as enterprise resource planning (ERP) software, radio frequency identification (RFID), bar code and point of sale tracking have catalyzed the changes by increasing real-time visibility and analysis of the movement of goods. Innovations to containerization have also facilitated coordination of intermodal transport because goods can be put into a container at their point of production and left in that package until they arrive at their point of origin, with all transport vessels in between now easily accommodating the container shape [5, 16]. These changes to logistics have dramatically decreased costs in relation to the overall sale process [5]. Logistics has rendered transport costs so low that that it is often less expensive to manufacture and ship a product tens of thousands of miles than to produce it at a regional manufacturing site [16].

But as a growing body of critical scholarship has argued, these gains in logistics – specifically large-scale business management logistics – can also raise troubling questions of organizational power and control. Rossiter and Zehle [25] analyze the global emergence of SAP, the ERP software tool set to have a billion users by 2020, and argue that it has the power to shape “social, economic, and cross-institutional relations within the global logistics industries,” exerting a form of “soft control” over globally distributed workforces [25]. In conjunction with logistical technologies such as voice recognition software in warehouses, GPS tracking and RFID, SAP can organize and analyze labor productivity data in real time, inhibiting the mobility of logistics laborers and establishing a “hegemony of standards” [25]. Levy has shown how the implementation of electronic monitoring systems facilitates trucking firms’ control over their long-haul truckers by giving them increased access to data regarding their physical location, allowing them to evaluate their performance based on electronically-collected data rather than human report [17]. Several scholars point to the rise of Walmart, described as “primarily a logistics company” rather than a retailer, as an example of how integrated logistics has led to the disempowerment of logistics laborers and commodities producers through a process of streamlining, data sharing, and cutting out of middlemen [5, 8, 26]. Cowen [8] demonstrates how logistics relies on seamless labor throughout its supply chain; large-scale logistics therefore rescales the classic Taylorism concern with efficiency from the laborer’s body to global systems. The “logistical world” [26] project, through a case study of the Greek port of Piraeus, also focuses on how logistics “stitches together” cheap labor in Chinese factories with broad markets through infrastructural expansion and exposes previously peripheral places to global forces of coordination and control.

Anthropological theory supplements this critical logistics work by showing how *difference* affects mobility and flow. While Appadurai notes that mobility is a key characteristic

of our age and that we “live in a world of flows” [2], Tsing [36, 37] renders this image of a fluid global world more complicated. She contends that even the term “globalization” “encourages dreams of a world in which everything has become part of one single imperial system” [36, p.xiii] when, in fact, the systems are still broken up and global connections are fraught with “friction.” For Tsing, friction is “the awkward, unequal, unstable and creative qualities of interaction across difference” [36, p3]. Sites of friction are the best places to understand the deeply connected contemporary world, since “aspirations for global connection...come to life in ‘friction’ – the grip of worldly encounter” [36, p1]. Escobar [10] similarly argues for a “continued attention to place-based and regional expressions of difference in contexts of globalization” and shows many “subaltern struggles can be seen today... as forms of place-based globalism” [10, p15].

Logistics as Care and Control

Collectively, this work points to both the centrality and ambivalence of logistics as an aspect and instrumentality of contemporary global flows. The same ambivalence, we argue, attends the work of logisticians themselves, and in particular the contradictory pull of care and control that animates and complicates work in this space. Insight into this tension can be drawn from Foucault’s notion of “pastoral power,” [11] modeled after the Christian metaphor of the shepherd tending his flock. The shepherd takes on the duty for the salvation of the flock by protecting the sheep from danger and treating them with individualized kindness. At the same time, the shepherd leads his sheep, keeps watch over them, and holds them to a strict discipline. These paradoxical qualities of pastoral power, in which governance is “defined by its beneficence” [11], are analogous to the dialectic of care and control that we observe in much logistical work.

Our understanding of care leverages the ‘beneficence’ at the heart of Foucault’s theoretical construct and builds on it with more recent feminist theories of care. These scholars have given examples of caregiving ranging from care of the sick, elderly and children to care of animals, plants, technologies or crafts [19]. All these forms of care involve “a notion of doing and intervening” and have “strong affective and ethical connotations” [4]. Care is a *practice* and can be done well or badly [19, 20]. Though care does not automatically make work successful (just as articulation work does not always make work succeed) it helps build and embody forms of responsibility and commitment that helps work get done, including in relation to emergent obstacles and barriers that formal programs of action may encounter.

The preceding discussions tell us important things about the nature of contemporary logistics and logistical work as practiced in and beyond the global development industry. As the critical logistics literature has shown, the ‘logistics revolution’ has changed the nature of global connectedness

and now, more than ever, logistics brings the world together through integrated infrastructural chains. Changes in logistical techniques as well as the increased use of information technologies have introduced more control over material flow, with resulting hegemonic effects on logistics laborers and consumers. Like the critical logistics scholars we have reviewed, we see that a primary goal for logisticians is to exert more control over where, how, and when objects (and, in some cases, people) move. We argue, however, that business management and the critical logistics literature has often made the work of control appear too easy or one-dimensional, reducing logistics (and logisticians) to an instrumental abstraction that belies the nature and difficulty of the work. This effect may be amplified in organizational contexts like UNICEF, both due to the humanitarian nature of their mandate (a charge deeply and personally felt by our informants) and the complexity of challenges associated with logistical work in the environments UNICEF is called on to serve. In such instances, logistics is revealed to include affective, difficult and often invisible forms of articulation work that more mechanical understandings of logistics (whether celebratory or critical) often miss. In this way, we argue that logistics has a dual character as both care and control.

Our understanding of logistics as care also relies on an understanding of logistical infrastructures as frequently messy and dynamic. Logistical spaces (such as warehouses and ports) give concrete examples of *seamful spaces*, marked by the overlap of material and information infrastructures required to support flow. Logistics highlights the changing quality of the infrastructures that co-exist in these spaces. New infrastructures are perpetually being built and existing ones are constantly changed through ongoing processes of construction and decay. This dynamism emerges from the challenge of building and maintaining infrastructures against the messy churn of the world around them, constituted in part through practical and contextual instabilities that may be particularly acute in the settings UNICEF works in.

In the next section, we will explore more deeply how these qualities of logistics play out at UNICEF Supply Division. In 2012, UNICEF headquarters rolled out a global enterprise resource planning (ERP) system based on SAP into all of the UNICEF country offices and warehouses and senior management now claims they have greater visibility into stock levels, transactions, and distribution patterns at all of its remote sites. A new initiative aims to develop mobile applications to monitor and report on the goods distributed to beneficiaries through their implementing partners. We also see care as a key component of the work done at UNICEF Supply, emerging out of the strong affective resonances in UNICEF's core organizational commitment to vulnerable populations (especially children). Care also operates through the stories that UNICEF logisticians tell about the challenges of their work and the frictions inherent to their global network. The importance of care to

overcoming these difficulties becomes particularly salient when employees relate stories of the field and give examples of trying to "reach the unreachable."

UNICEF LOGISTICS

Our fieldwork at UNICEF Supply began in April 2015, with remote and in-person interviews of selected Supply Division staff in Copenhagen and New York City respectively. At this time, we also reviewed publicly available and internal documents including year-end reviews, annual reports and case studies. In August 2015, we traveled to UNICEF Supply headquarters in Copenhagen, where we conducted an additional 15 in-person interviews, each lasting approximately an hour. 7 of these interviews included two or more employees and some employees were interviewed more than once, for a total of 22 informants. Topics included UNICEF Supply history and strategy, the process and plans for the development of new IT tools, interviewees' professional backgrounds, personal work duties and challenges, and ways that UNICEF Supply differs from private sector logistics firms. Interviewees were made up of individuals of 11 nationalities and worked in the following business units: the director's office, warehouse, monitoring, change management, data science, IT, international transport, and in-country logistics. Interviews were audio-recorded, transcribed, and shared among members of the research team. During the fieldwork, we followed online and offline work processes, observed warehouse and office spaces, and had many informal conversations with Supply employees of all functions. We also reviewed internal strategy memos, performance reviews, and various data visualization dashboards provided to the research team by UNICEF staff. Upon return from the field, the team transcribed interview data and continued to read and re-read public and private documentation, transcripts, and field notes. We have also continued to interact with the UNICEF staff via email and phone around follow up questions. Based on a Straussian grounded theory method [33], we wrote analytic memos throughout this process, describing key themes we found emerging from the data; we continued to iterate these through subsequent phases of data collection and analysis, leading to the main findings and arguments reported in this paper.

The Supply headquarters first opened a small warehouse in Copenhagen city center in the 1970s before moving into its current high-tech warehouse and office complex in a port district of Copenhagen in 2012, with financial support from the Danish government. Supply currently operates 202 global warehouses including four headquarter warehouses in Panama City, Shanghai, Dubai, and Copenhagen. Supply maintains long-term contracts with commodity manufacturers and freight forwarders from around the world, awarded through public tender in conjunction with other UN agencies.

UNICEF Supply's functions are of two primary types: delivering supplies for long term development assistance

and emergency relief. In its development assistance wing, UNICEF country officers work with governments and partner NGOs to forecast the need for goods in the coming year and ensure the funding needs are in place prior to procuring the goods. The headquarter team processes each country's forecast of goods for international procurement and determines the appropriate manufacturer for each good from a range of international companies. Most goods (~95%) are shipped directly from the supplier to the port of arrival within the destination country and the rest are delivered from one of the headquarter warehouses. Funds must be available in cash upon placement of the order; invoices are paid after goods reach the port of entry. At that point, in-country UNICEF teams, in collaboration with local governments, follow customized processes for customs clearance, warehousing and final leg distribution of goods. Emergency goods distribution follows a similar process with different strategies based on the contexts. Distribution to emergency sites is unpredictable and entails additional needs and complications.

For the Supply Division, the definition of logistical success is to get goods "where they need to be, when they need to be there." A failure can erode trust with partners and can lead to lower coverage rates for life-saving products like vaccines, nutrition supplements, and other health care products: under many circumstances failure can be literally life-threatening. At the same time, the ways UNICEF logistics can fail are almost limitless. As one interviewee explained,

"There are so many different points that logistics can fail. I think stock out is always a failure... if a customer goes into a shop and whatever it is they are looking for isn't on the shelf, it's logistics' ultimate failure. For us, that holds true as well. If the supplies are not where they need to be, when they need to be there, that's a logistics failure... Any delay in customs is a failure, any demurrage or detention charge is a failure. Any supplies being damaged during customs clearance, lost during customs clearance is an issue. Same thing with warehousing – receiving supplies incorrectly, storing supplies that require specialized storage in regular storage, it's a failure. Any kind of loss, expiration is a failure. Distribution: making sure the correct supplies are released, making sure that the earliest expiring supplies are released first, making sure that they are going out with sufficient time. Making sure that the transporters are getting where they need to be, getting the proof back signed and stamped, that the trucks got to where they needed to be. If [any of these steps] don't happen, it's a logistics failure."

On a more macro level, the staff at UNICEF cite four major challenges to getting goods where they need to be, when they need to be there. The first challenge is that Supply needs to work and communicate well with multiple agents, including the country programs, suppliers and freight forwarders at the beginning of the process and the government and NGO partners at the end of the process.

The second challenge is uncertainties in demand for goods due to challenges in forecasting and unpredictability of conditions such as funding, emergencies, weather conditions and other uncertainties. The third challenge is the lack of predictability in transport, resulting in variable delivery times. A fourth challenge is the lack of visibility into whether products actually get to the intended final beneficiary.

Given these challenges and shifts in global logistics more generally, the state and quality of information infrastructures (old and new) are a constant hope and concern of the organization. In recent years, the Supply Division has been particularly aggressive in looking to IT tools as a way to help overcome some of these challenges and keep up to date with private sector standards. Though the organization is working on dozens of such IT projects, here we will focus on two primary projects. The first is the roll out of an SAP implementation called VISION into all of its country offices, beginning in 2012. The second is the ongoing development of a mobile application and data synchronization with VISION to monitor and report on distribution of goods by partners to beneficiaries.

VISION Implementation

As a large, distributed organization, UNICEF requires robust operational software. UNICEF headquarters has been using SAP as its enterprise resource planning (ERP) software since 1998 for finance, supply and program activities; until 2012, however, all of the country offices were using separate in-house developed systems called ProMS. Each country had an individual instance of ProMS that synchronized data periodically with the headquarter ERP system. Headquarters needed to interface with 168 different instances of the system, making it very difficult to share information and fix errors on all of the separate systems. These processes for maintenance and information sharing became increasingly inefficient so the IT team decided to shift all offices to a single ERP called VISION, based on SAP. This ERP was implemented in a "big bang" approach in January 2012.

Though many interviewees indicated the benefits to having all the information in one place, the initial rollout was very challenging. One aspect was the steep learning curve required to use the product. One interviewee reported,

"The learning curve is not steep, it is vertical. You take weeks and weeks to master just basic things... We here in our context here in Europe, people are familiar with computers, they use them at home. But imagine in the middle of third world countries, in an emergency..."

The second major challenge was data integrity. Accuracy was unreliable at first due to migration issues and user inexperience. Fixing these bugs has required a great deal of collaboration between the headquarter team, the IT staff and the field office employees. As a result of this

communication, the problem is improving with time. As an interviewee explained,

“In the past 2 years, it’s become better, more clean and more stable as users have logged onto the system and have got a lot of experience with it.”

Implementation problems were exacerbated by a lack of enthusiasm in some country offices. One interviewee explained that some countries’ management teams are more supportive of the VISION implementation than others. The support often hinges on officers’ feelings about the centralized control and visibility into local operations. Describing the VISION warehouse module, an interviewee said that all country warehouse staff react “with a mix of surprise and horror” when they learn the extent of the oversight from headquarters that VISION allows.

She explained, *“A few times when I’ve been on the phone trying to resolve a technical issue. One of our guys will say, well you performed this transaction on this date. [The country officer will respond] What do you mean, no we didn’t. [HQ staff will say] We can see that you’re name is here.... [Country officer replies] Aah! You can see?”*

Some country officers, on the other hand, appreciate the greater visibility into their activity. As our interviewee explained,

“The flipside of the horror – some colleagues will say, can you tell us if you see us going off track? We have to respond that there are 200 warehouses and we can’t track every single transaction you are doing.”

Several interviewees suggest that employees across the Supply global community are seeing benefits from the VISION implementation. According to one interviewee, Supply officers in country offices are traditionally known as the “custodian of the supplies.” They do not have control over when and how products are used programmatically, but are instead responsible for keeping them safe while they are in UNICEF hands. They see VISION as a “big stick for a logistician to use.” Using data from VISION, the supply officer can show stock levels with ease and can therefore better work with program managers to plan for supply distribution and use. As VISION continues to be used, the field office staff are giving more feedback about what functionality they need, including custom reports, visualizations, and data points they need to track. Many interviewees claim this collaboration is making the VISION platform more effective and more broadly used.

Nepal Supply Chain Monitoring and Reporting Pilot

Our second case concerns efforts to improve transparency over the processes by which goods flow through UNICEF channels around the world. Through this work, the Supply Division seeks to build a comprehensive tracking mechanism capable of monitoring the flow of goods along

the entire delivery chain, from the supplier level to the point of consumption. Keeping track of the supplies to this level would allow UNICEF to give evidence for, and therefore celebrate, their own and their partners’ successes; if supplies are missing, tracking would help the organization determine what went wrong and how to improve. One employee describes achieving this visibility, however, as still a “distant dream.” The trickiness inherent to UNICEF’s supply chain, such as the need to interface with many different stakeholders, to deliver a wide range of products in inconsistent package types, and to transport to widely varied locations, makes this tracking an ambitious goal. Interviewees report, for example, difficulties in choosing standards for new technologies, such as barcodes, due to the organization’s requirement to interface with so many different kinds of actors.

Because of these challenges, the team is excited about a promising monitoring application currently under development that may give better insight into supply delivery. After the April 2015 earthquake in Nepal, UNICEF Supply increased goods delivery to displaced citizens. Both the Nepal country office and headquarters were worried to hear media reports claiming that supplies were not reaching beneficiaries. The staff therefore decided to try to show that the supplies were, in fact, reaching the beneficiaries or to determine how they were being lost. Typically in Nepal, the country office supply officer hands off products to implementing partners for delivery to final beneficiaries at the in-country warehouse level. The monitoring of goods after handoff has been, to date, ad hoc.

In support of this country office initiative, the data science team at headquarters suggested using the Nepalese crisis as an opportunity to pilot a new initiative to extend monitoring to the in-country partner level. The working group was inspired by a project recently developed in Lebanon by UNICEF for distribution of winterization kits. UNICEF built a mobile application and an online database in order to track and communicate with partners which goods were required, how they were to be delivered, and to whom, down to the name of specific beneficiaries. The beneficiaries were given barcoded cards that could be scanned upon the receipt of goods. The project had, according to business analysts and IT personnel at Supply, been successful, and several interviewees were excited to see the possibility for visibility into goods movement to the very end of the distribution channel.

The headquarters team and the Nepal country office staff are now in the process of building and testing a similar application to monitor and track distribution of goods in Nepal. The tool used in Lebanon has been modified to adapt to the Nepal context where implementing partners can use it to report if they have delivered goods per the distribution plan. Like in Lebanon, these partners with UNICEF plan precise targets in terms of where and what kind of products

are to be delivered. After distribution, they will enter the amount and location of delivery into an application designed for low literacy users using a smartphone or tablet. The data from the application can be uploaded into an online database that is then reconciled with UNICEF's central VISION system. The application will be tested on the ground starting in the first quarter of 2016.

Though there are many reasons to be excited by the new possibilities that this application will afford, there are also important barriers and challenges to overcome. As one interviewee noted, partners may choose not to use the application for myriad reasons including illiteracy, access to devices, or lack of training. The partner might also input false information, due to human error (loss, data entry mistake) or bad intent (theft, resale, etc). The interviewee raised concern about partners interpreting UNICEF oversight as "policing" rather than "celebrating their success." As the initiative develops to the point where it tracks goods directly to the beneficiary level, this interviewee noted other potential barriers which could emerge from existing social structures or the interpretation of tracking as surveillance by beneficiaries. For example, one concern is the lack of universal identification cards (or devices), which may unfairly inhibit the distribution of goods to individuals who do not have identification. This is particularly concerning for individuals who may not want to be named on databases, including members of vulnerable, marginalized groups.

Though this initiative is still in early stages, it signals concrete steps towards a radical new direction for Supply, allowing it to monitor goods delivery outside of its own organizational limits and connecting that data to its encompassing information system. Adapting this application so that it can track receipt by ultimate beneficiaries and scaling it to other countries are priorities for the organization, though they know this scaling will require patience and many iterations. As an interviewee explained concisely, "in wider supply chain management, the use of barcode is not new. There are complexities in the UNICEF environment." This case thus highlights the difficulties that organizations and individuals face when attempting to move logistical work outside of logistical zones; these challenges also demonstrate the potential ambivalences of care and control that such efforts might provoke.

Stories of Care

Like all logistics enterprises, UNICEF seeks to achieve greater control over the movement of its supplies; the complexities of its network, however, make this control challenging to achieve in practice. UNICEF's logisticians confront unpredictable conditions on a daily basis that are plainly out of their control. These might include donor uncertainty, weather conditions for transport, and queues at port or customs. The in-country distribution process faces another collection of uncertainties, including partner

availability, road (or other transport) conditions, or political or infrastructural disruption (ranging from war to natural disasters).

Given these difficulties, we paid close attention to the motivations that employees cited for making their logistical work succeed. According to many employees, UNICEF's mandate to get supplies to children in most need make these organizational challenges and potential solutions meaningful and important.

A senior manager explained that, *"The mission is important to all the employees. In our HR surveys, we see that the mandate is something that brings people together. The passion and commitment to the mandate totally binds us together. It has a face. Even if employees are unhappy about certain things... they are still behind the mandate. You find passionate people here."* This interviewee later explained that *because of this passion, employees tend to take on projects that are too ambitious. Employees want to improve operations so take on projects that they underestimate in scope.*

This passion is helpful when performing under the pressures of the logistics industry. One interviewee, working in the international transport center, explained,

"I call it a business that never sleeps. So, basically after a supplier has delivered their goods, it is expected that transport kicks in and then they load in five hours and take off a charter and things happen, you know. It is a function where you get calls at 1 in the morning. The plane was grounded, it's delayed for 30 minutes, oh another 30 minutes... When it comes to transport, it's like running the last mile... All the time is a rush... I don't think there is any compensation for it. People who work this type of work, there is a certain element that is not in a job description but you need, it is a passion... You have these people who say, oh my God, did I wake you up? We are trying to do things at crazy times, experiment with crazy things, and so on, but it is associated with the function in general. You can recognize it with the carriers, you can recognize it with the freight forwarders and it is not something that they do because they can publish or will get compensation, but it is an expectation of the work. And in transport, when it is goods that save lives, it is [like trying to get] someone who is really in need to get to the hospital, you know it is that urge, that someone feels like doing something... This is one thing that the computer does not understand."

This interview captures a common tendency for staff to compare their large-scale global logistics work to logistics at a personal scale, giving them analogies to conceptualize how their work affects specific individuals. Throughout the course of the fieldwork, we heard interviewees and employees informally connecting their work, across the organization including in the Copenhagen office space, to

the children who are the beneficiaries of their work. The imagination or reality of these children motivates and provides meaning to their projects.

We also heard many employees explaining the challenges and impacts of their work by describing specific field sites, often drawing on past experiences or colleagues' experiences working in country offices. For example, one interviewee explained a particularly challenging but successful initiative to bring textbooks to children in Zimbabwe.

One of the projects that I worked on when I was in Zimbabwe was that we set-packed textbooks for every child. It was a one to one distribution. It was a huge project. It started with the identification of the schools, then GPS mapping of the schools, then finding transport. It was a very long project. At the launch the prime minister... said he had thought we'd gone to most schools. Like everything else, he said, I thought we had hit most of the schools in the country. He had reason to be in a very, very rural area where there were no roads. There was this tiny little hut school. Not marked, not identified, not nothing. He thought this would have been one of the ones that we had not reached. It didn't look like a school. There's no sign that there's a school. It's hours off any road. He stopped and he asked the kids, asked the teacher, did you get textbooks? He said, I would like to see every child outside with the textbooks. Then all the kids came outside with their textbooks. He said that was the point that he realized that we had done what we had set out to do. It's not just reach the easy schools, not just reach the urban schools, but actually get to all of them. Even the ones that didn't look like schools. We actually managed to get to all of them... We have this focus on equity. It's a lot of what we do. We're not just focusing on the easy to reach. That's where logistics comes in. That's how we reach the hard to reach."

This interviewee was amongst many that we spoke to who were proud of beating expectations and overcoming the trying circumstances of doing logistics with UNICEF. They often described their motivation for accomplishing these difficult projects as wanting to promote UNICEF's mandate of equity and helping the most vulnerable in a particular site. This motivation to help makes the organization different in important ways from private sector logistics. Using a different field site example, another interviewee described ways that UNICEF Supply differs from Walmart, FedEx, UPS because it needs to reach everyone, even the "unreachable."

"When it comes down to the partners, they might not distribute to a type of people... That's something I really like about UNICEF - it's the equity... How do you reach the unreachable?... In Nepal, in some cases it takes up to six man days to walk up a mountain to deliver a package or deliver a vaccine because the whole vaccine goes up on a

donkey. It's not a private delivery truck. As a business model [we are] totally different. We are more humanitarian. When I go humanitarian, I cannot refuse. UNICEF cannot refuse to deliver a blanket to the top of the Himalayas. That is equity, right? That is reaching the unreachable. That is our mandate."

These stories of the field serve a dual purpose, both demonstrating the motivation and affective resonances of UNICEF's logistical work and providing concrete examples of how difficult UNICEF's logistical infrastructures are to traverse. We cannot imagine a more demanding logistical challenge than getting goods to the top of the Himalayas and this almost hyperbolic example from the field illustrates the care required to extend the organization's reach to everyone and what "reaching the unreachable" means in practice. If this care operates as a property and commitment of individuals and wider organizational culture, it is also built into the infrastructure itself, hard-wired as a permanent and enduring feature and challenge of the logistical tools and operations examined here.

DISCUSSION

In this paper we have explored the dual logics of logistics as forms of care and control, and the centrality of logistical work within the world of humanitarian assistance and ICTD efforts more generally. We have also documented practical and ethical challenges confronting efforts to practice care and control at a distance, and strategies employed by workers at UNICEF Supply to overcome these. Technology is central to these efforts, as new tools and infrastructures change the conditions under which global flows – at UNICEF and elsewhere – may be made to happen. UNICEF must construct effective logistical zones capable of organizing distributed work and care across the breakages, transitions, and deep heterogeneities that the deeply intermodal enterprise must navigate. But it must also construct effective *stories* that can make sense of and unite, both practically and ethically, the starkly different realities that UNICEF is required to negotiate. We now move from a direct attention on the case above to describe how it opens up tensions of logistics as practiced in large distributed organizations like UNICEF.

Care at a Distance

As we have shown, practicing care at UNICEF Supply means doing hard, stressful work that is often taken for granted, motivated by a sense of empathy for distant beneficiaries. UNICEF's mandate to improve the lives of disadvantaged children allows – and tasks – its employees to abstractly connect office work in Copenhagen to human beneficiaries in far away places. The employees make this abstract connection more concrete through stories of the field and analogies to smaller scale logistics. One telling example is the analogy that one interviewee used comparing doing the work required to rush a shipment to its destination and rushing a critically wounded or ill person to the hospital in an ambulance.

There are of course complications to performing care at a distance. As other scholars on care have shown, giving the cared for choice is sometimes at odds with giving good care [20]. An expert, older person, or outside opinion can sometimes have better insight into needed care than the care receiver (such as a doctor giving medical care or a parent giving child care). Beneficiary choice and participation, however, are important values in design and can shed light on the real rather than presumed needs of receivers of care. The differences embedded into distance exacerbate this fundamental tension, making it more difficult to actively engage with beneficiaries and have an accurate understanding of their needs. This lack of engagement has been a commonly cited problem in much development work, including ICTD [12, 35]. Care at a distance risks becoming paternalistic, misguided, or harmful.

Like scholars of the critical logistics literature [17, 25], we acknowledge that the new logistical tools we have described build into their very structures power differentials between the center and the periphery. As UNICEF continues to build monitoring applications that extend outside its walls, it will be particularly important to ensure that they do not exclude any residual members [30] of “unreachable” communities or compromise locally held values of privacy or autonomy.. Designers will need to monitor and balance these potential issues throughout the design and organizational deployment of new logistical tools.

Messy Infrastructures

As Taylor has described, the “network” is currently a “taken for granted analytical device” in HCI that “neatly joins things up when looking from ‘here’ ‘out there’” [35]. This case shows the various ways that logistics networks do not neatly tie things together and are fraught with breakages of various unpredictable types. The logistics required for material movement is ‘intermodal’ by nature. This can be understood literally, as seen for example in the transport of goods from air to ship to truck. Logistics is also intermodal in infrastructure and culture. *Friction* [36] is characteristic of moving things and people across heterogeneous cultures and infrastructures. We have revealed in this case the work of logisticians to maintain the invisibility of logistics and the *appearance* of neatness in the face of these broken up networks. Building on foundational work on infrastructure [29], this case, and the logistics concept more broadly, shows the ways that infrastructures do not exist in binaries of invisible or visible, broken or not broken, but can fluctuate between these categories or be all of these things at once from various vantage points.

Logistics also offers an alternative reading of *why* global infrastructures can be effective agents of globalization. UNICEF employees work and live in *seamful spaces* [38], interacting with many infrastructures simultaneously; though some of these infrastructures are shared globally, others are not. Headquarter employees are brought together with field offices when they work together to fix bugs in

these globally shared infrastructures, particularly when adjusting them to conform better to the unpredictable and locally-specific infrastructures that exist outside of headquarters. Unlike Edward’s case, which showed how the “enduring, reliable” quality of global information infrastructures makes them “particularly effective agents of globalization” [9], the information infrastructures in this case are constantly being built across modes and then continue to change after they are built. This dynamic quality brings the headquarters staff closer to field staff through the process of infrastructural development and repair. UNICEF staff are continually working on and suggesting new “improvement projects” – new IT tools to support the dynamic and unpredictable qualities of their work – and work closely with their global staff to make them work. By fostering global collaboration and dialogue, the friction inherent to bringing these infrastructures together is made generative.

HCI Meets Logistics

Our third argument concerns the distinct contribution that logistics (as developed here) may bring to HCI work and theorizing. With the emergence of ICTD research within HCI and a growing body of internationally focused work [1, 18, 39], HCI scholars have started to engage in a flourishing debate about the role of HCI research in global contexts, particularly in “developing” countries. Some scholars have raised concern about the power dynamics, appropriateness, and effectiveness of HCI researchers, based in the Global North, designing and deploying technologies in the South using currently dominant ICTD methods [12, 35]. We argue that logistics captures the work that happens in the background to make the global reach of contemporary HCI possible. As such, logistics is fundamental to global HCI and offers an avenue to better understand its conditions of possibility. It extends the concepts of articulation work and infrastructure by focusing on movement, thereby opening up a new approach to study the relations between materiality, flow, and global difference. We argue that HCI needs to more carefully attend to logistics in order to plan and execute successful global technology dissemination efforts. We also argue that HCI has an ethical stake in the ‘logistical revolution’ since technology designers help create the IT tools that make logistical flows happen.

Logistics may offer new insight into the scales at which HCI research might and should operate. In calling attention to the neglected role of logistics in the success (or not) of design-level interventions in the ICTD and wider HCI field, this work helps remind us that the field’s traditional orientation to design-level interventions may require deeper and more careful attention to the broader systems and infrastructures that render design efforts both meaningful and possible [1, 21]. More broadly, the concept of logistics allows us to deploy insights from the body of scholarship on articulation and infrastructure to answer new questions focused on the frictions that facilitate (or hinder) connection across culturally and geographically disparate places. More

specific attention to logistics, for example, highlights the ways that asymmetries in material flow result in unequal access to technologies, information, and commodities.

IT tools are central to logistics; designers and IT staff have an important role in building these and therefore a direct impact on the way that goods move. The IT team at the Supply Division, for example, plays a critical part in building and refining new technologies, which have significant impact on the forms of collaboration and control that constitute distributed work within the broader organization. In the case of the new monitoring application, they have been responsible for developing the initial design based on a complex problem space and the inputs of many different stakeholders. In maintaining and improving VISION, the team weighs complaints and suggestions from a globally dispersed user base. All of the technical decisions that the IT team makes represent choices about who to listen to and priorities for flow. By building new efficiencies, the developers might allow goods to travel more quickly or more predictably. Other functionalities might make communication between global users and stakeholders outside of the organization more effective or more obscured. In these ways, these designers' decisions influence the fairness and efficacy of material flows.

CONCLUSION

This paper has argued for logistics as a critical and growing problem of HCI work and practice, both in the immediate contexts of international development and ICTD work studied here, and in the wider fields of global engagement that increasingly characterize and challenge HCI work. We have shown that global logistical infrastructures are messy, dynamic, and overlap with local infrastructures – but we argue that these dynamic qualities often contribute to their efficacy as “agents of globalization.” We have argued that logistics is simultaneously a form of care and control, building on Foucault's description of “pastoral power.” Drawing on fieldwork at the UNICEF Supply Division, we have found that Supply employees, like all logisticians, seek more control over the movement of supplies in order to get “goods where they need to be, when they need to be there.” They connect this difficult work to values of equity and stories of affected children in the field. As HCI continues to contribute to global infrastructure design, understanding the power and the limitations of this care at a distance will be essential to building effective systems.

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